CRC Handbook of tables for Organic Compound Identification

CRC HANDBOOK

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ORGANIC COMPOUND IDENTIFICATION

Third Edition

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PREFACE

The present volume is a revised and enlarged third edition of the book formerly titled TABLES FOR IDENTIFICATION OF ORGANIC COMPOUNDS. Four new classes of compounds, i.e., sulfonyl chlorides, sulfonamides, thiols and thioethers were added, bringing the number of classes included in the book to twenty-six. The tables of alkanes, alkenes, alkynes, aromatic hydrocarbons, phenols, nitriles and sulfonic acids were all thoroughly revised and considerably enlarged. In all, the addition of 2400 compounds to the third edition, raised the total number of parent compounds in the book to over 8150.

Three tables containing the dissociation constants of more than 1050 phenols, organic acids and organic bases were added. Correlation charts for I.R., Far I.R. and N.M.R. were also included.

Explanatory sections entitled "Explanations and References" precede the tables. In these sections the formulas of the derivatives and the full reaction equations for their preparation by the most important methods, together with some essential details and references to their preparations, are given.

An index covering both the names and synonyms of the compounds was added at the end of the book. An index listing the names of all tables and major subjects was also added.

The main objective of this book is to assist chemists in the identification of organic compounds. The organization of the compounds in classes according to increasing boiling points should also assist in the search for standard vapor phase chromatography work.

For further information of techniques of organic analysis one or more of the following books should be consulted:

N. D. Cheronis, J. B. Entrikin and E. M. Hodnett, *Semimicro Qualitative Organic Analysis*, 3rd Ed., Interscience Publishers, New York, 1965.

L. Meites, *Handbook of Analytical Chemistry*, McGraw Hill Book Co., 1963.

F. Feigl, *Spot Tests in Organic Analysis*, 6th Ed., Elsevier Publishing Co., 1960.

A. I. Vogel, *A Textbook of Practical Organic Chemistry*, 3rd Ed., Longmans Green and Co., London, 1957.

R. L. Shriner, R. C. Fuson and D. Y. Curtin, *The Systematic Identification of Organic Compounds*, 4th Ed., John Wiley and Sons, New York, 1956.

F. Wild, *Characterization of Organic Compounds*, 2nd Ed., Cambridge University Press, 1958.

The publication of the third edition would not have been possible without the work of those involved in the preparation of the earlier editions. The editor is thankful for the part in the earlier work contributed by Professors M. Frankel, S. Patai and A. Zilkha, and the late Mr. R. Farkas-Kadmon. Thanks are due also to Mrs. E. Shohamy and Mr. A. Glazer for assisting in collection of new data, to Mrs. Y. Elmaleh for typing the index, and especially to Prof. S. Patai, who as consulting editor, read all the new material and gave many helpful suggestions. The cooperation of Dr. Robert C. Weast and Mrs. F. Thomas in the publication of the book is gratefully acknowledged.

Z. R.

Jerusalem
January 1967

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LIST OF ABBREVIATIONS USED

$[\alpha]_D^t$	specific rotation
a	acid
abs	absolute
abt	about
ac a	acetic acid
ac anh	acetic anhydride
acet	acetone
add	addition
al	alcohol
alk	alkali
amor	amorphous
anh	anhydrous
arom	aromatic
aqu	aqueous
asym , *as*	asymmetric
bl	blue
blk	black
boil	boiling
b p , B P	boiling point
br	brown
bz	benzene
brt	bright
brnsh	brownish
c	cold
ca	about
caust	caustic
chl	chloroform
cl -bz	chlorobenzene
col	colorless
comp	compound
conc	concentrated
cor	corrected
cr , cryst	crystals
d	decomposes
d , D	dextrorotatory (or D-configuration)
deriv	derivative
deliq	deliquescent
dil	dilute
dist	distillate
dk	dark
dl , d,l, D,L	racemic
efflor	efflorescent
et	ethyl
et ac	ethyl acetate
eth	ether
exp	explodes
f	from
fl	flakes
fluores	fluorescent
f p	freezing point
frz	freezes
fum	fuming
glac	glacial
glit	glittering
glyc	glycerol
gran	granular
grn	green
h	hot
htng	heating
hyd	hydrate or hydrolyses
hyg , hygr	hygroscopic
i	inactive
i	insoluble
ign	ignites
insol	insoluble
l , L	levorotatory (or L-configuration)
leaf , lf	leaflets
lg	large
lgr	ligroin
liq	liquid
lng	long
lt	light
lvs	leaves
m-	meta
me , meth	methyl
micr	microscopic
mixt	mixture
ml	milliliter
mod	modification
monohyd	monohydrate
monocl	monoclinic
m p , M P	melting point
need , nd	needles
o-	ortho
ol	olive
or	orange
ord	ordinary
org	organic
orth	orthorhombic
oxid	oxidation
p-	para
pa	pale
part	partly
pet	petroleum
pet eth	petroleum ether
ph	phenyl
ph hydraz	phenyl hydrazine
$PhNO_2$	nitrobenzene
pl	plates
powd	powder
pr	prisms
purp	purple
pyr	pyridine
rac	racemic (or racemate)
rect	rectangular
recr	recrystallization
redsh	reddish
rhomb	rhombic
r	rapid
r h	rapid heating
s	soluble
sec	secondary
scar	scarcely
s h	slow heating
sh	short
sl	slightly
sld	solid
slend	slender
sm	small
soft	softens
sol , soln	solution(s)
solv	solvent(s)
st	steel
stab	stable
subl	sublimes
sym	symmetrical
tab , tabl	tablet(s), tables
tert	tertiary
tetr	tetragonal
tol	toluene
trans	transparent
thk	thick
tricl	triclinic
trim	trimeric
uns	unsymmetrical
unst	unstable
vac	vacuum, in vacuo
v	very
var	variable
vic-	vicinal
visc	viscous
volat	volatile or volatilizes
vlt	violet
w	water
wh	white
yel	yellow
yelsh, ylsh	yellowish
>	above, greater than
<	below, smaller than
∞	miscible
xyl	xylene

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EXPLANATIONS AND REFERENCES TO THE TABLES

The following section gives explanations and references for the preparation of the derivatives appearing in the Tables Formulas of the derivatives as well as the main methods for their preparation are given Usually, only the reagents and the solvents required for the preparation of a derivative are mentioned without specific details for the reaction conditions and the exact procedure The aim of these notes is mainly to enable the worker to choose the method preferable in the conditions and the reagents available to him in his laboratory for the derivatization of his specific compound However, THIS IS ONLY A REFERENCE SECTION AND NOT AN INSTRUCTION MANUAL AND THE QUOTED REFERENCES SHOULD BE CONSULTED FOR THE ACTUAL PREPARATION OF DERIVATIVES, ESPECIALLY REGARDING SAFETY HAZARDS INVOLVED IN THE WORK

References are usually given for the preparation of all the derivatives having separate columns in the Tables, as well as for important ones listed in the "miscellaneous" section of the Tables References to five different popular analytical textbooks are given, assuming that at least one of them, or another equivalent publication, would be available to the worker These are

N D Cheronis, J B Entrikin and E M Hodnett, *Semimicro Qualitative Organic Analysis*, 3rd edition, Interscience, New York, 1965, quoted in the text as "Cheronis "

R P Linstead and B C L Weedon, *A Guide to Qualitative Organic Chemical Analysis*, Butterworth Scientific Publication, London, 1956, quoted in the text as "Linstead "

R L Shriner, R C Fuson and D Y Curtin, *The Systematic Identification of Organic Compounds*, 4th edition, John Wiley and Sons, New York, 1956, quoted in the text as "Shriner "

A I Vogel, *A Textbook of Practical Organic Chemistry*, 3rd edition, Longmans, Green and Co , London, 1957, quoted in the text as "Vogel "

F Wild, *Characterization of Organic Compounds*, 2nd edition, Cambridge University Press, Cambridge, 1958, quoted in the text as "Wild "

In addition, leading references from the original literature are also given Although the literature coverage is not complete (especially for the common derivatives) it was attempted to describe different methods, and to give as many references as possible to less common derivatives having limited scope More references can be found in the textbooks mentioned above

Derivatives appear either in a separate column or in the "miscellaneous" section in the Tables, where separate columns are usually given for derivatives which should be tried first, and for which enough data are available Derivatives which should be tried as a second choice, or preferred derivatives for which not enough data are available appear in the "miscellaneous" section The explanations and the references for the different derivatives are arranged usually in the same order as in the Tables Occasionally, this order is changed in the explanatory notes in order to describe the derivatives in a logical order (e g , in Table 17 the phenylurethane appears in a separate column, while the phenylhydantoin appears in the "miscellaneous" section in the "explanations and references" section the phenylhydantoin appears directly after the phenylurethane)

Derivatives which are followed by an asterisk are those recommended for first trial Other derivatives should be tried after these

Although "Ar" usually stands for monovalent aromatic group, we used it a few times in the following sections as a polyvalent aromatic residue This was done only for demonstration purposes

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EXPLANATIONS AND REFERENCES TO TABLE I

As a result of their inertness no general suitable derivative exists for alkanes and cycloalkanes Characterization is based only on the physical constants given in the Table melting and boiling points, index of refraction and density Any laboratory text-book will give adequate directions for the determination of these constants

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE I. ALKANES AND CYCLOALKANES

a) Gases and Liquids (Listed in order of increasing b.p.*)**

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}
1	**Methane**	−161 49	−182 48[T]		
2	**Ethane**	−88 63	−183 27[T]		
3	**Propane**	−42 07	−187 69[T]		0 5005[S]
4	**Cyclopropane**	−32 86	−127 42		0 720[−79]
5	**2-Methylpropane** (Isobutane)	−11 73	−159 6		0 5572[S]
6	***n*-Butane**	−0 50	−138 35	1 3326[S]	0 5788[S]
7	**2,2-Dimethylpropane** (Neopentane)	9 503	−16 55	1 342[S]	0 5910[S]
8	**Cyclobutane**	13 08[741], 12 5	−80	1 37520[0]	0 7038[0]
9	**1,1-Dimethylcyclopropane**	20 63	−108 96	1 3668	0 6589
10	**2-Methylbutane**	27 852	−159 9	1 35373	0 61967
11	***trans*-1,2-Dimethylcyclopropane**	29		1 3713	0 6769
12	**Ethylcyclopropane**	35 94	−149 41	1 3786	0 6839
13	***n*-Pentane**	36 074	−129 721	1 35748	0 62624
14	**Methylcyclobutane**	36 3		1 3830	0 6933
15	***cis*-1,2-Dimethylcyclopropane**	37	−140 9	1 3822	0 6928
16	**Spiropentane**	38 977	−107 06	1 41200	0 755
17	**Cyclopentane**	49 262	−93 879	1 40645	0 74538
18	**2,2-Dimethylbutane**	49 741	−99 87	1 36876	0 64916
19	**1,1,2-Trimethylcyclopropane**	56 7[750]		1 3848[19 5]	0 6822[19 5]
20	**2,3-Dimethylbutane**	57 988	−128 538	1 37495	0 66164
21	**2-Methylpentane**	60 271	−153 67	1 37145	0 65315
22	**3-Methylpentane**	63 282		1 37652	0 66431
23	**1,2,3-Trimethylcyclopropane**	65 7[755]		1 3945[18]	0 6946[18]
24	***n*-Hexane**	68 74	−95 348	1 37486	0 65937
25	**Ethylcyclobutane**	70 64	−142 85	1 4020	0 7280
26	**Methylcyclopentane**	71 812	−142 455	1 4097	0 74864
27	**2,2-Dimethylpentane**	79 197	−123 811	1 38215	0 67385
28	**2,4-Dimethylpentane**	80 5	−119 242	1 38145	0 67270
29	**Cyclohexane**	80 738	6 554	1 42623	0 77855
30	**2,2,3-Trimethylbutane**	80 882	−24 912	1 38944	0 69011
31	**3,3-Dimethylpentane**	86 064	−134 46	1 39092	0 69327
32	**1,1-Dimethylcyclopentane**	87 846	−69 795	1 41356	0 75448
33	**2,3-Dimethylpentane**	89 784		1 39196	0 69508
34	**2-Methylhexane**	90 052	−118 276	1 38485	0 67859
35	***trans*-1,3-Dimethylcyclopentane**	90 773	−133 702	1 40894	0 74479
36	***cis*-1,3-Dimethylcyclopentane**	91 725	−133 975	1 41074	0 74880
37	**3-Methylhexane**	91 850		1 38864	0 68713
38	***trans*-1,2-Dimethylcyclopentane**	91 869	−117 58	1 41200	0 75144
39	**3-Ethylpentane**	93 475	−118 604	1 39339	0 69816
40	**Quadricyclane** (Quadricyclo [2,2,1,$0^{2,6}$,$0^{3,5}$] heptane)	98		1 4804	
41	***n*-Heptane**	98 427	−90 61	1 38764	0 68376
42	**2,2,4-Trimethylpentane**	99 238	−107 38	1 39145	0 69192
43	***cis*-1,2-Dimethylcyclopentane**	99 532	−53 892	1 42217	0 77262
44	**Methylcyclohexane**	100 934	−126 593	1 42312	0 76939
45	**Ethylcyclopentane**	103 466	−138 446	1 41981	0 76647
46	**1,1,3-Trimethylcyclopentane**	104 893	−142 44	1 41119	0 74825
47	**2,2-Dimethylhexane**	106 84	−121 18	1 39349	0 69528
48	**2,5-Dimethylhexane**	109 103	−91 20	1 39246	0 69354
49	**1,*trans*-2,*cis*-4-Trimethylcyclopentane**	109 29	−130 78	1 41060	0 74727
50	**2,4-Dimethylhexane**	109 429		1 39534	0 70036
51	**2,2,3-Trimethylpentane**	109 841	−112 27	1 40295	0 71602
52	**1,*trans*-2,*cis*-3-Trimethylcyclopentane**	110 2	−112 705	1 4138	0 7535
53	**3,3-Dimethylhexane**	111 969	−126 1	1 40009	0 7100
54	**2,3,4-Trimethylpentane**	113 467	−109 21	1 40422	0 71906
55	**1,1,2-Trimethylcyclopentane**	113 729	−21 64	1 42298	0 77252
56	**2,3,3-Trimethylpentane**	114 76	−100 70	1 40750	0 72619
57	**2,3-Dimethylhexane**	115 607		1 40113	0 71214
58	**3-Ethyl-2-methylpentane**	115 65	−114 96	1 40401	0 71932

*Derivative data given in order m p , crystal color, solvent from which crystallized

**T = triple point, S = at saturation pressure

TABLE I. ALKANES AND CYCLOALKANES

a) Gases and Liquids (Listed in order of increasing b.p.*) (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}
59	1,*cis*-2,*trans*-4-Trimethylcyclopentane	116 731	−132 55	1 41855	0 76345
60	1,*cis*-2,*trans*-3-Trimethylcyclopentane	117 5	−112	1 4218	0 7704
61	2-Methylheptane	117 647	−109 04	1 39494	0 69792
62	4-Methylheptane	117 709	−120 955	1 39792	0 70463
63	3,4-Dimethylhexane	117 725		1 40406	0 71923
64	1,*cis*-2,*cis*-4-Trimethylcyclopentane	118		1 422	0 766
65	3-Ethyl-3-methylpentane	118 259	−90 87	1 40775	0 72742
66	3-Ethylhexane	118 534		1 40162	0 71358
67	3-Methylheptane	118 925	−120 5	1 39848	0 70582
68	Cycloheptane (Suberane)	118 20	−7 98	1 4449	0 8275[0]
69	*trans*-1,4-Dimethylcyclohexane	119 351	−36 962	1 42090	0 76255
70	1,1-Dimethylcyclohexane	119 543	−33 495	1 42900	0 78094
71	*cis*-1,3-Dimethylcyclohexane	120 088	−75 573	1 42294	0 76603
72	*trans*-1-Ethyl-3-methylcyclopentane	120 8	−108	1 4186	0 7619
73	*trans*-1-Ethyl-2-methylcyclopentane	121 2		1 4219	0 7690
74	*cis*-1-Ethyl-3-methylcyclopentane	121 4		1 4203	0 7724
75	1-Ethyl-1-methylcyclopentane	121 522	−143 80	1 42718	0 78093
76	2,2,4,4-Tetramethylpentane	122 284	−66 54	1 40694	0 71947
77	1,*cis*-2,*cis*-3-Trimethylcyclopentane	123 0	−116 43	1 4262	0 7792
78	*trans*-1,2-Dimethylcyclohexane	123 419	−88 194	1 42695	0 77601
79	2,2,5-Trimethylhexane	124 084	−105 78	1 39972	0 70721
80	*cis*-1,4-Dimethylcyclohexane	124 321	−87 436	1 42966	0 78285
81	*trans*-1,3-Dimethylcyclohexane	124 45	−90 108	1 43085	0 78472
82	*n*-Octane	125 665	−56 795	1 39743	0 70252
83	Isopropylcyclopentane	126 419	−111 375	1 42582	0 77653
84	2,2,4-Trimethylhexane	126 54	−120	1 4033	0 7156
85	*cis*-1-Ethyl-2-methylcyclopentane	128 050	−105 95	1 42933	0 78522
86	*cis*-1,2-Dimethylcyclohexane	129 728	−50 023	1 43596	0 79627
87	2,4,4-Trimethylhexane	130 38	−113 38	1 40745	0 72381
88	*n*-Propylcyclopentane	130 8	−118 7	1 4266	0 7761
89	2,3,5-Trimethylhexane	131 34	−127 8	1 4061	0 7219
90	Ethylcyclohexane	131 783	−111 323	1 43304	0 78792
91	2,2-Dimethylheptane	132 69	−113 0	1 4016	0 7105
92	2,2,3,4-Tetramethylpentane	133 016	−121 09	1 41472	0 73895
93	2,4-Dimethylheptane	133 5		1 4033	0 716
94	Methylcycloheptane	133 5		1 4410	0 8052
95	2,2,3-Trimethylhexane	133 6		1 4105	0 7292
96	4-Ethyl-2-methylhexane	133 8		1 4068	0 723
97	3-Ethyl-2,2-dimethylpentane	133 83	−99 2	1 4123	0 7348
98	4,4-Dimethylheptane	135 2		1 4076	0 725
99	2,6-Dimethylheptane	135 21	−102 9	1 4007	0 7089
100	2,5-Dimethylheptane	136 0		1 4038	0 715
101	3,5-Dimethylheptane	136 0		1 4067	0 723
102	Bicyclo[4.2.0]octane	136 0		1 4613	0 8573
103	*cis*-Bicyclo[3.3.0]octane	136–6 5		$1\ 4595^{25}$	$0\ 8638^{25}$
104	2,4-Dimethyl-3-ethylpentane	136 73	−122 2	1 4137	0 7379
105	1,1,3-Trimethylcyclohexane	137–8		1 4362	$0\ 7868^{25}$
106	3,3-Dimethylheptane	137 3		1 4085	0 725
107	2,2,5,5-Tetramethylhexane	137 5		1 40550	0 71875
108	2,3,3-Trimethylhexane	137 68	−116 80	1 4141	0 738
109	3-Ethyl-2-methylhexane	138		1 4120	0 731
110	*trans*-1,3,5-Trimethylcyclohexane	$138\ 5\text{–}9^{754}$		$1\ 42740_H$	0 7720
111	2,3,4-Trimethylhexane	139 0		1 4144	0 7392
112	*cis*-1,3,5-Trimethylcyclohexane	$140\text{–}0\ 5^{752}$		$1\ 43010_H$	0 7773
113	*trans*-1,2,4-Trimethylcyclohexane	140–1		$1\ 43121_{He}$	0 7813
114	2,2,3,3-Tetramethylpentane	140 274	−9 9	1 42360	0 75666
115	4-Ethyl-3-methylhexane	140 4		1 416	0 742
116	3,3,4-Trimethylhexane	140 46	−101 2	1 4178	0 7454
117	2,3-Dimethylheptane	140 5		1 4085	0 7260

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE I. ALKANES AND CYCLOALKANES

a) Gases and Liquids (Listed in order of increasing b.p.*) (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}
118	**3,4-Dimethylheptane**	140 6		1 4111	0 7314
119	**3-Ethyl-3-methylhexane**	140 6		1 4142	0 741
120	**4-Ethylheptane**	141 2		1 4096	0 730
121	**2,3,3,4-Tetramethylpentane**	141 551	− 102 123	1 42222	0 75473
122	**2,3-Dimethyl-3-ethylpentane**	142		1 419	0 754
123	***trans*-1,2,3-Trimethylcyclohexane**	142 3 5[762]		1 43582$_{He}$	0 7914
124	**1-Isopropyl-3-methylcyclopentane** (Pulegan)	142 4		1 4236	0 7730[22]
125	**4-Methyloctane**	142 48	− 113 2	1 4061	0 7199
126	**1-Isopropyl-2-methylcyclopentane**	142 5[759]		1 4279	0 7792
127	**3-Ethylheptane**	143 0		1 4093	0 727
128	**2-Methyloctane**	143 26	− 80 4	1 4031	0 7134
129	***cis*-1,2,3-Trimethylcyclohexane**	144−6[753]		1 43682$_{He}$	0 7930
130	**3-Methyloctane**	144 18	− 107 6	1 4062	0 7207
131	**2,4,6-Trimethylheptane**	144 8		1 4071	0 7225
132	***cis*-1,2,4-Trimethylcyclohexane**	146		1 43209	0 786
133	**3,3-Diethylpentane**	146 168	− 33 11	1 42051	0 75359
134	**2,2-Dimethyl-4-ethylhexane**	147		1 4131	0 733
135	**2,2,4-Trimethylheptane**	147 7		1 4092	0 7275
136	**2,2,4,5-Tetramethylhexane**	147 8		1 41318	0 73546
137	**2,2,5-Trimethylheptane**	148		1 409	0 726
138	**2,2,6-Trimethylheptane**	148 2		1 4059	0 7195
139	**2,2,3,5-Tetramethylhexane**	148 4		1 4142	0 7378
140	**Nopinane** (7,7-Dimethylbicyclo[3 1 1]heptane)	149[747]		1 4641	0 8611$^{22}_{22}$
141	***trans*-1-Ethyl-4-methylcyclohexane**	149 05− 15	− 80 8	1 4304	0 7798
142	**Cyclooctane**	150[750]	14 (4 3)	1 4586	0 8349
143	**1-Ethyl-2-methylcyclohexane**	150 2		1 432	0 784
144	***n*-Nonane**	150 81	− 53 519	1 40542	0 71763
145	**1,3,3-Trimethylbicyclo[2.2.1]heptane** (Fenchane)	151 2		1 44714	0 8345
146	***trans*-1-Ethyl-4-methylcyclohexane**	151 69		1 4382	0 7972
147	***cis*-1,1,3,5-Tetramethylcyclohexane**	152 4− 5		1 4319	0 7813
148	***cis*-1-Ethyl-4-methylcyclohexane**	152 55 60		1 4374	0 7969
149	**2,5,5-Trimethylheptane**	152 8		1 4136	0 7368
150	**2,4,4-Trimethylheptane**	153		1 412	0 733
151	**2,3,3,5-Tetramethylhexane**	153		1 4196	0 746
152	**2,2,4,4-Tetramethylhexane**	153 3		1 4208	0 7470
153	**Isopropylcyclohexane**	154 5	− 89 8	1 44095	0 80232
154	**1,1,3,3-Tetramethylcyclohexane**	154 8−5 0		1 4374	0 7936
155	**2,2,3,4-Tetramethylhexane**	154 9		1 4226	0 7548
156	**2,2-Dimethyloctane**	155		1 4082	0 7245
157	**3-Ethyl-2,2,4-trimethylpentane**	155 3		1 4223	0 7571
158	**3,3,5-Trimethylheptane**	155 6		1 4170	0 7428
159	**2,3,6-Trimethylheptane**	155 7		1 4125	0 7345
160	**2,4-Dimethyloctane**	155 8 6 0		1 4090	0 7259$^{20}_{20}$
161	***d,l-cis*-1-Ethyl-3-methylcyclohexane**	155 97		1 4432	0 8094
162	***d,l*-2,5-Dimethyloctane**	156−8		1 4160	0 7370
163	**1,1,3,5-Tetramethylcyclohexane**	156 4 5		1 4370	0 7929
164	***n*-Butylcyclopentane**	156 56	− 107 985	1 4316	0 7846
165	***n*-Propylcyclohexane**	156 724	− 94 90	1 43705	0 79360
166	**2,3,5-Trimethylheptane**	157		1 416	0 741
167	**2,5-Dimethyl-3-ethylhexane**	157		1 416	0 741
168	**2,4,5-Trimethylheptane**	157		1 4160	0 741
169	**2,4-Dimethyl-3-isopropylpentane**	157		1 42463	0 75830
170	**2,2,3-Trimethylheptane**	158		1 417	0 7420
171	**2,4-Dimethyl-4-ethylhexane**	158		1 419	0 747
172	**2,2-Dimethyl-3-ethylhexane**	159		1 420	0 749
173	**2,2,3,4,4-Pentamethylpentane**	159 3		1 43069	0 76703
174	**1,1,3,4-Tetramethylcyclohexane**	159 5−6 1		1 4380	0 7976
175	**5-Ethyl-2-methylheptane**	159 7		1 4134	0 736
176	**2,7-Dimethyloctane**	159 9		1 4086	0 7242

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE I. ALKANES AND CYCLOALKANES

a) Gases and Liquids (Listed in order of increasing b.p.*) (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^t
177	**3,6-Dimethyloctane**	160		1 4145[18]	0 7363
178	**3,5-Dimethyloctane**	160		1 413	0 736
179	**4-Isopropylheptane**	160		1 417	0 741
180	**2,3,3-Trimethylheptane**	160		1 4202	0 7488
181	**4-Ethyl-2-methylheptane**	160		1 413	0 736
182	**2,6-Dimethyloctane**	160-0 5		1 4113	0 7285
183	**2,2,3,3-Tetramethylhexane**	160 3		1 42818	0 76446
184	***trans*-1-Isopropyl-4-methylcyclohexane** (*p*-Menthane)	161		1 4393	0 792
185	**4,4-Dimethyloctane**	161		1 4144	0 7347
186	**2,3,4,5-Tetramethylhexane**	161		1 424	0 757
187	**5-Ethyl-3-methylheptane**	161		1 414	0 737
188	**3,3-Dimethyloctane**	161 2		1 4165	0 7390
189	**4,5-Dimethyloctane**	162		1 4173	0 7458
190	**3,4-Diethylhexane**	162		1 420	0 754
191	**4-Propylheptane**	162		1 4150	0 7364
192	**1,1,4-Trimethylcycloheptane** (Eucarvane)	162 3[720]		1 4420	0 8011
193	***trans*-1,2,3,5-Tetramethylcyclohexane**	162 4		$1\ 44657_{He}$	0 8140
194	**2,3,4,4-Tetramethylhexane**	162 2		1 4270	0 7639
195	**2,3,4-Trimethylheptane**	163		1 421	0 751
196	**3-Isopropyl-2-methylhexane**	163		1 421	0 751
197	**2,2,7-Trimethylbicyclo[2.2.1]heptane** (α-Fenchane)	163 5 4 5[753]		1 4590	0 8579
198	**3-Ethyl-3-methylheptane**	163 8		1 4208	0 7501
199	**2,4-Dimethyl-3-ethylhexane**	164		1 424	0 759
200	**3,4,4-Trimethylheptane**	164		1 424	0 757
201	**3,3,4-Trimethylheptane**	164		1 424	0 757
202	**3,4,5-Trimethylheptane**	164		1 424	0 759
203	**2,3-Dimethyl-4-ethylhexane**	164		1 424	0 759
204	**1-Methyl-3-propylcyclohexane**	164-5 (171 3)		1 4377	0 7895[21]
205	**2,3-Dimethyloctane**	164 4 4 6[764]		1 4152	0 7377
206	***d,l*-Pinane**	164 5 5 0		1 4609	0 8551
207	**2,3,3,4-Tetramethylhexane**	164 6		1 4297	0 7694
208	**3,3-Dimethyl-4-ethylhexane**	165		1 427	0 764
209	**5-Methylnonane**	165 1	−87 7	1 4122	0 7326
210	**4-Methylnonane**	165 7	−98 7	1 4123	0 7323
211	**3-Ethyl-2-methylheptane**	166		1 418	0 746
212	**3,4-Dimethyloctane**	166		1 4182	0 746
213	***d*-α-Pinane**	166 6 5[762]		1 4630	0 8560
214	***d,l*-1-Isopropyl-3-methylcyclohexane** (*d,l-m*-Menthane)	166 7		1 44[24]	0 7965[24]
215	**2,2,3,3,4-Pentamethylpentane**	166 1		1 43606	0 78009
216	***trans*-1,2,4,5-Tetramethylcyclohexane**	166 2-8 0		$1\ 44446_{He}$	0 8100
217	**3,3-Diethylhexane**	166 3		1 428	0 767
218	**2-Methylnonane**	166 8	−74 5	1 4099	0 7281
219	***d*-1-Isopropyl-3-methylcyclohexane** (*d-m*-Menthane)	167		1 446[23]	0 8116[23]
220	**3-Ethyl-4-methylheptane**	167		1 422	0 753
221	**4-Ethyl-3-methylheptane**	167		1 422	0 753
222	**4-Ethyl-4-methylheptane**	167		1 421	0 752
223	***l*-β-Pinane**	167 5-8[748]		1 4605	0 8567
224	**3-Methylnonane**	167 8	−84 8	1 4125	0 7334
225	**3-Ethyloctane**	168		1 416	0 740
226	**4-Ethyloctane**	168		1 416	0 740
227	**3-Ethyl-2,2,3-trimethylpentane**	168		1 436	0 781
228	***l*-1-Isopropyl-3-methylcyclohexane** (*l-m*-Menthane)	168		1 4358	0 7938
229	***cis*-1-Isopropyl-4-methylcyclohexane** (*cis-p*-Menthane)	168 5		1 4515	0 816
230	***cis*-1,2,3,5-Tetramethylcyclohexane**	168-70[762]		$1\ 44847_{He}$	0 8166
231	**2,3-Dimethyl-3-ethylhexane**	169		1 427	0 765

*Derivative data given in order m p , crystal color solvent from which crystallized

TABLE I. ALKANES AND CYCLOALKANES
a) Gases and Liquids (Listed in order of increasing b.p.*) (Continued)

No	Name		Boiling point, °C	n_D^{20}	D_4^{20}
232	**1-Isopropyl-4-methylcyclohexane** (*p*-Menthane)	169 70		1 4375[21]	0 7929
233	**3,4-Dimethyl-3-ethylhexane**	170		1 431	0 772
234	**3,3,4,4-Tetramethylhexane**	170		1 4368	0 7824
235	**Cyclononane**	170–2	9 7	1 4328[16]	0 8534[15 2]
236	**1-Isopropyl-2-methylcyclohexane** (*o*-Menthane)	171		1 447[21]	0 8135[21]
237	***cis*-1,2,4,5-Tetramethylcyclohexane**	171[755]		1 44647$_{He}$	0 8122
238	**1-Methyl-1-propylcyclohexane**	172		1 4440	0 8101
239	***n*-Decane**	174 123	– 29 661	1 41189	0 73005
240	**1-Methyl-4-propylcyclohexane**	174 3–7 1		1 4393	0 798
241	**1-Methyl-2-propylcyclohexane**	175 5 6 0[7 6]		1 4468[19]	0 8130[19]
242	***n*-Pentylcyclopentane**	180 60[10]	– 83	1 4358	0 7912
243	***n*-Butylcyclohexane**	180 947	– 74 725	1 44075	0 79918
244	***trans*-Decahydronaphthalene** (*trans*-Decalin)	187 25	– 30 40	1 4695	0 8699
245	**Isoamylcyclohexane**	193		1 4423	0 8023
246	***cis*-Decahydronaphthalene** (*cis*-Decalin)	195 69	– 43 01	1 4810	0 8965
247	***n*-Undecane** (*n* Hendecane)	195 89	– 25 594	1 41716	0 74017
248	**Cyclodecane**	201	9 6	1 4692	0 8577[20 4]
249	***n*-Pentylcyclohexane**	202 8	– 57 5	1 4437	0 8037
250	***n*-Hexylcyclopentane**	203		1 4392	0 7965
251	**9-Methyl-*trans*-decahydronaphthalene**	205, 77[10]		1 4631	0 8620
252	**1,10-Dimethyl-*trans*-decahydronaphthalene**	213 83[10]		1 4659	0 8633
253	**9-Methyl-*cis*-decahydronaphthalene**	215 85[10]		1 4804	0 8910
254	***n*-Dodecane**	216 278, 51 84[1]	– 9 587 (– 12)	1 42160	0 74869
255	**1,10-Dimethyl-*cis*-decahydronaphthalene**	220, 88 99[10]		1 4812	0 8896
256	***n*-Hexylcyclohexane**	224 0, 92 0[10]	– 43	1 4462	0 8076
257	***n*-Heptylcyclopentane**	224		1 4421	0 8010
258	**9-Ethyl-*trans*-decahydronaphthalene**	225 93 06[10]		1 466	0 8610
259	**9-Ethyl-*cis*-decahydronaphthalene**	233 99[10]		1 480	0 8860
260	**1-Methyl-*trans*-decahydronaphthalene**	235, 101[10]		1 4270	
261	***n*-Tridecane**	235 44 66 35[1]	– 5 392	1 4256	0 7564
262	**Bicyclohexyl**	236 5 7 5, 100[10]	3 5–4 0	1 4795	0 8848
263	***n*-Octylcyclopentane**	243		1 4446	0 8048
264	***n*-Heptylcyclohexane**	244		1 4484	0 8109
265	***n*-Tetradecane**	235 57, 80 13[1]	5 863	1 4289	0 7628
266	***n*-Nonylcyclopentane**	262		1 4467	0 8081
267	***n*-Octylcyclohexane**	264		1 4503	0 8138
268	***n*-Pentadecane**	270 63, 93 26[1]	9 926	1 4319	0 7685
269	***n*-Decylcyclopentane**	279 3		1 44862	0 81097
270	***n*-Nonylcyclohexane**	282		1 4519	0 8163
271	***n*-Undecylcyclopentane** (*n*-Hendecylcyclopentane)	296		1 4503	0 8135
272	***n*-Decylcyclohexane**	299		1 45338	0 81858
273	**2-Methylheptadecane**	311, 178 5[15]		1 4394[14]	0 7838[15]
274	***n*-Dodecylcyclopentane**	312		1 4518	0 8158
275	***n*-Undecylcyclohexane** (*n*-Hendecylcyclohexane)	316	5 8	1 4547	0 8206
276	***n*-Tridecylcyclopentane**	327	5	1 4531	0 8178
277	***n*-Dodecylcyclohexane**	331	12 5	1 4559	0 8223
278	***n*-Tetradecylcyclopentane**	341	9	1 4543	0 8196

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE I. ALKANES AND CYCLOALKANES

b) Solids (Listed in order of increasing m.p.*)**

No.	Name	Melting point, °C	Boiling point, °C	n_D	D_4
1	**Pentadecylcyclopentane**	17	355	1.4554^{20}	0.8213^{20}
2	***n*-Hexadecane** (Cetane)	18.165	286.793; 105.20[1]	1.43453^{20}	0.7734^{20}
3	**Tridecylcyclohexane**	18.5	346	1.4570^{20}	0.8239^{20}
4	**Hexadecylcyclopentane**	21		1.4543^{25}	0.8194^{25}
5	***n*-Heptadecane**	21.98	301.82; 117.26[1]	1.4348^{25}; 1.4369^{20}_{U}	0.7745^{25}; 0.7780^{20}_{U}
6	**Tetradecylcyclohexane**	24		1.4559^{25}	0.8221^{25}
7	**Heptadecylcyclopentane**	27		1.4532^{30}	0.8173^{30}
8	***n*-Octadecane**	28.18	316.12; 128.28[1]	1.4191^{70}; 1.4390^{20}_{U}	0.7751^{30}; 0.7819^{20}_{U}
9	**Pentadecylcyclohexane**	29		1.4545^{30}	0.8201^{30}
10	**Octadecylcyclopentane**	30		1.4541^{30}	0.8186^{30}
11	***n*-Nonadecane**	32.1	329.7; 138.8[1]	1.4211^{70}; 1.4409^{20}_{U}	0.7787^{30}; 0.7855^{20}_{U}
12	**Hexadecylcyclohexane**	33.6		1.4596^{20}_{U}	0.8279^{20}_{U}
13	**Nonadecylcyclopentane**	35		1.4588^{20}_{U}	0.8266^{20}_{U}
14	***n*-Eicosane**	36.8	342.7; 148.9[1]	1.4230^{70}; 1.4426^{20}_{U}	0.7550^{70}; 0.7887^{20}_{U}
15	**Heptadecylcyclohexane**	37.8		1.4603^{20}_{U}	0.8290^{20}_{U}
16	**Eicosylcyclopentane**	38		1.4595^{20}_{U}	0.8276^{20}_{U}
17	***n*-Heneicosane**	40.5	356.5; 152.94[1]	1.4247^{70}; 1.4441^{20}_{U}	0.7583^{70}; 0.7917^{20}_{U}
18	**Octadecylcyclohexane**	41.6		1.4610^{20}_{U}	0.8300^{20}_{U}
19	**Heneicosylcyclopentane**	42		1.4602^{20}_{U}	0.8286^{20}_{U}
20	***n*-Docosane**	44.4 (47)	368.6; 161.88[1]	1.4260^{70}; 1.4455^{20}_{U}	0.7631^{70}
21	**Docosylcyclopentane**	45		1.4608^{20}_{U}	0.8295^{20}_{U}
22	**Nonadecylcyclohexane**	45.2		1.4616^{20}_{U}	0.8310^{20}_{U}
23	***n*-Tricosane**	47.6	380.2; 170.48[1]	1.4276^{20}; 1.4468^{20}_{U}	0.7641^{70}; 0.7969^{20}_{U}
24	**Eicosylcyclohexane**	48.5		1.4622^{20}_{U}	0.8318^{20}_{U}
25	**Tricosylcyclopentane**	49		1.4614^{20}_{U}	0.8304^{20}_{U}
26	***n*-Tetracosane**	50.9	391.3; 178.7[1]	1.4286^{70}; 1.4480^{20}_{U}	0.7657^{70}; 0.7991^{20}_{U}
27	**Tetracosylcyclopentane**	51		1.4619^{20}_{U}	0.8312^{20}_{U}
28	**Heneicosylcyclohexane**	51.5		1.4627^{20}_{U}	0.8326^{20}_{U}
29	***n*-Pentacosane**	53.7	401.9; 186.55[1]	1.4302^{70}; 1.4491^{20}_{U}	0.7693^{70}; 0.8012^{20}_{U}
30	**Pentacosylcyclopentane**	54		1.4624^{20}_{U}	0.8319^{20}_{U}
31	**Docosylcyclohexane**	54.4		1.4632^{20}_{U}	0.8334^{20}_{U}
32	**Hexacosylcyclopentane**	56		1.4628^{20}_{U}	0.8326^{20}_{U}
33	**Nortricyclene** (Tricyclo[2.2.1.$0^{2,6}$]heptane)	56	106–7		
34	***n*-Hexacosane**	56.4	412.2; 194.18[1]	1.4310^{70}; 1.4501^{20}_{U}	0.7704^{70}; 0.8032^{20}_{U}
35	**Cyclohexadecane**	57	$93–8^{0.8}$		
36	**Tricosylcyclohexane**	57		1.4637^{20}_{U}	0.8341^{20}_{U}
37	**Heptacosylcyclopentane**	59		1.4633^{20}_{U}	0.8333^{20}_{U}
38	***n*-Heptacosane**	59.0	422.1; 201.54[1]	1.4321^{70}; 1.4511^{20}_{U}	0.7732^{70}; 0.8050^{20}_{U}
39	**Tetracosylcyclohexane**	59.5		1.4641^{20}_{U}	0.8347^{20}_{U}
40	**Cyclopentadecane**	60–1		$1.4592^{61.5}$	$0.8634^{61.5}$
41	**Octacosylcyclopentane**	61		1.4637^{20}_{U}	0.8339^{20}_{U}
42	***n*-Octacosane**	61.4	431.6; 208.58[1]	1.4330^{70}; 1.4520^{20}_{U}	0.7750^{70}; 0.8067^{20}_{U}
43	**Pentacosylcyclohexane**	61.9		1.4645^{20}_{U}	0.8353^{20}_{U}
44	**Nonacosylcyclopentane**	63		1.4640^{20}_{U}	0.8345^{20}_{U}
45	***n*-Nonacosane**	63.7	440.8; $172.36^{0.1}$	0.7797^{65}; 1.4529^{20}_{U}	1.4361^{65}; 0.8083^{20}_{U}

*Derivative data given in order: m.p., crystal color, solvent from which crystallized.

**U = undercooled liquid.

TABLE I. ALKANES AND CYCLOALKANES
b) Solids (Listed in order of increasing m.p.*)** (Continued)

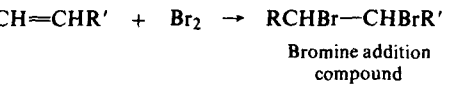
No	Name	Melting point, °C	Boiling point, °C	n_D	D_4
46	**Hexacosylcyclohexane**	64		1.4649^{20}_{U}	0.8359^{20}_{U}
47	**Triacontylcyclopentane**	65		1.4644^{20}_{U}	0.8350^{20}_{U}
48	***d,l*-Isobornane** (2,2,3-Trimethylbicyclo[2.2.1]heptane)	65–7		1.44186^{67}	0.82757^{67}
49	***n*-Triacontane**	65.8	449.7, 222.00[1]	1.4348^{70}, 1.4536^{20}_{U}	0.7797^{70}, 0.8097^{20}_{U}
50	**Heptacosylcyclohexane**	66.1		1.4653^{20}_{U}	0.8365^{20}_{U}
51	**Hentriacontylcyclopentane**	67		1.4648^{20}_{U}	0.8356^{20}_{U}
52	***n*-Hentriacontane**	67.9	458, 184.17[0.1]	1.4543^{20}_{U}	0.8111^{20}_{U}
53	**Octacosylcyclohexane**	68		1.4656^{20}_{U}	0.8370^{20}_{U}
54	**Dotriacontylcyclopentane**	69		1.4651^{20}_{U}	0.8360^{20}_{U}
55	***n*-Dotriacontane** (Bicetyl)	69.7	467, 234.8[1]	1.4550^{20}_{U}	0.7791^{75}, 0.8124^{20}_{U}
56	**Nonacosylcyclohexane**	69.9		1.4659^{20}_{U}	0.8374^{20}_{U}
57	**Tritriacontylcyclopentane**	70		1.4654^{20}_{U}	0.8365^{20}_{U}
58	**Tritriacontane**	71.4		1.4557^{20}_{U}	0.8136^{20}_{U}
59	**Triacontylcyclohexane**	71.6		1.4662^{20}_{U}	0.8379^{20}_{U}
60	**Tetratriacontylcyclopentane**	72		1.4657^{20}_{U}	0.8370^{20}_{U}
61	**Tetratriacontane**	72.6, 73.1	285.4[3]	1.4296^{90}, 1.4563^{20}_{U}	0.7728^{90}, 0.8148^{20}_{U}
62	**28-Methylnonacosane**	73.4	222[0.3]		
63	**Hentriacontylcyclohexane**	73.3		1.4665^{20}_{U}	0.8383^{20}_{U}
64	**Pentatriacontylcyclopentane**	74		1.4660^{20}_{U}	0.8374^{20}_{U}
65	**Pentatriacontane**	74.7	331	1.4568^{20}_{U}	0.8157^{20}_{U}
66	**Dotriacontylcyclohexane**	74.8		1.4668^{20}_{U}	0.8388^{20}_{U}
67	**Hexatriacontylcyclopentane**	75		1.4662^{20}_{U}	0.8378^{20}_{U}
68	**Hexatriacontane**	76.2		1.4573^{20}_{U}	0.8169^{20}_{U}
69	**Tritriacontylcyclohexane**	76.3		1.4670^{20}_{U}	0.8391^{20}_{U}
70	**Heptatriacontane**	77.7		1.4578^{20}_{U}	0.8179^{20}_{U}
71	**Tetratriacontylcyclohexane**	77.7		1.4673^{20}_{U}	0.8395^{20}_{U}
72	**Octatriacontane**	79		1.4583^{20}_{U}	0.8188^{20}_{U}
73	**Pentatriacontylcyclohexane**	79.1		1.4675^{20}_{U}	0.8399^{20}_{U}
74	**Nonatriacontane**	80.3		1.4588^{20}_{U}	0.8197^{20}_{U}
75	**Hexatriacontylcyclohexane**	80.4		1.4678^{20}_{U}	0.8402^{20}_{U}
76	**Tetracontane**	81.5		1.4593^{20}_{U}	0.8205^{20}_{U}
77	**Norbornane** (Bicyclo[2.2.1]heptane)	86–7, subl			
78	**2,2,3,3-Tetramethylbutane**	100.69	106.47	1.4695^{20}	0.8242^{23}_{solid}
79	**Bornane** (Camphane)	158.9, subl			
80	***Adamantane***	268 (252.3)		1.568	1.07_{solid}

*Derivative data given in order m.p., crystal color, solvent from which crystallized

**U = undercooled liquid

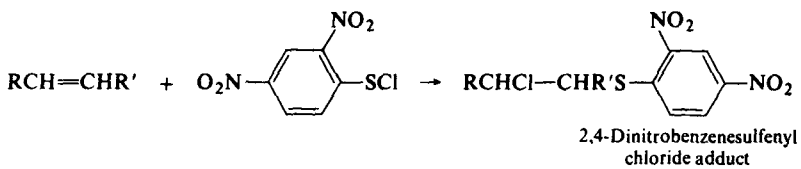
EXPLANATIONS AND REFERENCES TO TABLE II

*Bromine addition compound.**



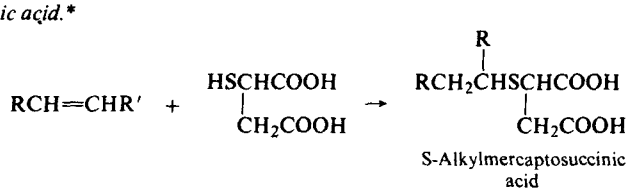
From the alkene and bromine in carbon tetrachloride.
For directions and examples see: Cheronis, p. 576; Shriner, p. 106.
From the alkene and bromine in water.
See: Vogel, p. 241.
From the alkene and bromine in chloroform.
See: C. G. Schmitt and C. E. Boord, *J. Amer. Chem. Soc.*, **54**, 751 (1932).

*2,4-Dinitrobenzenesulfenyl chloride addition compound.**



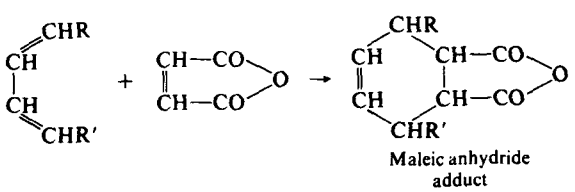
From the alkene and 2,4-dinitrobenzenesulfenyl chloride in glacial acetic acid.
For directions and examples see: Cheronis, p. 577; N. Kharasch and C. M. Buess, *J. Amer. Chem. Soc.*, **71**, 2724 (1949); D. J. Cram, *J. Amer. Chem. Soc.*, **71**, 3883 (1949); N. Kharasch, C. M. Buess and S. I. Strashun, *J. Amer. Chem. Soc.*, **74**, 3422 (1952).
From the alkene and 2,4-dinitrobenzenesulfenyl chloride in benzene or in carbon tetrachloride.
See: N. Kharasch and C. M. Buess, *J. Amer. Chem. Soc.*, **71**, 2724 (1949).

*S-Alkylmercaptosuccinic acid.**



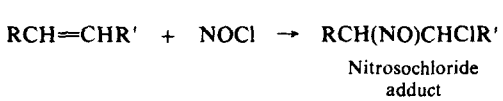
From the alkene, mercaptosuccinic acid and benzoyl peroxide in methanol.
For directions and examples see: J. G. Hendrickson and L. F. Hatch, *J. Org. Chem.*, **25**, 1747 (1960).

Maleic anhydride adduct (from dienes).



From the diene and maleic anhydride in benzene.
For directions and examples see: Linstead, p. 51; Vogel, p. 943.
From the diene and maleic anhydride in xylene.
See: Linstead, p. 51.
For general references see: M. C. Kloetzel in *Organic Reactions*, Vol. 4 (Ed. R. Adams), John Wiley and Sons, New York, 1948, p. 1; H. L. Holmes in *Organic Reactions*, Vol. 4, (Ed. R. Adams), John Wiley and Sons, New York, 1948, p. 60; O. Diels and K. Alder, *Chem. Ber.*, **62**, 2081 (1929).

Nitrosochloride addition compound.



*Derivatives recommended for first trial.
WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

EXPLANATIONS AND REFERENCES TO TABLE II (Continued)

From the alkene and nitrosyl chloride (prepared from sodium nitrite in concentrated hydrochloric acid) in ether-acetic acid mixture.

For directions and examples see: Linstead, p. 52; R. Perrot, *Compt. Rend.*, **203**, 329 (1936).

From the alkene and nitrosyl chloride (prepared from thionyl chloride and nitrogen trioxide) in ether.

See: M. Tuot, *Compt. Rend.*, **204**, 697 (1937).

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

a) Liquids 1) (Listed in order of increasing b.p.*)**

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Bromine addition product					Miscellaneous
						x-Bromo-	B P , °C	M P , °C	n_D^{20}	D_4^{20}	
1	**Ethene** (Ethylene)	−103 71	−169 15[T]		0 384[0]	*di-*	131 36	9 8ɔ	1 53868	2 1792	
2	**Propene** (Propylene)	−47 70	−185 25[T]		0 5139	*di-*	141 99	−55 5	1 52004	1 93268	
3	**Cyclopropene**	−36[741]									
4	**Allene**	−34 5	−136			*tetra-*		10 7	1 6200	2 703	
5	**2-Methylpropene**	−6 90	−140 35	1 3467	0 5942[S]	*di-*	149		1 5080	1 7595	2,4 Dinitrophenyl-sulfenyl chloride, 86 7
6	**1-Butene**	−6 26	−185 35	1 3465	0 5951	*di-*	166 3		1 5150	1 7951	2,4-Dinitrophenyl-sulfenyl chloride, 77 5 8 5
7	**1,3-Butadiene**	−4 41	−108 92	1 4292[2] 0 650 [t]	0 6255 [t]	*tetra-*		118 lgr			
8	*trans*-**2-Butene**	0 88	−105 55		0 6042[S]	*di-*	161 0		1 5110	1 7852	
9	**Cyclobutene**	2 4			0 733[0]						
10	*cis* **2-Butene**	3 72	−138 91		0 6306[t]	*di-*	161 0		1 5110	1 7852	
11	**1,2-Butadiene** (Methylallene)	10 85	−136 19	1 4208[5]	0 652[S]	*tetra-*	97 5	−2	1 6070	2 5085	
12	**3-Methyl-1-butene**	20 06	−168 49	1 3643	0 6272	*di-*	61 2[12]		1 50932	1 6776	
13	**1,4-Pentadiene**	25 97	−148 28	1 38876	0 66706	*tetra*		85 5 6 0, eth			
14	**1-Pentene**	29 97	−165 22	1 37148	0 64050	*di-*	68[12]		1 5012[12]	1 592[19]	Mercaptosuccinic acid adduct, 107 3 6
15	**2-Methyl-1-butene**	31 16	−137 56	1 3778	0 6504	*di-*	47 4 48[9]		1 5088	1 6711	Mercaptosuccinic acid adduct, 122 3- 6
16	**3-Methylcyclobutene**	32		1 4005							
17	**2-Methyl-1,3-butadiene** (Isoprene)	34 07	−145 95	1 42194	0 68095	*di-* *tetra-*	90-6[12] 155 60[12]				Maleic anh adduct, 63-4, lgr
18	*trans*-**2-Pentene**	36 35	−140 24	1 3793	0 6482	*di-*	91 0[50]		1 5096	1 6809	
19	*cis*-**2-Pentene**	36 94	−151 39	1 3830	0 6556	*di-*	92 4[50]		1 5096	1 6817	
20	**1-Methyl-1-cyclobutene**	37 1		1 4088	0 7244						
21	**2-Methyl-2-butene**	38 57	−133 77	1 3874	0 6623						Nitrosochloride, 74, Mercaptosuccinic acid adduct, 153 7-4 0
22	**3-Methyl-1,2-butadiene** (1 1 Dimethylallene)	40		1 410	0 680	*tetra-*	150 2[1]		1 594[17]	2 305[17]	
23	**Cyclopentadiene**	40 83 [2]	−85	1 4398[19 5]	0 7983[19]						Dimer 32, Maleic anh adduct, 164 5 Benzoquinone adduct, 75 6
24	**1,3-Pentadiene** (Piperylene)	41 1	−88 9	1 4309	0 6803	*tetra-*		114 5, al			Maleic anh adduct, 61, pet eth , Oxid by $KMnO_4$ → HCOOH + CH_3COOH
25	**3,3-Dimethyl-1-butene**	41 24	−115 2	1 3760	0 6529	*di-*	95 3 5 6[10]		1 5109	1 5615	
26	**1,** *trans*-**3-Pentadiene**	42 03	−87 47	1 43008	0 67603	*tetra-*	131[3]	115, al			
27	**1,***cis*-**3-Pentadiene**	44 07	−140 82	1 43634	0 69102	*tetra-*	131[3]	115, al			

*Derivative data given in order m p , crystal color, solvent from which crystallized

**T = triple point, S = at saturation pressure

TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

a) Liquids 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Bromine addition product					Miscellaneous
						x Bromo-	B P °C	M P °C	n_D^{20}	D_4^{20}	
28	**Cyclopentene**	44 24	−135 08	1 42246	0 77199	*dl-*	71 5[12]		1 5510[11]	1 8713[11]	Mercaptosuccinic acid adduct 142 8 3 1 Pseudonitrosite 69 70 Perbenzoic acid oxid → epoxycyclopentane b p 102 3
29	**1,2-Pentadiene** (Ethylallene)	44 86	−137 26	1 42091	0 69257	*tetra-*	94 6[0 1]			2 3469[15]	
30	**2,3-Pentadiene** (1 3-Dimethylallene)	48 27	−125 26	1 42842	0 69502						
31	**4-Methyl-1-pentene**	53 88	−153 63	1 3828	0 6642	*dl*	87[21]		1 4980	1 5689	Mercaptosuccinic acid adduct 102 6 9
32	**3-Methyl-1-pentene**	54 14	−153 0	1 3842	0 6675	*dl*	99[30]		1 5060	1 6016	
33	**3-Methyl-1,4-pentadiene**	55		1 405	0 695						
34	**2,3-Dimethyl-1-butene**	55 67	−157 27	1 3904	0 6779	*dl-*	80[1]		1 5105	1 6033	
35	**2-Methyl-1,4-pentadiene**	56		1 405	0 694						
36	**4-Methyl-*cis*-2-pentene**	56 3	−134 43	1 3880	0 6690	*dl*	72 3[18]		1 5060	1 5983	
37	**4-Methyl-*trans*-2-pentene**	58 55	−140 81	1 3889	0 6686	*dl-*	78[22]		1 5070	1 5996	
38	**1,5-Hexadiene** (Biallyl)	59 46	−140 8	1 4042	0 6923	*tetra-*		52			Dil HNO_3 → succinic ac 185
39	**2-Methyl-1-pentene**	60 7	−135 72	1 3920	0 6817	*dl*	87 8[20]		1 5015	1 5581	
40	**1-Hexene**	63 49	−139 82	1 38788	0 67317	*dl-*	89 90[18]		1 5024	1 5774	2,4-Dinitrophenylsulfenyl chloride 61 2 Mercaptosuccinic acid adduct, 94 5 5 7
41	**2-Ethyl-1-butene**	64 6	−131 53	1 3969	0 6894	*dl-*	87[21]		1 5112	1 6045	
42	***trans*-1,3-Hexadiene**	64 5 5 5		1 4060[19]	0 6925[19]	*tetra-*		19			
43	**3-Methylcyclopentene**	65 0		1 4207	0 7622						
44	***cis*-3-Hexene**	66 44	−137 82	1 3947	0 6796	*dl*	80 1[13]		1 5045	1 6027	
45	**3-Hexene** (*cis-trans* mixture)	66 6-67		1 3942	0 6816	*dl-*	80 1[13]		1 5045	1 6027	
46	***trans*-3-Hexene**	67 08	−113 43	1 3943	0 6772	*dl-*	80 1[13]		1 5045	1 6027	
47	**2-Methyl-2-pentene**	67 29	−135 7	1 4004	0 6863	*dl-*	71-2[18]		1 5063	1 5849	Mercaptosuccinic acid adduct, 152 1 6
48	**3-Methyl-*trans*-2-pentene**	67 63	−134 84	1 4016	0 6942	*dl-*	72 4[15]		1 5085		
49	***trans*-2-Hexene**	67 87	−132 97	1 3935	0 6784	*dl-*	90[16]		1 5025	1 5812	
50	**2-Hexene** (*cis-trans* mixture)	67 9 8 1		1 3928	0 6813	*dl-*	90[16]		1 5025	1 5812	
51	**2,3-Hexadiene**	68		1 395	0 680						
52	**2,3-Dimethyl-1,3-butadiene**	68 78	−76 01	1 4394	0 7267	*dl-* *tetra-*		47, lgr 138, bz			Maleic anh adduct, 78-9
53	***cis*-2-Hexene**	68 84	−141 14	1 3977	0 6869	*dl-*	90[16]		1 5025	1 5812	
54	**4-Methyl-1,2-pentadiene** (1-Isopropylallene)	70		1 424	0 708						
55	**3-Methyl-*cis*-2-pentene**	70 45	−138 45	1 4045	0 6986	*dl-*	72-4[15]		1 5085		

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

a) Liquids 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Bromine addition product					Miscellaneous
						x-Bromo-	B P , °C	M P , °C	n_D^{20}	D_4^{20}	
56	**2-Methyl-2,3-pentadiene** (Trimethyl allene)	72		1 425	0 711						
57	**1,4-Hexadiene**	72 3 2 5		1 4402[19]	0 7057[19]	*tetra-* 2 forms		a) 63 4 b) f p <-50			
58	**4,4-Dimethyl-1-pentene**	72 49	-136 6	1 3918	0 6827	*di*	77-8[9]		1 4970	1 5129	Mercaptosuccinic acid adduct, 119 0 5
59	**1, (*cis* and/or *trans*)-3-hexadiene**	73		1 438	0 705						
60	**2,3-Dimethyl-2-butene**	73 21	-74 28	1 4122	0 7080	*di*		173 4 121			
61	**2-Ethyl-1,3-butadiene**	75		1 445	0 717						
62	**4-Methylcyclopentene**	75 2		1 4306	0 7796						
63	**1-Methylcyclopentene**	75 8	-127	1 4330	0 7802						
64	**2-Methyl-1,(*cis* and/or *trans*)-3-pentadiene**	76		1 446	0 719						
65	**1,2-Hexadiene** (*n*-Propylallene)	76		1 4282	0 7149	*tetra-*	130[3]		1 5850	2 1873	
66	**2-Methyl-1,(*cis* and/or *trans*)-3-pentadiene**	76		1 446	0 719						
67	**4-Methyl-1,3-pentadiene**	76 3		1 451	0 719						
68	**4,4-Dimethyl-*trans*-2-pentene**	76 75	-115 24	1 3982	0 6889	*di-*	92 8-93[14]		1 5080	1 5538	
69	**3,3-Dimethyl-1-pentene**	77 54	-134 3	1 3984	0 6974	*di-*	95 3 6[10]		1 5109	1 5615	
70	**2,3,3-Trimethyl-1-butene**	77 87	-109 85	1 4029	0 7050	*di-*	98-9[14]	38-9			
71	**3-Methyl-1,3-pentadiene**	78 0 3		1 4494	0 7499						
72	***trans*-1,3,5-Hexatriene**	78 5, 77 8 5		1 4884[13 5]	0 74229[15/15]	*hexa-*		78			
73	***cis*-1,3,5-Hexatriene**	78 5		1 4577	0 7179						
74	**3-Methyl-1,2-pentadiene**	79 70		1 425	0 715						
75	**2,4-Hexadiene**	79 4 81 6[765]	-79	1 4493	0 7152	2,5-*di-* *tetra-*	85[11]	182	1 534[19]	1 622[19]	Maleic anh adduct, 95 6, lgr , SO_2 adduct, 43-3 5
76	**3-Methyl-1,5-hexadiene**	80-1		1 4116	0 7103						
77	**4,4-Dimethyl-1,2-pentadiene** (*tert*-Butylallene)	80-3			0 7184						
78	**1,3-Cyclohexadiene**	80 31[757]	-104 8	1 4740	0 8413	*di-* *tetra-* 2 forms		68, isomerizes → m 108 1, *trans*-2,*cis*-3, *trans*-4, 92, 1,*cis*-2, *trans*-3, *trans*-4, 156			Maleic anh adduct, 145-6, heptane, Benzoquinone adduct, 196 7, lgr
79	**4,4-Dimethyl-*cis*-2-pentene**	80 42	-135 46	1 4024	0 6996	*di-*	92 8 3 0[14]		1 5080	1 5538	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

a) Liquids 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Bromine addition product					Miscellaneous
						x-Bromo-	B P °C	M P °C	n_D^{20}	D_4^{20}	
80	**3,4-Dimethyl-1-pentene**	81		1 3995	0 701						
81	**Cyclohexene**	82 97	−103 51	1 44654	0 81096	*dl*-	101 3[13]		1 5445[19]	1 7759[19]	Mercaptosuccinic acid adduct, 150 5 1 5, $KMnO_4$ oxid → adipic ac , 154, 2,4-Dinitrophenylsulfenyl chloride, 117 8 HBr → cyclohexyl bromide, b p 165
82	**2,4-Dimethyl-2-pentene**	83-4	−127 7	1 40165[22]	0 6958[22]	*dl*-	88[17]		1 50920[22 5]	1 5431[22 5]	
83	**3-Methyl-1-hexene**	84 0		1 397	0 695	*dl*-	84 0- 2[6]		1 5028	1 5248	
84	**2,3-Dimethyl-1-pentene**	84 26	−134 8	1 4033	0 7051	*dl*-	72 5- 3 0[3]		1 5028	1 5245	
85	**3-Ethyl-1-pentene**	85 13	−127 4	1 3980	0 6962	*dl*-	93 5[15]		1 5006	1 5251	
86	**5-Methyl-1-hexene**	85 31		1 3966	0 6920	*dl*-	142 6 3 6[101]		1 4970	1 5072	
87	**5-Methyl-*trans*-2-hexene**	86 0		1 400	0 700	*dl*-	87 8[10]		1 4960	1 5027	
88	**2-Methyl-3-hexene**	86 0		1 399	0 694	*dl*-	96[19]		1 5060	1 5310	
89	**2,4-Dimethyl-2,3-pentadiene** (Tetramethylallene)	86 5		1 40039	0 7006						
90	**4-Methyl-1-hexene**	86 73	−141 45	1 4000	0 6985	*dl*-	94 7- 5 7[11]		1 4980	1 5027	
91	**3,4-Dimethyl-2-pentene**	87 0		1 407	0 713	*dl*-	65 5 6 0		1 5104	1 5400	
92	**4-Methyl-*cis*-2-hexene**	87 37		1 4024	0 6996	*dl*-	91 2[11]		1 5045	1 5382	
93	**4-Methyl-*trans*-2-hexene**	87 6	−126 5	1 4023	0 6975	*dl*-	91 2[11]		1 5045	1 5382	
94	**3,3-Dimethylcyclopentene**	88		1 423	0 771						
95	**2-Ethyl-3-methyl-1-butene**	89		1 410	0 715	*dl*-	72 5 3 5[3]		1 5062	1 5261	
96	**5-Methyl-*cis*-2-hexene**	91		1 400	0 700	*dl*-	89 90[11]		1 4990	1 5152	
97	**5-Methyl-1,4-hexadiene**	91-2 5		1 4390	0 7258	1,2-*dl*-	101 4[18]		1 5233[16]	1 566[16]	
98	**2-Methyl-1-hexene**	92 0	−102 84	1 4034	0 7030	*dl*-	100 5 1 5[23]		1 5000	1 5066	
99	**1,3-Dimethylcyclopentene**	92		1 428	0 766						
100	**2-Methyl-1,5-hexadiene**	92 5[769]		1 423/6[17 3]	0 7289[18 5]						Nitrosochloride, 75 6
101	**2,4-Dimethyl-1,3-pentadiene**	93	−114	1 4412	0 7368						
102	**1,4-Dimethylcyclopentene**	93 2		1 4283	0 779						
103	**3-Methyl-*trans*-3-hexene**	93 5		1 4107	0 7099						
104	**1-Heptene**	93 64	−119 03	1 39980	0 69698	*dl*-	106 2[13]		1 4990	1 5208	Mercaptosuccinic acid adduct 103 4- 9

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

a) Liquids 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Bromine addition product					Miscellaneous
						x Bromo	B P , °C	M P , °C	n_D^{20}	D_4^{20}	
105	3-Methyl-*trans*-2-hexene	94 0		1 410	0 7120	*di*-	65 0 5 1[2]		1 5040	1 5240	
106	2-Ethyl-1-pentene	94		1 405	0 708	*di*-	77 8[3]		1 4990	1 4929	
107	3-Methyl-*cis*-3-hexene	95 35		1 4123	0 7132						
108	2-Methyl-2-hexene	95 41	−130 35	1 4106	0 7082	*di*-	73 0 1[8]		1 4990	1 5116	
109	*trans*-3-Heptene	95 67	−136 63	1 4043	0 6981	*di*-	105 5 6 5[23]		1 5010	1 5153	
110	*cis*-3-Heptene	95 75		1 4059	0 7030	*di*-	105 5- 6 5[23]		1 5010	1 5153	
111	5-Methyl-1,2-hexadiene (Isobutylallene)	96		1 4282[19]	0 7225[19]						
112	3-Ethyl-2-pentene	96 01		1 4148	0 7204	*di*-	76 0- 4[3]		1 5090	1 5426	
113	2,3-Dimethyl-2-pentene	97 5	−118 3	1 4208	0 7277	*di*-	97 9[15]		1 517[22]	1 547[22]	
114	*trans*-2-Heptene	97 95	−109 48	1 4045	0 7012	*di*-	96 2[12]		1 5000	1 5129	
115	3-Ethylcyclopentene	98 1		1 4319	0 7830						
116	*cis*-2-Heptene	98 5		1 406	0 708	*di*-	96 2[12]		1 5000	1 5129	
117	5-Methyl-1,3-cyclohexadiene	100 5 1 5[762]		1 4662[22 5]	0 8252						
118	2,2-Dimethyl-*trans*-3-hexene	100 9		1 4063	0 7039	*di*-	96 5- 7 0[8]		1 5032	1 4856	
119	1,4-Heptadiene	101		1 4202	0 7106	*di*-			1 5734	2 091	
120	2,4,4-Trimethyl-1-pentene	101 44	−93 48	1 4086	0 7150						
121	3,3-Dimethyl-1,5-hexadiene	101 6		1 4160	0 7249						
122	3,4-Dimethyl-1,5-hexadiene	101 8		1 4211	0 7304						
123	2,5-Dimethyl-3-hexene	102		1 406	0 710	*di*-	109[19]		1 5058	1 5034	
124	5,5-Dimethyl-1-hexene	102 5		1 4049	0 709						
125	4-Methylcyclohexene	102 74	−115 5	1 4414	0 7947	*di*-	130[40]			1 650[15 15]	
126	3-Methylcyclohexene	104 0		1 4444	0 8010						
127	2-Isopropyl-3-methyl-1-butene	104		1 4085	0 722						
128	3,4,4-Trimethyl-1-pentene	104		1 412	0 719						
129	3,5-Dimethyl-1-hexene	104		1 404	0 708						
130	3,3-Dimethyl-1-hexene	104		1 4070	0 7140						
31	5,5-Dimethyl-*trans*-2-hexene	104 1		1 4055	0 7066						
32	2,4,4-Trimethyl-2-pentene	104 91	−106 33	1 4160	0 7218						
33	3,3,4-Trimethyl-1-pentene	105		1 4144	0 729						
34	2,2-Dimethyl-*cis*-3-hexene	105 4	−137 4	1 4099	0 7128						
35	1,2-Heptadiene (*n*-Butylallene)	105 5 6 0		1 432[18]	0 7306[18]	2,3-*di*-	108- 10[12],		1 5200[18]	1 5595[18]	
						tetra-	140[3]		1 5718	2 0675	
36	1,2-Dimethylcyclopentene	105 8	−90 4	1 4448	0 7976						
37	4-Ethylcyclopentene	106		1 440	0 798						
38	4,4-Dimethyl-2-hexene	106		1 413	0 722	*di*-	92 3[4]		1 5113	1 5148	
39	1-Ethylcyclopentene	106 3	−118 4	1 4410	0 7982						
40	5,5-Dimethyl-*cis*-2-hexene	106 9		1 4113	0 7169						

)erivative data given in order m p , crystal color, solvent from which crystallized

TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

a) Liquids 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Bromine addition product					Miscellaneous
						x-Bromo-	B P °C	M P °C	n_D^{20}	D_4^{20}	
141	**2-Methyl-2,4-hexadiene**	107		1 4266[24]	0 7439						
142	**2-Methyl-1,3-cyclohexadiene**	107 8		1 4662[18]	0 8272[18/18]						
143	**3-Methyl-2,4-hexadiene**	107 8		1 46146[15]	0 7625[15]						
144	**4,4-Dimethyl-1-hexene**	107 2		1 4102	0 7198	*dl-*	224 5		1 5003	1 4689	
145	**3-Ethyl-4-methyl-1-pentene**	107 5		1 4097	0 7200						
146	**2,4-Heptadiene**	107 5 8 0		1 4578	0 7384						
147	**2,4-Dimethyl-*trans*-3-hexene**	107 6		1 4126	0 7145						
148	**Quadricyclene** (Quadricyclo [2,2,1,$0^{2,6}$, $0^{3,5}$] heptane)	108[740] sl d		1 4804							
149	**2,3,4-Trimethyl-1-pentene**	108		1 415	0 729						
150	**4-Methyl-1,3-hexadiene**	108 10		1 4523	0 7558						
151	**2,3,3-Trimethyl-1-pentene**	108 3	−69	1 4174	0 7352						
152	**4,5-Dimethyl-1-hexene**	109		1 414	0 728						
153	**1,5,5-Trimethylcyclopentene** (Isolaurolene)	109[754]		1 4324	0 7824						Reduces Tollen's reagent on warming
154	**2,4-Dimethyl-*cis*-3-hexene**	109		1 4140	0 7178						
155	**3,3-Dimethyl-2-ethyl-1-butene**	110		1 4159	0 728						
156	**3-Ethyl-2-methyl-1-pentene**	110		1 415	0 730						
157	**4,5-Dimethyl-2-hexene**	110		1 413	0 725						
158	**1-Methylcyclohexene**	110 0	−121	1 4503	0 8102	*dl-*	100 2[12]				2,4-Dinitrophenylsulfenyl chloride, 139 40
159	**2-Ethyl-4-methyl-1-pentene**	110 3		1 4105	0 7195						
160	**3-Ethyl-1-hexene**	110 3		1 407	0 715						
161	**2,3-Dimethyl-1-hexene**	110 5		1 4113	0 7214						
162	**2,4-Dimethyl-2-hexene**	110 6		1 4118	0 7213						
163	**3-Methyl-1-heptene**	111		1 406	0 711						
164	**2,4-Dimethyl-1-hexene**	111 2		1 4110	0 720						
165	**2,5-Dimethyl-1-hexene**	111 6		1 4105	0 7172						
166	**3-Ethyl-3-methyl-1-pentene**	112		1 418	0 7305						
167	**3,4-Dimethyl-1-hexene**	112		1 413	0 724						
168	**3,4,4-Trimethyl-2-pentene**	112		1 4232	0 7395						
169	**3,5-Dimethyl-2-hexene**	112		1 416	0 725						
170	**2-Methyl-3-heptene**	112		1 402	0 706						
171	**5-Methyl-3-heptene**	112		1 410	0 713						
172	**2,5-Dimethyl-2-hexene**	112 2		1 4140	0 720	*dl-*	88[13]		1 4740	1 3980	
173	**3-Methyl-1,5-heptadiene**	112 5		1 4230[22 5]							
174	**2-Ethyl-3-methyl-1-pentene**	112 5		1 4142	0 729						

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TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

a) Liquids 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Bromine addition product					Miscellaneous
						x-Bromo-	B P , °C	M P °C	n_D^{20}	D_4^{20}	
175	**4-Methyl-1-heptene**	112 8		1 410	0 717						
176	**6-Methyl-3-heptene**	113^{734}		1 4114	0 7256	*di-*		97			
177	**4-Ethyl-1-hexene**	113		1 412	0 726						
178	**4-Ethyl-2-hexene**	113		1 412	0 725						
179	**2-Isopropyl-1-pentene**	113		1 414	0 725						
180	**5-Methyl-1-heptene**	113 3		1 4094	0 7164						
181	**4-Methyl-2-heptene**	113 5 4 1		1 4096	0 7154						
182	**2,3-Dimethyl-3-hexene**	114		1 416	0 728						
183	**4-Methyl-2-octene**	114		$1\ 4100^{25}$	$0\ 7188^{25}$						
184	**2,4-Dimethyl-2,4-hexadiene**	114–5		$1\ 45457^{16\ 5}$	$0\ 7635^{16\ 5}$						
185	**6-Methyl-2,4-heptadiene**	114 6		$1\ 4397^{25}$	$0\ 7041^{25}$						
186	**3-Ethyl-4-methyl-*trans*-2-pentene**	114 3		1 4210	0 7350						
187	**Cycloheptene** (Suberene)	114 38	–56	1 4580	0 8254	*di-*	unstable				Nitrosochloride, 118 Oxid → pimelic ac , 105
188	**1-Methyl-1,4-cyclohexadiene**	114 5–4 8	< –70	1 4703	0 848	*tetra-*		171			
189	**3-Ethyl-4-methyl-*cis*-2-pentene**	115		1 424	0 739						
191	**1,3,5-Cycloheptatriene** (Tropilidene)	115 5	–79 49	1 5243							Maleic anh adduct, 104 2–5 0, CCl_4
192	**3,4-Dimethyl-2-hexene**	116		1 418	0 737						
193	**3-Ethyl-3-hexene**	116		1 418	0 729						
194	**6-Methyl-1,3-heptadiene**	116 8			$0\ 741^{22}$						
195	**2,5-Dimethyl-1,3-hexadiene**	116 8	> –80	1 45024	0 7412						
196	**2,3,4-Trimethyl-2-pentene**	116 3	–113 3	1 4275	0 7434						
197	**4,4-Dimethylcyclohexene**	116 98	–80 5	1 4420	0 7996						
198	**6-Methyl-2-heptene**	117		1 412	0 718						
199	**2-*n*-Propyl-1-pentene**	117 7		1 4136	0 7240						
200	**5-Methyl-2-heptene**	118		1 414	0 723						
201	**3,3-Dimethylcyclohexene**	119		1 445	0 804						
202	**2-Methyl-1-heptene**	119 22	–87 38	1 41195	0 72025						
203	**2,5-Dimethyl-1,5-hexadiene**	119 23	solid at –80, liq at –23	1 45054	0 7637						
204	**2-Ethyl-1-hexene**	120		1 4157	0 7270						Mercaptosuccinic acid adduct, 101 9–2 7
205	***d l*-1,2,3-Trimethylcyclopentene** (Laurolene)	$120\ 1^{752}$		1 4421	0 7950						
206	**4-Methyl-3-heptene**	120 4		$1\ 41712^{25}$	$0\ 7411^{25}$						
207	**3-Ethyl-2-hexene**	121		1 424	0 737						
208	**3-Methyl-3-heptene**	121		1 418	0 728						
209	**1-Octene**	121 28	–101 76	1 40870	0 71492	*di-*	240 2, $118\ 5^{15}$		1 4970	1 4580	Mercaptosuccinic acid adduct, 96 1–6

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

a) Liquids 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Bromine addition product					Miscellaneous
						x Bromo	B P C	M P C	n_D^{20}	D_4^{20}	
210	*trans*-4-Octene	121 4[739]	f p −94	1 41157	0 71467	*dl* (*meso*)	103[8]		1 4967[24]	1 4525	
211	1,3-Cycloheptadiene (Hydrotropilidene)	121 52	−110 42		0 8929[0]						H_2 → Cyclo heptane b p 118 20
212	3-Methyl-2-heptene	121 6		1 4183	0 7296						
213	*cis*-4-Octene	121 7[739]	f p −118	1 41361	0 72048	*dl* (*d l*)	84 0 8 4[4 3]		1 4981	1 4569	
214	2,3-Dimethyl-2-hexene	121 8	−115 1	1 4268	0 7408						
215	3,4-Dimethyl-*trans*-3-hexene	122		1 430	0 747	*dl*	85 7[5]		1 5060	1 387	
216	6-Methyl-1-heptene	122 4 113 5		1 4070	0 7125						
217	*cis*-3-Octene	122 3[741]	f p −126	1 41246	0 71888						
218	*trans*-3-Octene	122 4[741]	f p −110 4	1 41241	0 71630						
219	2-Methyl-2-heptene	123 5		1 4138	0 7241						
220	*trans*-2-Octene	125 0	−87 7	1 4132	0 7199						Mercaptosuccinic acid adduct 142 9 3 5
221	*cis*-2-Octene	125 64	−100 2	1 4150	0 7243						
222	2-Methyl-1,3-heptadiene	127 8 [4]		1 4432	0 7432						
223	1,4-Dimethylcyclohexene	128		1 446	0 802						Nitrosochloride 83 4
224	1,5-Dimethylcyclohexene	128		1 448	0 8051						Nitrosochloride 118 9
225	2,6-Dimethyl 2-heptene	128 9		1 412	0 722						
226	4-Vinylcyclohexene	129 5 30 5 36[23]		1 4623	0 8320	α β *dl*		69 5 70 eth			
227	4-Methyl-2,4-heptadiene	131 2		1 4621	0 7551						
228	3,4-Dimethyl-2,4-hexadiene	132 4 71 3		1 4410	0 7832						
229	3-Methyl-2,4-heptadiene	132 5		1 4649	0 7667						HBr → Dihydro bromide b p 109 11 [6]
230	Bicyclo[4,2,0]oct-7-ene	132 5		1 4761		*dl*	74[0]				
231	4-Ethylcyclohexene	133		1 449	0 810						
232	1,6-Dimethylcyclohexene	133		1 454	0 815						
233	3,5-Dimethyl-2,4-heptadiene	133 44 [4]		1 4487	0 7728						
234	2,4-Octadiene	133 5 4 0		1 4542[2]	0 7427[2]						
235	2,5-Dimethyl-2,4-hexadiene	133 6 28[1]	14 6 8	1 4796[1,3]	0 7646 [K]	*tetra*		101			Oxid in air → polymeric peroxide 59
236	3-Ethylcyclohexene	134		1 451	0 814						
237	1,2,3,3-Tetramethylcyclopentene (Campholene)	134 5		1 44406	0 8035						
238	1-Ethylcyclohexene	136		1 4575	0 823						
239	1,2-Dimethylcyclohexene	137		1 4588	0 8250	*dl*		142 3 acet			Nitrosochloride 58 60
240	1,3-Dimethylcyclohexene	137		1 445	0 802						
241	Bicyclo[4,2,0]oct-2-ene	137 9		1 4810[30]	0 8948						

*Derivative data given in order m p crystal color solvent from which crystallized

TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

a) Liquids 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	D_4^{20}	Bromine addition product					Miscellaneous
						x Bromo	B P °C	M P °C	n_D^{20}	D_4^{20}	
243	**1-Methylcycloheptene**	137 5 8 5		1 4581	0 8243[22]						Nitrosochloride, 106, Nitrosate, 97 8
244	**2-Methyl-4-octene**	138[713]		1 4181	0 7392						
245	**δ-Fenchene** (1,5 5-Trimethylbicyclo[2,2,1] hept-2-ene)	139 40		1 44862	0 8433						Nitrosochloride, 131
246	**1,5,5-Trimethylcyclohexene** (α-Cyclogeraniolene)	139-41 [31]		1 44612[21]	0 7981[21]						Nitrosochloride, 100 20, aq me , al Nitrosate, 102 4
247	**2,6-Dimethyl-2,4-heptadiene**	139 43[7 2]		1 4587[44]	0 74820						
248	**1,4,4-Trimethylcyclohexene** (Pulenene)	139 5-40 5		1 444[25 2]	0 8032[18 5]	*di-*	120 0 5[10]		1 5247[11]	1 5324[11]	Nitrosochloride, 118 22, et ac
249	**1,5,6-Trimethylcyclohexene**	140		1 4572	0 831[25]						
250	**2,3-Dimethyl-2-norbornene** (Santene 2,3-Dimethylbicyclo [2,2,1]-hept-2-ene)	140-1, 35[1]		1 46699	0 8640						Dichloride 88 9, Nitrosate, 216d , Nitrosochloride, 109 10 Nitrosite, 3 forms a) 122 4, bl b) 127-8, grn , c) 104, col
251	**2,6-Dimethyl-1,3-heptadiene** (Isogeraniolene)	140-2, 31		1 4606[22]	0 7923[22]						
252	**Cyclooctatetraene**	140 56 142 3, 42 2 5[1]	−4 68, −7	1 5290	0 9206						Maleic anh adduct, 167 8 Benzoquinone adduct, 141, al Acrylic ac adduct 112 3, lgr $AgNO_3$ adduct, 173 4
253	**7-Methyl-3-octene**	141[746]		1 4168	0 7278						
254	**2,6-Dimethyl-1,5-heptadiene** (Geraniolene)	141-2, 165 70	−70	1 44361[22]	0 7626[22]						
255	**1,8-Nonadiene** *	141-4		1 4302	0 7511						
256	**1,3,5-Trimethylcyclohexene** (Tetrahydromesitylene)	142 5-3 5		1 449[13 5]	0 8025[14 3]						Nitrosochloride, 134
257	**3-Methyl-2-octene**	143-5[734]		1 4247	0 7409[25]						
258	**Cyclooctene**	143 8-4 5[773]		1 4693							Br_2 → Bromocyclooctene, b p 7-8[23], n_D^{20} 1 5182, Dichloride, b p 130 4-0 6[25], m p −5, n_D^{20} 1 5061, D_4^{20} 1 1620
259	**3,6-Dimethyl-2,4-heptadiene**	144-6		1 46335[14]	0 7853[0]						
260	**4-Nonene**	144-6, 44 6[12]		1 4212[18]	0 732[18]	*di-*	119 20[12]		1 4988[17]	1 410[17]	
261	**1,4,5-Trimethylcyclohexene**	144-6		1 4482	0 805						

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TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

a) Liquids 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Bromine addition product					Miscellaneous
						x-Bromo-	B P , °C	M P , °C	n_D^{20}	D_4^{20}	
262	**1-Vinylcyclohexene**	145, 63 5[53]		1 4950[19]							50% H_2SO_4 → dimer, b p 118-9[5]
263	*cis*-**1,4-Cyclooctadiene**	145 1[758]	−53		0 8754	*tetra-*		139			
264	**1,3,5-Cyclooctatriene**	145 6, 76[90]		1 5035[25]	0 8971[25]						Maleic anh adduct, 144-5, $AgNO_3$ adduct, 125-6, al
265	**4,4-Dimethyl-1,7-octadiene**	145 8		1 4330	0 7647						
266	**ξ-Fenchene** (2,7,7-Trimethylbicyclo[2,2,1] hept-2-ene)	146 2 6 8[752]		1 4865	0 8626						$[\alpha]_D^{20}$ −24 1
267	**1,6,6-Trimethylcyclohexene**	146 2-7 2[767], 144 6		1 456[20 4]	0 8217[20 3]						Nitrosochloride, 133 4, et ac
268	**1-Nonene**	146 87	−81 37	1 41572		*di-*	141 5[20]		1 4942	1 3980	
269	**3-Nonene**	147 4[750]		1 4173	0 7294						
270	**1,5-Cyclooctadiene**	148 9		1 4905	0 8818[24]						N-Bromosuccinimide → bromocyclooctadiene, b p 64[1 9], n_D^{25} 1 5410, D_4^{25} 1 3420
271	**4-Methyl-3,5-octadiene**	148 51		1 46285[25]	0 7640[25]						
272	**7-Methyl-2,4-octadiene**	149		1 4543[18]	0 7521[18]	*tetra-*	184[18]				
273	**1-Ethyl-4-methylcyclohexene**	149, 153 4		1 453[16]	0 8169[16]						Nitrosochloride, 2 forms a) 103-4, pr , eth , b) 98 9, cr , eth
274	**1-Ethyl-3-methylcyclohexene**	149 51		1 454	0 8296						
275	**2-Nonene**	149 4 9 9		1 420[21]	0 738[21]						
276	**1,2,3-Trimethylcyclohexene**	149 6 150[749]		1 463[12]	0 8347[12]						
277	**1-Ethyl-5-methylcyclohexene**	150		1 4527[25]	0 812[25]						
278	**β-Fenchene** (2,2 Dimethyl-5-methylenebicyclo[2,2,1] heptane)	150 5 3 5		1 46511	0 8599	*di-*		81-2			$[\alpha]_D^{25}$ +62 5, Nitrosochloride, 120
279	**2,6-Dimethyl-2,5-heptadiene**	150 6 1 0		1 4490							
280	**2,7-Nonadiene**	150 6	−72 5	1 4358	0 7499						
281	**Allylcyclohexane** (3-Cyclohexylpropene)	151		1 4536[13]	0 8196[13]	*di-*	143 4[16]			1 537[0]	
282	**1-Ethylidene-4-methylcyclohexane**	152-3		1 4571[21]	0 81[21]						Nitrosochloride, 2 forms a) 117-8, least soluble, b) 113-4, more soluble
283	**4,5-Dimethyl-2,6-octadiene**	152 9-3 8		1 4375[25]	0 7611[25]						
284	**1-Ethylidene-3-methylcyclohexane**	153		1 458[4]	0 8135[19/19]						Nitrosochloride, 114, acet
285	**3,6-Dimethyl-2,6-octadiene**	153-5		1 44453	0 7767						
286	**2,6-Dimethyl-2,7-octadiene**	155 6[720]		1 4385[18]	0 7605[18]						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

a) Liquids 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Bromine addition product					Miscellaneous
						x Bromo	B P , °C	M P , °C	n_D^{20}	D_4^{20}	
287	**α-Pinene**	156 0-6 3	-50	1 4560	0 8600	*di-*		169 70, al			Nitrosochloride, 109, Hydrobromide, 89, Nitrosobromide, 91 2d , Acid $KMnO_4$ → pinonic ac , 103-5
288	**1-Ethylidene-2-methylcyclohexane**	158		1 47	0 823[0]						
289	**2,4-Dimethyl-2,4-octadiene**	161 3[746]		1 4558[9 8]	0 7802[9 8]						
290	**1,4,4-Trimethylcycloheptene** (Eucarvene)	161-5[720]		1 4561	0 8185						
291	**β-Pinene** (Nopinene, Pseudopinene)	163-4		1 4782	0 8694						$[\alpha]_D$ -22
292	**2,7-Dimethyl-2,6-octadiene**	163 5 4 5		1 44814	0 7849	*tetra-*		124-7			
293	**3,7-Dimethyl-2,4-octadiene**	164-7, 58[12]		1 456	0 7933						
294	***l*-4-Carene** (3,7,7-Trimethylbicyclo[2,2,1]hept-2-ene)	165 5 7 0[707]		1 474[30]	0 8552[30 30]						$[\alpha]_D^{30}$ +62 2
295	**Myrcene** (2-Methyl-6-methylene-2,7-octadiene)	166		1 4722	0 7982						Maleic anh adduct, 33-4, 1,4-Naphthoquinone adduct, 81
296	**2,6-Dimethyl-2,6-octadiene**	168, 56[14]		1 45245[15]	0 775[21]						Methiodide, 130d
297	***l*-3-Carene** (3,7,7-Trimethylbicyclo[2,2,1]-hept-3-ene)	168 9[705], 123 4[200]		1 469[30]	0 8586[30 30]						$[\alpha]_D^{30}$ +7 69, Nitrosochloride, 100-1
298	**3,8-*o*-Menthadiene** (*cis*-3-Isopropenyl-4-methylcyclohexene)	169-70		1 4749	0 8507						
299	**5-Decene**	170[750]	-112 to -111	1 4260	0 7474	*di-*	119[9]		1 4912	1 3484	
300	***p*-8-Menthene** (1-Isopropenyl-4-methylcyclohexane)	170		1 4523	0 8142						
301	***d-m*-8-Menthene** (1-Isopropenyl-3-methylcyclohexane)	170		1 4546	0 8179						$[\alpha]_D$ +9 73
302	***l-m*-8-Menthene** (1-Isopropenyl-3-methylcyclohexane)	170-1		1 4574	0 8189						$[\alpha]_D$ -8 06
303	**6,8-*o*-Menthadiene** (3-Isopropenyl-2-methylcyclohexene)	170 1		1 4758	0 8481						
304	**5,8-*o*-Menthadiene** (4-Isopropenyl-3-methylcyclohexene)	170-1		1 4778	0 8490[17 17]						
305	**1-Decene**	170 57	-66 31	1 42146	0 74081	*di-*	145 160[18]		1 4891[24]	1 324[28]	Mercaptosuccinic acid adduct, 93 5- 8
306	**4-Decene**	170 6		1 4243	0 7404						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

a) Liquids 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point, °C	n_D^{20}	D_4^{20}	Bromine addition product					Miscellaneous
						x-Bromo-	B P , °C	M P , °C	n_D^{20}	D_4^{20}	
307	***p*-Menthene** (1-Isopropylidene-4-methylcyclohexane)	172-4		1 4568	0 819[21]						Nitrosochloride, 101-3
308	**1-Isopropenyl-1,4-cyclohexadiene**	172-6		1 5216	0 9068	*tetra-*		113			
309	***o*-Menthene** (1-Isopropylidene-2-methylcyclohexane)	173, 160-2		1 467	0 8345						
310	***m*-Menthene** (1-Isopropylidene-3-methylcyclohexane)	173-5		1 4670	0 8214						
311	**α-Terpinene** (1-Isopropyl-4-methyl-1,3-cyclohexadiene)	173 5 4 8[755]		1 477	0 8375						Dihydrochloride, 53-4, me al , Dihydrobromide, 58 9, me al , Dihydroiodide, 76, me al , Nitrosite, 155, Maleic anh adduct, 62, 66-7
312	**2,4-*p*-Menthadiene**(2-Isopropyl-5-methyl-1,3-cyclohexadiene)	174 6		1 4845[27]	0 8441[27/27]						
313	***l*-5-Isopropyl-2-methyl-1,3-cyclohexadiene**	174-7		1 4732	0 8425						$[\alpha]_D^{20}$ −112 76, Nitrosite, α 120-1, β 105 6
314	**1,5-*p*-Menthadiene** (5-Isopropyl-2-methyl-1,3-cyclohexadiene)	175 6		1 4777	0 8463[25]						$[\alpha]_D$ +49 1, Nitrosite, α 113-4, β 105 Maleic anh adduct, 126-7, pet eth
315	***d*-Silvestrene**	175 8		1 4760	0 8479	*tetra-*		135			Dihydrochloride, 72, Nitrosochloride, 106-7
316	***d*-Limonene**	176 6 4		1 4743	0 8411	*tetra-*		104			Nitrosochloride, 100-4, 2,4-Dinitrophenylsulfenyl chloride, 195-6
317	**Isocarvestrene** (5-Isopropenyl-1-methylcyclohexene)	176 7[765]		1 4804	0 8496	*tetra-*		137-8, me al -chl			Dihydrochloride, 71 5, me al
318	***l*-3-Isopropenyl-1-methylcyclohexene**	176-8	.....	1 4761[18]	0 848[19]						$[\alpha]_D^{18}$ −68 2, Dihydrochloride, 72
319	**Dipentene** (*d l*-Limonene)	177 6-8 0		1 4727[20]	0 8402[20]	*tetra-*		125, eth			Dihydrochloride, 50-1, al
320	**3,8-*m*-Menthadiene** (1-Isopropenyl-5-methylcyclohexene)	179[730]		1 4972							$[\alpha]_D$ +17 5
321	**Menogerene** (5-Isopropylidene-2-methyl-1,3-cyclohexadiene)	180 1[769]		1 5005	0 8672	*di-*		115			
322	**γ-Terpinene** (1-Isopropyl-4-methyl-1,4-cyclohexadiene)	183		1 4765[14 5]	0 849	*tetra-*		129-30, pet eth			$[\alpha]_D^{25}$ +36, Nitrosochloride, 111, Nitrosate, 116d , ac a -me al
323	***d l*-2,8-*m*-Menthadiene** (1-Isopropenyl-3-methylcyclohexene)	184 7		1 503	0 864[20/20]						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

a) Liquids 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Bromine addition product					Miscellaneous
						x-Bromo	B P °C	M P °C	n_D^{20}	D_4^{20}	
324	**Menogene** (3-Iso-propylidene-6-methyl cyclohexene	184 $6^{764.5}$		1 5026	0 8624						Nitrosite, 155, me al or chl , Maleic anh adduct, 205 8
325	**Terpinolene** (4-Iso-propylidene-1 methylcyclohexene)	186		1 4883	$0\ 8633^{15}_{15}$	*di-tetra-* 2 forms		69 70 a) 119, ac a , b) 122			Maleic anh adduct, 182
326	**2-Undecene** (2-Hendecene)	192 3, 78 5^{14}		1 43325	$0\ 7735^{15}_{15}$	*di-*	145 6^{9}				
327	**5-Undecene** (5-Hendecene)	192 2		1 4289	0 7511						
328	**1-Undecene** (1-Undecene)	192 67	−49 19	1 42609	0 75032	*di-*	186^{23}		1 4916	1 3122	
329	*cis*-**Cyclodecene**	194 5^{740}		1 4854	0 8770	*di-*		121			O_3 → Sebacic acid, 134 5
330	**1-Dodecene**	213 36 88 7^{10}	−35 23	1 43002	0 75836	*di-*		−15			
331	**1-Tridecene**	232 78 104 5^{10}	−23 07	1 4336	0 7653						
332	**1-Tetradecene**	251 1, 119 0^{10}	−12 85	1 43631	0 7713	*di-*		0			Mercaptosuccinic acid adduct, 104 0 8
333	**Cedrene**	262–3, 124 6^{12}		1 5001^{19}	$0\ 9359^{15}_{15}$						
334	**1-Pentadecene**	268 17, 133 7^{10}	−3 73	1 4389	0 77641	*di-*	204–5^{17}		1 4897	1 2235	
335	**1-Hexadecene**	284 4 103 9^{1}	4 12	1 44120	0 78112	*di-*	225 7^{15}	13 5, al			1% Hot $KMnO_4$ → *n* pentadecylic ac , 52 3, Mercapto-succinic acid adduct, 105 0 8
336	**1-Heptadecene**	299 7, 116^{1}	11 2	1 4432	0 7852						
337	**2-Methyl-2-hepta-decene**	314, 277^{100}	−2 5		0 7953	*di-*	267–8^{28}				
338	**1-Octadecene**	314 2, 128^{1}	17 6	1 4449	0 7888	*di-*		24, al			

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

a) Liquids 2) (B.p. at reduced pressure only. Listed alphabetically)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Miscellaneous
1	**Bicyclo[12,2,2]octadeca-14,16,18-triene**	163 5 4 5[5 5]		1 5204[25]		Maleic anh adduct, 143 4
2	**Bicyclo[4,2,0]oct-3-ene**	81[140]		1 4832		
3	**Butylcyclooctatetraene**	98[20]		1 5083[25]	0 8876[25]	
4	*trans*-**Cyclodecene**	68-70[10]		1 4822	0 8672	$O_3 \rightarrow$ Sebacic acid, 134 5
5	**1,5,9,13-Cyclohexadecatetraene**	93 8[0 8]		1 5472		
6	*trans*-**Cyclononene**	73 4[30]		1 4799	0 8615	Phenylazide adduct, 97 8 8 2
7	**1,3-Cyclooctadecadiene**	115[3]		1 4899	0 8814	
8	**1,3-Cyclooctadiene**	48[25]	−57 to −55	1 4940[25]	0 8699[25]	
9	**1,3,6-Cyclooctatriene**	68[60]	−62 to −56		0 8940[25]	
10	**1,3-Cyclotetradecadiene**	106-8[3]		1 4982	0 8723[25]	Nitrosochloride, 109-10, Nitrosate, 210d
11	**1,2-Dimethylcyclooctatetraene**	107[96]		1 5219[25]	0 8950[25]	Maleic anh adduct, 184 5-5 5, bz -lgr , $AgNO_3$ adduct, 142 5 4 5, al
12	**2,6-Dimethyl-2,5-octadiene**	59 0- 5[12]		1 4500	0 733	
13	**Ethylcyclooctatetraene**	81[37]		1 5187[25]	0 8996[25]	Maleic anh adduct, 97 8 5, bz -cyclohexane, $AgNO_3$ adduct, 124-5 5, al
14	**5-Methylcycloheptene**	69 70[38]		1 42016[31]	0 76061[31]	
15	**Methylcyclooctatetraene**	84 5[67]		1 5249[25]	0 8978[25]	
16	**7-Pentadecene**	114[3 2]		1 4420	0 7765	
17	**Propylcyclooctatetraene**	73[9]		1 5131[25]	0 8870[25]	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE II. ORGANIC DERIVATIVES OF ALKENES, CYCLOALKENES, DIENES AND POLYENES

b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point °C	Boiling point, °C	n_D^{20}	D_4^{20}	Bromine addition product					Miscellaneous
						x Bromo	B p , °C	M p °C	n_D^{20}	D_4^{20}	
1	**1-Nonadecene**	23 4	328 0, 138 8[1]	1 4445	0 7886						
2	**Eicosene**	28 6	341 2	$1\ 4439^{30}$	$0\ 7882^{30}$						
3	**Bicyclo[4,7]pentadiene** (*endo*-4,7-Methylene-4,7,8,9-tetrahydroindene)	32	170	$1\ 5070^{25}$	$0\ 9766^{33}$						Phenylazide adduct, 128
4	**1-Heneicosene**	33 3	355	$1\ 4494^{S}$	$0\ 7977^{S}$						
5	**1-Docosene**	37 8		$1\ 4505^{S}$	$0\ 8002^{S}$						
6	**1-Tricosene**	41 6	379	$1\ 4516^{S}$	$0\ 8023^{S}$						
7	**1-Tetracosene**	45 3	390	$1\ 4527^{S}$	$0\ 8045^{S}$						
8	**1-Pentacosene**	48 7	401	$1\ 4536^{S}$	$0\ 8063^{S}$						
9	*cis cis cis* **1,4,7-Cyclononatriene**	49 5-50									$AgNO_3$ adduct, 243d
10	*d,l*-**Camphene** (2,2-Dimethyl-3-methylenebicyclo[2,2,1]heptene)	50	159 60			*di*-	91-2	153 5^{15}			
11	*l*-**Camphene**	51 3	159-60								2,4-Dinitrophenylsulfenyl chloride, 121 2, Hydrochloride, 125-7
12	**1-Heptacosene**	54 7	421	$1\ 4552^{S}$	$0\ 8097^{S}$						
13	**1-Triacontene**	62 4	448	$1\ 4573^{S}$	$0\ 8141^{S}$						
14	**1-Hentriacontene**	64 6	457	$1\ 4580^{S}$	$0\ 8153^{S}$						
15	**1-Dotriacontene**	66 7	465	$1\ 4585^{S}$	$0\ 8165^{S}$						
16	**1-Tritriacontene**	68 7	473	$1\ 4591^{S}$	$0\ 8176^{S}$						
17	**1-Tetratriacontene**	70 5	481	$1\ 4596^{S}$	$0\ 8186^{S}$						
18	**1-Pentatriacontene**	72 3	489	$1\ 4601^{S}$	$0\ 8196^{S}$						
19	**1-Hexatriacontene**	73 9	496	$1\ 4605^{S}$	$0\ 8205^{S}$						
20	**1-Heptatriacontene**	75 5	503	$1\ 4610^{S}$	$0\ 8214^{S}$						
21	**1-Octatriacontene**	77	510	$1\ 4614^{S}$	$0\ 8223^{S}$						
22	**1-Nonatriacontene**	78 4	517	$1\ 4618^{S}$	$0\ 8231^{S}$						
23	**1-Tetracontene**	79 8	523	$1\ 4622^{S}$	$0\ 8238^{S}$						
24	**Bicyclo(2,2,2)-oct-2-ene**	111 2	128 34			2,3-*trans*-*di*-		55 0 5 5			

*Derivative data given in order m p , crystal color, solvent from which crystallized

S = Supercooled liquid at 20°

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EXPLANATIONS AND REFERENCES TO TABLE III

Hg salt (Mercuric acetylide) *

$$2\,RC{\equiv}CH + K_2HgI_4 + 2\,KOH \rightarrow \underset{\text{Mercuric salt}}{(RC{\equiv}C)_2Hg} + 4\,KI + 2\,H_2O$$

From the terminal alkyne and K_2HgI_4 (prepared from mercuric chloride, potassium iodide and potassium hydroxide)

For directions and examples see Linstead, p 52, J R Johnson and W L McEwen, *J Amer Chem Soc*, **48**, 469 (1926)

Hydration to form carbonyl compound

$$\text{Terminal acetylenes}\quad RC{\equiv}CH + H_2O \xrightarrow[HgSO_4]{H_2SO_4} \underset{\text{Methyl ketone}}{RCOCH_3}$$

$$\text{Other acetylenes}\quad RC{\equiv}CR' + H_2O \xrightarrow[HgSO_4]{H_2SO_4} \underset{\text{Mixture of ketones}}{RCOCH_2R' + RCH_2COR'}$$

From the alkyne in methanol and a catalyst composed of boron trifluoride etherate, red mercuric oxide and trichloroacetic acid

For directions and examples see J G Sharefkin and E M Boghosian, *Anal Chem*, **33**, 640 (1961)

From the alkyne, mercuric sulfate and sulfuric acid in 70% methanol, in 70% acetone or in 60% acetic acid

See Cheronis, p 576, H Erdmann and F Kother, *Z Anorg Chem*, **18**, 48 (1898), R J Thomas, K N Campbell and G F Hennion, *J Amer Chem Soc*, **60**, 718 (1938)

From the alkyne, mercuric oxide and sulfuric acid in alcohol

See J R Johnson, A M Schwartz and T L Jacobs, *J Amer Chem Soc*, **60**, 1882 (1938)

NOTE For directions and examples for the preparation of the semicarbazones and the 2,4-dinitrophenylhydrazones of the formed carbonyl compounds see explanations and references to Table IX and X, p 141, 142, 143

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE III. ORGANIC DERIVATIVES OF ALKYNES (ACETYLENES)

a) Liquids (Listed in order of increasing b.p.)*

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Hydration product ($RC{\equiv}CR' \rightarrow RCOCH_2R$) and its derivatives				Hg salt	Miscellaneous
						Ketone	B p , °C	2,4-Dinitrophenylhydrazone of ketone	Semicarbazone of ketone		
1	**Ethyne** (Acetylene)	−84 0 (sat press)	−80 8, subl		0 6179[−84]	(Acetaldehyde)	(20 2)	(168)	(162-3)		
2	**Propyne** (Methyl acetylene)	−23 22	−102 7		0 6174[−23]	Acetone	56	128	190	204	
3	**1-Butyne** (Ethyl acetylene)	8 09, 8 3	−125 72	1 3962	0 6682[8]	2-Butanone	82	116-7	135 6	162 3, al	
4	**1,3-Butadiyne** (Diacetylene)	10 3	−35 to −36	1 4120	0 7249					161 5 2 0	KOBr → 1,4-Dibromo deriv , 49 50, bz
5	**3-Methyl-1-butyne** (Isopropyl acetylene)	26 35, 28	−89 7	1 3723	0 666						Tetrabromo deriv , b p 275
6	**2-Butyne** (Dimethyl acetylene)	27 2 6	−32 26	1 3921	0 6901	2-Butanone	82	116 7	135 6		Tetrabromo deriv , 243, eth , 2,4-Dinitrophenylsulfenyl chloride, 65 6
7	**3-Methyl-3-buten-1-yne** (Isopropenyl acetylene)	33		1 4158	0 6801[11]						3,4-Dibromo deriv , b p 50 0-1 5[10]
8	**3,3-Dimethyl-1-butyne** (*tert*-Butyl acetylene)	38 9	−81 20	1 37725[15]	0 6737[15]					92 5-3 0	Cu salt, 140, red
9	**1-Pentyne** (Propyl acetylene)	40 18	−105 7	1 3852	0 6901	2 Pentanone	102 3	145	112, 106	118 4	Tetrabromo deriv , b p 275
10	**1-Penten-4-yne** (Allyl acetylene)	42-3		1 4125[16]	0 738[16]	Allyl methyl ketone	111 2	160			1,2-Dibromo deriv , b p 79 5 80 5[10], 4,4,5,5-Tetrabromo deriv , b p 132 6[10]
11	*cis*-**3-Penten-1-yne** (*cis*-Propenyl acetylene)	44 6		1 4330						48	
12	*trans*-**3-penten-1-yne** (*trans* Propenyl acetylene)	52 2		1 4377	0 7270					155-7	1,2-Dibromo deriv , b p , 60-2[10], 3,4-Dibromo deriv , 66-76[10]
13	**2-Pentyne** (Ethyl methyl acetylene)	56 07	−109 3	1 4039	0 7107	2-Pentanone + 3-Pentanone	102 3 102	145 156	112, 106 138-9		$KMnO_4$ → formic ac + propionic ac
14	**1-Penten-3-yne** (Methyl vinyl acetylene)	59 2 60 1		1 4496	0 7401						
15	**4-Methyl-1-pentyne** (Isobutyl acetylene)	61 1 2, 99	−105 1	1 3936$_\alpha^{15}$	0 7092[15]					100 0- 5	
16	**3-Methyl-1-pentyne** (*sec*-Butyl acetylene)	65 70[770], 57 7		1 3916	0 7037					74-5	
17	**1-Hexyne** (Butyl acetylene)	71 33	−131 9	1 3989	0 7155	2-Hexanone	128	106 7	125	96 2 4	
18	**4-Methyl-2-pentyne** (Isopropyl methyl acetylene)	72 0 5	−110 37	1 4078[19]	0 716[19]						
19	**4,4-Dimethyl-1-pentyne**	73 5		1 4028	0 7154					125 6 5	
20	**1,3-Pentadiyne**	75 0- 5, 55-6	−45 to −35	1 4431[21]	0 7375[21]						
21	**1,4-Hexadiyne**	78-83			0 825$_4^0$						
22	**3-Hexyne** (Diethyl acetylene)	81 5[744]	−51	1 4112[25]	0 7263[25]	3-Hexanone	125	130	112		2,4-Dinitrophenylsulfenyl chloride, 65 6

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE III. ORGANIC DERIVATIVES OF ALKYNES (ACETYLENES)
a) Liquids (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^t	D_4^t	Hydration product (RC≡CR → $RCOCH_2R$) and its derivatives				Hg salt	Miscellaneous
						Ketone	B p °C	2 4 Di nitro phenyl hydrazone of ketone	Semicar bazone of ketone		
23	**4,4-Dimethyl-2-pentyne** (*tert* Butyl methyl acetylene)	82 9 3 0		1 4071	0 7176						
24	**2-Hexyne** (Methyl propyl acetylene)	83 7 4 0	−92	1 4135	0 7317	2 Hexanone	128	106 7	125		
						+ 3 Hexanone	125	130	112		
25	**1-Hexen-3-yne** (Ethyl vinyl acetylene)	85[758]		1 4522	0 7492						1 2 Dibromo deriv b p 87 0 5[10] 3 3 4 4 Tetra bromo deriv b p 140 50[10]
26	**1,5-Hexadien-3-yne** (Divinyl acetylene)	85 0	−87 83	1 5045	0 7857						
27	**1-Hexen-4-yne**	87 [53]		1 446[14]	0 767[14]						1 2 Dibromo deriv b p 93 0 5[1] 1 2 4 5 Tetra bromo deriv b p 154 5 5 0[10]
28	**3-Ethyl-1-pentyne**	87 0 8 5		1 4102	0 7246						
29	**1,5-Hexadiyne** (Dipro pargyl)	87 5 8 5[58] 20[46]	−4 266	1 4381[23]	0 79943						
30	**2-Hexen-4-yne**	88 9		1 4918	0 7710	Allyl ethyl ketone	74 5 6 5[90]	95 106			
31	**2-Methyl-3-hexyne**	95 2	−116 7	1 4114	0 7263						
32	**4-Methyl-2-hexyne**	95 94	f p −107 63	1 4170	0 73855						
33	**3-Ethyl-3-penten-1-yne**	96 5		1 4338[25]	0 7886[25]						
34	**5-Methyl-3-heptyne**	98 100 [45]		1 4102	0 7360						
35	**1-Heptyne** (*n* Pentyl acetylene)	99 74	−80 9	1 4087	0 7328	2 Heptanone	151 2	89	123 127	61 me al	
36	**5-Methyl-2-hexyne**	102 46	−92 91	1 41762	0 73776						
37	**8-Methyl-4-nonyne**	104 5		1 4311	0 7681						
38	**3-Heptyne** (Ethyl propyl acetylene)	105 6		1 415	0 7337	4 Heptanone	144	75	132		
39	**2-Heptyne** (*n* Butyl methyl acetylene)	111 5 2 5		1 4230	0 748	2 Heptanone	151 2	89	123 127		
						+ 3 Heptanone	148		101		
40	**2,2,5,5-Tetramethyl-3-hexyne** (Di *tert*-butyl acetylene)	111 9[746]	19 4	1 4055	0 7120						
41	**1,6-Heptadiyne**	112 30[26]	−85	1 451[1]	0 8164[17]						
42	**1-Octyne** (*n* Hexyl acetylene)	126 2	−79 3	1 4159	0 7461	2 Octanone	173	64 5 58	124 5	80 4 7 me al	
43	**4-Octyne** (Dipropyl acetylene)	130 4 6[745]		1 4226	0 7484						
44	**3-Octyne** (Butyl ethyl acetylene)	131 0- 5		1 4261	0 748						
45	**2-Octyne** (Hexyl methyl acetylene)	138 0 4		1 4285	0 761	2-Octanone	173	64 5 58	124 5		
						+ 3-Octanone	169 70[738]	64 5	117 0 5		
46	**4-Nonyne** (*n* Butyl propyl acetylene)	150 4[752]		1 4296[25]	0 757[25]	4-Nonanone	187 8	57 8	73 4		
						+ 5-Nonanone	188 4		90		

*Derivative data given in order m p , crystal color solvent from which crystallized

TABLE III. ORGANIC DERIVATIVES OF ALKYNES (ACETYLENES)

a) Liquids (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Hydration product ($RC{\equiv}CR' \rightarrow RCOCH_2R'$) and its derivatives				Hg salt	Miscellaneous
						Ketone	B p , °C	2,4-Dinitrophenylhydrazone of ketone	Semicarbazone of ketone		
47	**1-Nonyne** (Heptyl acetylene	150 8	−50	1 4217	0 7568	2-Nonanone	195 3	55-6	118 20	67 8-8 5, me al	
48	**3-Nonyne** (Methyl pentyl acetylene)	153 5[745], 92[97]		1 4299	0 7616	3-Nonanone + 4-Nonanone	187[751] 187-8	55 6 57-8	111-2 73 4		
49	**Cyclooctyne**	157 5-8 0[740]		1 4850	0 868						
50	**2-Nonyne** (Methyl hexyl acetylene)	161		1 4331	0 769	3-Nonanone + 2-Nonanone	187[751] 195 3	55-6 55 6	111 2 118 20		
51	**1,8-Nonadiyne**	162, 55 0-5[13]	−27 28	1 4490	0 8158						
52	**1-Decyne** (*n*-Octyl acetylene)	174 0	−44	1 4265	0 7655	2-Decanone	215 5	124	63, 81	80 0- 7	
53	**3-Decyne** (Ethyl hexyl acetylene)	175-6		1 433[21]	0 7765[21]	3-Decanone + 4-Decanone	211 206 7		100 1 51 2		
54	**5-Decyne** (Dibutyl acetylene)	177, 100[80]	−73	1 4332	0 7688	5-Decanone		60 1 5	57 5-8 0		$NaNH_2$ at 210° → 1-Decyne, b p 174
55	**Cyclononyne**	177 8[740]	−36 4	1 4890	0 8972	Cyclononanone	m p 34	146	184 5		
56	**2,7-Nonadiyne**	180	4 30	1 4674	0 8332						
57	**1-Undecyne** (1-Hendecyne, Nonyl acetylene)	195, 96 43[30]	−25	1 4306	0 7728	2-Undecanone	228	63	122 0- 5	79	
58	**Cyclodecyne**	203 4[740] 78 5[12]		1 4950	0 8975	Cyclodecanone	100 2[12]		203-5		Ozonolysis → sebacic acid, 134 5
59	**6-Dodecyne** (Dipentyl acetylene)	209[745], 90[8]		1 4380[25]	0 7816[25]						$NaNH_2$ → 1-Dodecyne, b p 215
60	**1-Dodecyne** (Decyl acetylene)	215 89 09[10]	19	1 4340	0 7788					84 2 8	
61	**1-Tridecyne** (*n*-Undecyl acetylene)	234, 102 95[10]	−5	1 4371	0 7842						
62	**1-Tetradecyne** (Dodecyl acetylene)	252, 118 31[10]	0	1 4396	0 7888						
63	**1-Pentadecyne** (Tridecyl acetylene)	268 129 79[10]	10	1 4419	0 7928						
64	**1-Hexadecyne** (Tetradecyl acetylene)	284 103 3[1]	15	1 4440	0 7965						

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE III. ORGANIC DERIVATIVES OF ALKYNES (ACETYLENES)

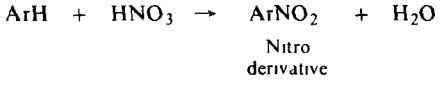
b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point °C	Boiling point C	n_D^{20}	D_4^{20}	Miscellaneous
1	**1-Heptadecyne**	22	299	1 4437[25]	0 7961[25]	
2	**2,6-Octadiyne**	27	62[19]	1 453[21]	0 828[40]	
3	**1-Octadecyne**	27	313 180	1 4474	0 8025	
4	**2-Octadecyne**	30	184[15]		0 8016	
5	**1-Nonadecyne**	33	327 144[1 5]	1 4488[S]	0 8050[S]	Hg salt, 96 7 *n*-BuOH
6	**1-Eicosyne**	35	340 153[1]	1 4501[S]	0 8073[S]	
7	**2-Heneicosyne**	35 6	180[2]	1 4499[40]		
8	**1-Heneicosyne**	41		1 4513[S]	0 8094[S]	
9	**1-Docosyne**	45	363	1 4524[S]	0 8114[S]	
10	**1-Tricosyne**	49	374	1 4534[S]	0 8131[S]	
11	**1-Tetracosyne**	52	385	1 4544[S]	0 8148[S]	
12	**1-Pentacosyne**	55	395	1 4552[S]	0 8163[S]	
13	**1-Hexacosyne**	57	405	1 456[S]	0 8177[S]	
14	**1-Heptacosyne**	60	415	1 4568[S]	0 8190[S]	
15	**1-Octacosyne**	62	426	1 4575[S]	0 8202[S]	
16	**1-Nonacosyne**	65	432	1 4581[S]	0 8213[S]	
17	**1-Triacontyne**	67	441	1 4587[S]	0 8224[S]	
18	**1-Hentriacontyne**	69	449	1 4593[S]	0 8234[S]	
19	**1-Dotriacontyne**	71	457	1 4598[S]	0 8243[S]	
20	**1-Tritriacontyne**	73	464	1 4603[S]	0 825[S]	
21	**1-Tetratriacontyne**	74	472	1 4608[S]	0 8260[S]	
22	**1-Pentatriacontyne**	76	479	1 4612[S]	0 8268[S]	
23	**1-Hexatriacontyne**	77	486	1 4617[S]	0 8275[S]	
24	**1-Heptatriacontyne**	79	493	1 4621[S]	0 8282[S]	
25	**1-Octatriacontyne**	80	499	1 4625[S]	0 8289[S]	
26	**1-Nonatriacontyne**	82	505	1 4628[S]	0 8295[S]	
27	**1-Tetracontyne**	83	512	1 4632[S]	0 8301[S]	

Derivative data given in order m p crystal color solvent from which crystallized
S = supercooled liquid at 20°

EXPLANATIONS AND REFERENCES TO TABLE IV

Nitro derivative *



From the aromatic hydrocarbon with concentrated nitric and sulfuric acids

For directions and examples see Cheronis, p 578 80, Linstead, p 48, 49, Shriner, p 249, Vogel, p 520, Wild, p 24

From the aromatic hydrocarbon with fuming and concentrated nitric acids

See Shriner, p 249, Wild, p 24

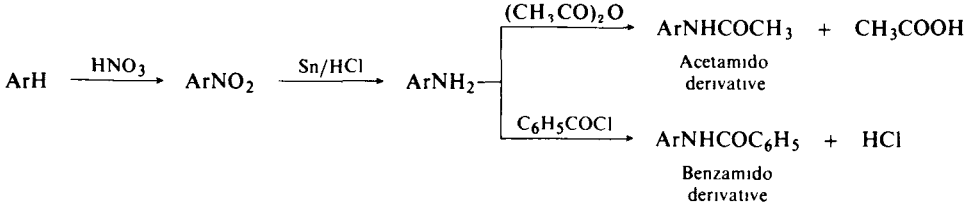
From the aromatic hydrocarbon with fuming nitric acid in acetic acid

See Vogel, p 520

From the aromatic hydrocarbon with nitric and sulfuric acids in chloroform

See Vogel, p 580

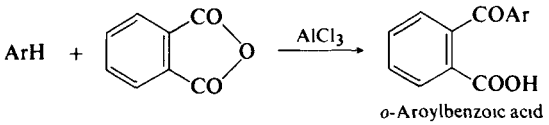
Acetamido and Benzamido derivatives *



Nitration of the aromatic hydrocarbon is followed by reduction with tin and hydrochloric acid The resulting amine is acetylated with acetic anhydride or benzoylated with benzoyl chloride

For directions and examples see Cheronis, p 581, V L Ipatieff and L A Schmerling, *J Amer Chem Soc*, **59,** 1056 (1937), **60,** 1476 (1938), **65,** 2470 (1943)

o-Aroylbenzoic acid (product with phthalic anhydride)



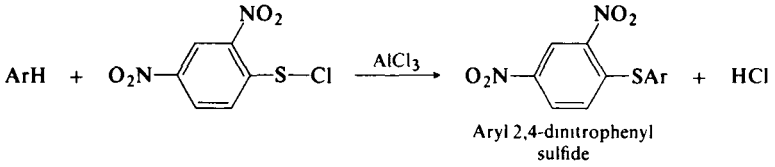
From the aromatic hydrocarbon, phthalic anhydride and aluminum chloride in carbon disulfide

For directions and examples see Cheronis, p 548, Shriner, p 250, Vogel, p 519, Wild, p 28, H W Underwood and W L Walsh, *J Amer Chem Soc*, **57,** 940 (1935)

From the aromatic hydrocarbon, phthalic anhydride and aluminum chloride without solvent

See G F Lewenz and K T Serijan, *J Amer Chem Soc*, **75,** 4087 (1953)

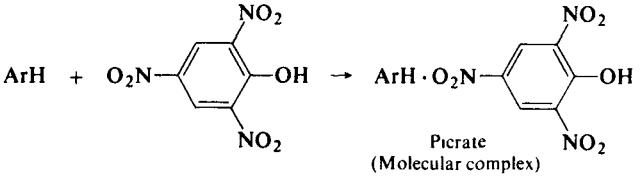
2,4-Dinitrobenzenesulfenyl chloride derivative (Aryl 2,4-dinitrophenyl sulfide)



From the aromatic hydrocarbon, 2,4-dinitrobenzenesulfenyl chloride and aluminum chloride in 1,2-dichloroethane

For directions and explanations see Cheronis, p 585, C M Buess and N Kharasch, *J Amer Chem Soc*, **72,** 3529 (1950)

Picrate



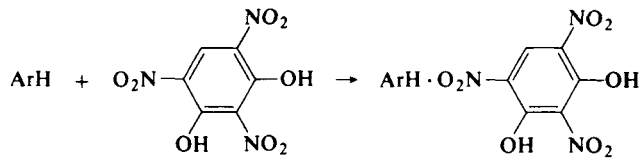
*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

EXPLANATIONS AND REFERENCES TO TABLE IV (Continued)

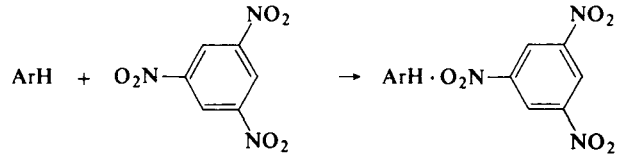
From the aromatic hydrocarbon and picric acid in alcohol
For directions and examples see Linstead, p 50 Vogel, p 518, Wild, pp 29 30
From excess of liquid aromatic hydrocarbon and picric acid without solvent
See Wild, pp 28 9 Baril and Hauber, *J Amer Chem Soc*, **53**, 1087 (1931)
From the aromatic hydrocarbon in methanol or in dry benzene
See Cheronis, pp 582 3

Styphnate



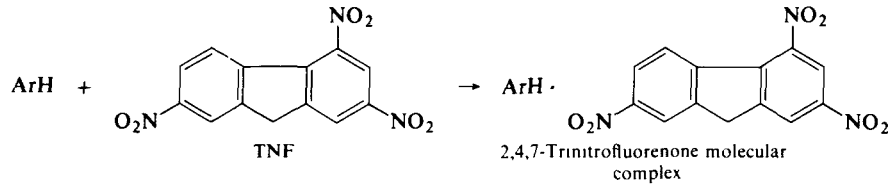
From the aromatic hydrocarbon and styphnic acid (2,4,6-trinitroresorcinol) in acetic acid
For directions and examples see Vogel, p 519, W J Hickinbottom, *Reactions of Organic Compounds*, 2nd ed , Longmans, Green and Co , London, 1948, p 76

1,3,5-Trinitrobenzene derivative



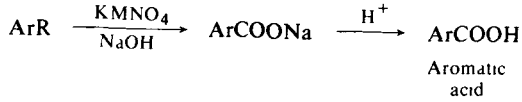
From the aromatic hydrocarbon and 1,3,5-trinitrobenzene in alcohol, acetic acid, or benzene
For directions and examples see Vogel, p 519

2 4,7-Trinitrofluorenone (TNF) derivative *



From the aromatic hydrocarbon and 2,4,7-trinitrofluorenone in methanol-benzene and ethanol-benzene mixtures
For directions and examples see Cheronis, pp 582 3, M Orchin, *J Amer Chem Soc*, **68**, 1727 (1946), M Orchin, L Reggel and E O Woolfolk, *J Amer Chem Soc*, **69**, 1225 (1947)
From the aromatic hydrocarbon and 2,4,7-trinitrofluorenone in glacial acetic acid
See M C Kloetzel and H E Mertel, *J Amer Chem Soc*, **72**, 4786 (1950), M D Soffer and R A Stewart, *J Amer Chem Soc*, **74**, 567 (1952)
From the aromatic hydrocarbon and 2,4,7-trinitrofluorenone without solvent
See D E Laskowski and W C McCrone, *Anal Chem*, **30**, 542 (1958)

Acids from side-chain oxidation



*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

EXPLANATIONS AND REFERENCES TO TABLE IV (Continued)

From the alkyl-substituted aromatic hydrocarbon with potassium permanganate in sodium hydroxide or sodium carbonate solution

For directions and examples see Cheronis, p 585, 627, Linstead, p 50, Shriner, p 250, Vogel, p 520, Wild, p 26

From the alkyl-substituted aromatic hydrocarbon with sodium bichromate and sulfuric acid

See Cheronis, p 627, Shriner, p 250, Wild, p 26

Sulfonamide *

$$ArH + ClSO_3H \rightarrow \underset{\text{Sulfonyl chloride}}{ArSO_2Cl} \xrightarrow{NH_3} \underset{\text{Sulfonamide}}{ArSO_2NH_2}$$

From the aromatic hydrocarbon and chlorosulfonic acid in chloroform, followed by aqueous ammonia

For directions and examples see Linstead, p 49, Wild, p 27, E H Huntress and F H Carten, *J Amer Chem Soc*, **62**, 511 (1940), E H Huntress and J S Autenrieth, *J Amer Chem Soc*, **63**, 3446 (1941)

From the aromatic hydrocarbon with chlorosulfonic acid without solvent, followed by ammonolysis with dry ammonium carbonate

See Wild, p 27

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS

a) Liquids. (Listed in order of increasing b.p.)*

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Picrate	1 3 5 Trinitro benzene derivative	Nitro derivative	Acetamido derivative	Phthalic anhydride derivative	2,4-Dinitrophenyl sulfenyl chloride derivative	Miscellaneous
1	**Benzene**	80 1	5 5	1 5011	0 87901	84		1,3-*di* 89, 1,3,5 *tri* 122		127	120	Sulfonamide, 156
2	**Toluene**	110 6	−95	1 49613	0 86694	88 2, pa yel		2,4-*di* 70	2,4-*di* 221	137	102 3	Oxid → benzoic acid, 121, Sulfonamide, 137
3	**Ethylbenzene**	136 2	−93 9	1 49594	0 86690	96 6, pa yel		2,4,6-*tri* 37	2,4-*di* 223	122, 128	97	Oxid → benzoic acid, 121, Sulfonamide, 109
4	**1,4-Xylene**	138 3	13 26	1 49581	0 86105	90		2,3,5-*tri* 139		132, 148	134-5	Oxid → terephthalic acid, >300, subl , Sulfonamide, 147
5	**1,3-Xylene**	139 1	−47 89	1 49722	0 86417	91		2,4,6-*tri* 183		126, 142		Oxid → isophthalic acid, 348, h w , Sulfonamide, 137
6	**1,2-Xylene**	144 4	−25 18	1 50545	0 88020	88		4,5-*di* 118		178		Oxid → phthalic acid, 206 8, Sulfonamide, 144
7	**Isopropylbenzene** (Cumene)	152 4	−96 04	1 49146	0 86179			2,4,6-*tri* 109	4-*mono* 106, 2,4-*di* 216	133		Oxid → benzoic acid, 121 Sulfonamide, 106
8	***n*-Propylbenzene**	159 2	−99 59	1 49202	0 86204	103		2,4-*di* b p 150[1]	4-*mono* 96, 2,4-*di* 208	125		Oxid → benzoic
9	**1-Ethyl-3-methylbenzene** (*m*-Ethyltoluene)	161 3	−96 55	1 49661	0 86455							Oxid → isophthalic acid, 348, h w
10	**1-Ethyl-4-methylbenzene** (*p*-Ethyltoluene)	162 1	−62 35	1 49500	0 86118							Oxid → terephthalic acid, >300, subl
11	**1,3,5-Trimethylbenzene** (Mesitylene)	164 7	−44 72	1 49937	0 86518	97		2,4-*di* 86, 2,4,6-*tri* 235		212		Oxid → trimesic acid, 380, Sulfonamide, 141
12	**1-Ethyl-2-methylbenzene** (*o*-Ethyltoluene)	165 2	−80 83	1 50456	0 88069							Oxid → phthalic acid, 206 8
13	***tert*-Butylbenzene**	169 1	−58 34	1 49266	0 86650			2,4-*di* 62, 2,4,6-*tri* 124	4-*mono* 170, 2,4-*di* 210		130 1	Oxid → benzoic acid, 121
14	**1,2,4-Trimethylbenzene** (Pseudocumene)	169 4	−43 91	1 50484	0 87582	97		3,5,6-*tri* 185				Oxid → trimellitic acid, 225 35 d
15	**Isobutylbenzene**	172 8	−51 53	1 48646	0 85321				4-*mono* 127 0 7 5		99 100	Oxid → benzoic acid, 121
16	***sec*-Butylbenzene**	173 3	−75 57	1 49020	0 86207			2,4-*di* b p 161 2[5]	4-*mono* 126, 2,6-*di* 192		88-9	Oxid → benzoic
17	**3-Isopropyl-1-methylbenzene** (3-Isopropyltoluene, *m*-Cymene)	175 1	−63 75	1 4930	0 8610							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS

a) Liquids. (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Picrate	1,3,5 Trinitrobenzene derivative	Nitro derivative	Acetamido derivative	Phthalic anhydride derivative	2,4-Dinitrophenyl sulfenyl chloride derivative	Miscellaneous
18	**1,2,3-Trimethylbenzene** (Hemimellitene)	176 08	−25 41	1 51393	0 89438	90 5						Oxid → hemimellitic acid, 190 7 d
19	***trans*-Propenylbenzene**	176 5 7 5	−27 1 to −25 9	1 5463^{25}	0 902							
20	**Indane**	177	−51 4	1 5381	0 9645							
21	**4-Isopropyl-1-methylbenzene** (4-Isopropyltoluene, 4-Cymene)	177 1	−67 94	1 4909	0 8537			2,6-*di* 54, 2,3,6 *tri* 118		123 4		Sulfonamide, 115
22	**2-Isopropyl-1-methylbenzene** (2 Isopropyltoluene 2-Cymene)	178 35	−71 71	1 5006	0 8766							Br_2 → Tetrabromo, 59 5 60 5
23	**1,3-Diethylbenzene**	181 1		1 49552	0 86394			2,4,6-*tri* 62		114		
24	**1-Methyl-3-propylbenzene** (*m*-Propyltoluene)	181 8		1 4936	0 8610							
25	**Indene**	182 4	−2	1 5764	0 9915	98, yel						Acid → polymer
26	***n*-Butylbenzene**	183 27	−88 15	1 48979	0 86013				4-*mono* 105 2,4-*di* 214	97	72 3	
27	**1-Methyl-4-propylbenzene** (*p*-Propyltoluene)	183 3		1 4919	0 8584							
28	**1,2-Diethylbenzene**	183 4		1 50346	0 87996							
29	**1,4-Diethylbenzene**	183 8		1 49483	0 86196							
30	**1,3-Dimethyl-5-ethylbenzene**	183 8	−84 4	1 4981	0 8648			2,4,6-*tri* 117 0 7 6				Br_2 → Tribromo, 89
31	**1-Methyl-2-propylbenzene** (*o*-Propyltoluene)	184 8	−60 2	1 4998	0 8744							
32	**2,2-Dimethyl-1-phenylpropane** (Neopentylbenzene)	186		1 4880	0 858							
33	**1,4-Dimethyl-2-ethylbenzene**	186 9		1 5043	0 8772			3,5,6-*tri* 127 8, al	4-*mono* 142, 2,4-*di* 181			Sulfonamide, 107-8
34	**2-Methylindane**	187 0		1 5070	0 9034							
35	**3-Methyl-2-phenylbutane**	188		1 486	0 8701				4-*mono* 147 8, 2,4-*di* 193			4-Benzamido deriv , 141 2
36	**1-Methylindane**	188 90		1 5274	0 939							Heat with Pt at 310-350 → Naphthalene, 80 3
37	**1,3-Dimethyl-4-ethylbenzene**	188 4	−63 0	1 5038	0 8763			2,5,6-*tri* 127 5 9 0				Br_2 → 2,5,6-Tribromo, 94 5, 81 2
38	**3-*tert*-Butyl-1-methylbenzene** (3-*tert*-Butyltoluene)	189 3	−41 39	1 4944	0 8657							
39	**1,2-Dimethyl-4-ethylbenzene**	189 55	−67 1	1 5031	0 8745							Oxid → trimellitic acid, 225 35 d
40	**1,3-Dimethyl-2-ethylbenzene**	190		1 5107	0 8904							Oxid → hemimellitic acid, 190-7 d

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS

a) Liquids. (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Picrate	1 3 5 Trinitro benzene derivative	Nitro derivative	Acetamido derivative	Phthalic anhydride derivative	2 4 Dinitro phenyl sulfenyl chloride derivative	Miscellaneous
41	**3-Phenylpentane**	191		1 4877	0 8649				4-*mono* 145 6 2 4-*di* 199 200			4 Benzamido deriv , 154
42	**1-Ethyl-3-isopropylbenzene**	192		1 4955	0 859							
43	**2-Methyl-2-phenylbutane**	192 38		1 4934	0 8737				4 *mono* 142 2 4 *di* 181			4-Benzamido deriv 112 3
44	**4-*tert*-Butyl-1-methylbenzene** (4-*tert* Butyltoluene)	192 8	– 52 49	1 4918	0 8612			2 6 *di* 96				
45	**1-Ethyl-2-isopropylbenzene**	193		1 5080	0 888							
46	**2-Phenylpentane**	193		1 4876	0 8576				4-*mono* 107 2 4-*di* 181 2			4-Benzamido 127 8
47	**1,2-Dimethyl-3-ethylbenzene**	193 9	– 49 5	1 5117	0 8921							Oxid → hemimellitic acid 190 7 d
48	**3-*sec*-Butyl-1-methylbenzene** (3-*sec*-Butyltoluene)	194		1 490	0 858							
49	**3-Isobutyl-1-methylbenzene** (3-Isobutyltoluene)	194		1 4888	0 8536							
50	***d*-2-Methyl-1-phenylbutane**	194		1 4880	0 8617							
51	**1,3-Dimethyl-5-isopropylbenzene**	194 5 191		1 4955	0 8591							Oxid → trimesic acid, 380
52	**2-Phenyl-*cis*-2-butene**	194 5		$1\ 5402^{25}$	$0\ 9191^{2}$						81 2	
53	**4-Isobutyl-1-methylbenzene** (*p* Isobutyltoluene)	196		1 4874	0 8517							
54	**2-*sec*-Butyl-1-methylbenzene** (2-*sec* Butyltoluene)	196		1 497	0 873							
55	**2-Isobutyl-1-methylbenzene** (*o*-Isobutyltoluene)	196		1 4935	0 8649							
56	**1,4-Dimethyl-2-isopropylbenzene**	196 2		1 5010	0 8738							
57	**1-Ethyl-4-isopropylbenzene**	196 6		1 4923	0 8585							
58	***d,l*-2-Methyl-1-phenylbutane**	197		1 486	0 859				4-*mono* 115 6 2 4 *di* 193 4			4-Benzamido 126
59	**1,2,3,5-Tetramethylbenzene** (Isodurene)	197 9		1 5125	0 8899			4 6-*di* 181 157		213		
60	**3-Methyl-1-phenylbutane** (Isopentylbenzene)	198 9 196		1 4847	0 8558				4-*mono* 114 2,4-*di* 215 6			
61	**1,3-Dimethyl-2-isopropylbenzene**	199		1 509	0 890							
62	**1,3-Dimethyl-4-isopropylbenzene**	199 1 195		1 5018	0 869							
63	**3-Methylindene**	199 2 200 198 5		$1\ 55907^{27}$	0 9640	76 8, or - yel , al						
64	**4-*sec*-Butyl-1-methylbenzene** (*p*-*sec*-Butyltoluene)	200		1 4932	0 8650							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS

a) Liquids. (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	D_4^{20}	Picrate	1 3,5-Trinitro benzene derivative	Nitro derivative	Acetamido derivative	Phthalic anhydride derivative	2 4-Dinitrophenyl sulfenyl chloride derivative	Miscellaneous
65	**2-*tert*-Butyl-1-methylbenzene** (2-*tert*-Butyltoluene)	200 5		1 5076	0 8897							
66	**3,5-Diethyl-1-methylbenzene** (3,5-Diethyltoluene)	200 7	−74 12	1 4969	0 8630			2,4,6-*tri* 106 6 5				
67	**2-Butyl-1-methylbenzene** (2-Butyltoluene)	201, 208		1 4958	0 8721							
68	**1-Ethyl-3-propylbenzene**	201		1 4930	0 8607							
69	**1,2-Dimethyl-4-isopropylbenzene**	201 8		1 4993	0 8699							
71	**1,2-Dimethyl-3-isopropylbenzene**	202 6		1 508	0 888							
72	**1-Ethyl-2-propylbenzene**	203		1 4992	0 8744							
73	**1,3-Di-isopropylbenzene**	203 2	−63 1	1 4883	0 85593			4,6-*di* 76 9 7 2, 2-ProH				
74	**1,2-Diethyl-4-methylbenzene**	203 6		1 5039	0 8762							
75	**1,2-Di-isopropylbenzene**	203 8		1 4960	0 8771							
76	**1,4-Dimethyl-2-propylbenzene**	204 3		1 4999	0 8717							
77	**1,2,3,4-Tetramethylbenzene** (Prehnitene)	205 0	−6 3	1 5201	0 9053	92-5		5,6-*di* 176				
78	**1-Ethyl-4-propylbenzene**	205		1 4921	0 8594							
79	**3-Butyl-1-methylbenzene** (*m*-Butyltoluene)	205		1 491	0 859							
80	**2,4-Diethyl-1-methylbenzene** (2,4-Diethyltoluene)	205		1 5027	0 8748							
81	***n*-Pentylbenzene**	205 4	−75	1 4878	0 8585				4-*mono* 101-2, 2,4-*di* 202			4-Benzamido, 128 9
82	**3-Methyl-3-phenylpentane**	206		1 4958	0 8755							
83	**1,3-Dimethyl-5-*tert*-butylbenzene**	206-6 5	−21 5	1 4958	0 8645			2,4,6-*tri* 107 (one form), 114 (another form)				
84	**1,3-Dimethyl-4-propylbenzene**	206 6		1 4998	0 8723							
85	**1,2-Diethyl-3-methylbenzene**	206 6		1 5105	0 8910							
86	**4-Butyl-1-methylbenzene** (4-Butyltoluene)	207		1 490	0 857							
87	**2,5-Diethyl-1-methylbenzene** (2,5-Diethyltoluene)	207 1		1 5034	0 8758							
88	**1,2,3,4-Tetrahydronaphthalene** (Tetralin)	207 6	−35 79	1 54135	0 9702			5,7-*di* 95		153 5		Cl_2 → 5,6,7,8-Tetrachloro, 172
89	**1,3-Diethyl-2-propylbenzene**	207 6		1 5063	0 8856							
90	**2,6-Diethyl-1-methylbenzene** (2,6-Diethyltoluene)	208 8		1 5106	0 8907							
91	**1,2-Dimethyl-4-propylbenzene**	208 9		1 5000	0 8715							
92	**1,3-Dimethyl-5-propylbenzene**	209		1 4933	0 8610							
93	**2-Methyl-3-phenylpentane**	209		1 4912	0 8678							
94	**4-*tert*-Butyl-1,3-dimethylbenzene**	210-4		$1\ 5030^{37}$	$0\ 9372^{30}$			2,5,6-*tri* 112, al				
95	**1,4-Di-isopropylbenzene**	210 4	−17 1	1 48983	0 85676							
96	**1,2-Dimethyl-3-propylbenzene**	210 7		1 5075	0 8864							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS

a) Liquids. (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Picrate	1 3,5 Trinitrobenzene derivative	Nitro derivative	Acetamido derivative	Phthalic anhydride derivative	2,4-Dinitrophenyl sulfenyl chloride derivative	Miscellaneous
97	**1-*tert*-Butyl-4-ethylbenzene**	211		1 4950	0 8635			2,6-*dı* 94 5, al				
98	***d,l*-3-Phenylhexane**	211 208 3		1 4867	0 8596				2,4-*dı* 207 8			
99	**2-Ethyl-1,3,5-trimethylbenzene**	212 4	−12 2	1 5074	0 883			4,6-*dı* 111, al				
100	**3-Ethyl-4-isopropyl-1-methylbenzene**	213		1 5006	0 8722							
101	**5-Ethyl-1,2,4-trimethylbenzene**	213	−13 ٦	1 5075	0 833			3,6-*dı* 87 8, al				3,6-Dibromo, 60–1, acet
102	**6-Ethyl-1,2,4-trimethylbenzene**	213		1 5118	0 8897							
103	**2-Phenylhexane**	214		1 4882	0 8600				2,4-*dı* 178			
104	**2-Methyl-1-phenylpentane**	215		1 4847	0 8624							
105	**4-Isopropyl-1-propylbenzene**	215		1 4972	0 8614							
106	**1,3-Dipropylbenzene**	215 8		1 5155[14]	0 9137[1]							
107	**5-Ethyl-1,2,3-trimethylbenzene**	215 8		1 5101	0 8863							
108	**3-Ethyl-1,2,4-trimethylbenzene**	216 6		1 5133	0 895			5,6-*dı* 79 80, al				
109	**1,2,4-Triethylbenzene**	217 7		1 4982	0 8791							
110	**1,3,5-Triethylbenzene**	218 211 2		1 4965	0 8568[25]			2,4,6-*trı* 112 4 2 6		129		2,4,6-Tribromo, 105
111	**2-Methyl-1,2,3,4-tetrahydronaphthalene** (2 Methyltetralin)	218		1 5311	0 952							
112	**1-Methyl-1,2,3,4-tetrahydronaphthalene** (1-Methyltetralin)	219		1 5357	0 9580							
113	**4-Ethyl-1,2,3-trimethylbenzene**	220 4		1 5180	0 9019							
114	**1,4-Dipropylbenzene**	221		1 4914	0 8564							
115	**3-Methyl-1-phenylpentane**	221		1 4876	0 8605							
116	**2-Propyl-1,3,5-trimethylbenzene**	221		1 5033	0 8782							
117	**1,1-Dimethyl-1,2,3,4-tetrahydronaphthalene** (1,1-Dimethyltetralin)	221		1 5292	0 950			Ar-x, x-*dı* 64 5				
118	**3-*tert*-Butyl-1-isopropylbenzene**	222		1 4832	0 8512							
119	**1-Methyl-3-pentylbenzene** (3-Pentyltoluene)	223		1 4911	0 8593							
120	**4-*tert*-Butyl-1-isopropylbenzene**	224		1 4872	0 8665							
121	**2-Methyl-2-phenylhexane**	225		1 4943	0 8737							
122	**2,4-Di-isopropyl-1-methylbenzene** (2,4-Di-isopropyltoluene)	225		1 4990	0 8664							
123	**3-Methyl-3-phenylhexane**	226		1 4980	0 8776							
124	***n*-Hexylbenzene**	226 1	−61 2	1 4864	0 8575				2,4-*dı* 205 6			
125	**3-Phenylheptane**	227		1 4862	0 8607							
126	**2,6-Di-isopropyl-1-methylbenzene** (2,6-Di-isopropyltoluene)	228		1 5032	0 8768							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS

a) Liquids. (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	D_4^{20}	Picrate	1 3 5 Trinitro benzene derivative	Nitro derivative	Acetamido derivative	Phthalic anhydride derivative	2,4 Dinitro phenyl sulfenyl chloride derivative	Miscellaneous
127	**5-Propyl-1,2,4-trimethylbenzene**	228		1 5095	0 887							
128	**6-Methyl-1,2,3,4-tetrahydronaphthalene** (6-Methyltetralin)	229		1 5357	0 9537							
129	**2,2-Dimethyl-1,2,3,4-tetrahydronaphthalene** (2 2 Dimethyltetralin)	230		1 5200	0 935							
130	**2-Phenylheptane**	231		1 4863	0 8610							
131	**5-Methyl-1,2,3,4-tetrahydronaphthalene** (5-Methyltetralin)	234 4		1 54395	0 9720							
132	**2-Ethyl-1,2,3,4-tetrahydronaphthalene** (2-Ethyltetralin)	235		1 523	0 938							
133	**Cyclohexylbenzene**	235-6	7 8	1 5329	0 9502							
134	**1-Ethyl-1,2,3,4-tetrahydronaphthalene** (1-Ethyltetralin)	236		1 5321	0 9535							
135	**2,5-Dimethyl-1,2,3,4-tetrahydronaphthalene** (2,5-Dimethyltetralin)	236		1 526	0 946							
136	**2,8-Dimethyl-1,2,3,4-tetrahydronaphthalene** (2,8-Dimethyltetralin)	236		1 526	0 941							
137	**2,7-Dimethyl-1,2,3,4-tetrahydronaphthalene** (2,7-Dimethyltetralin)	237 8		1 526	0 941							
138	**2,6-Dimethyl-1,2,3,4-tetrahydronaphthalene** (2,6-Dimethyltetralin)	238		1 526	0 941							Oxid → trimellitic acid 225 35 d
139	**1,4-Di-*sec*-butylbenzene**	239		1 4892	0 8590							
140	**1,5-Dimethyl-1,2,3,4-tetrahydronaphthalene** (1,5 Dimethyltetralin)	239		1 526	0 9410							
141	**3-Ethyl-3-phenylhexane**	239		1 4943	0 875							
142	**6-Ethyl-1,2,3,4-tetrahydronaphthalene** (6 Ethyltetralin)	241		1 5331	0 9568							
143	**2-Methyl-1-phenyl-1-butene**	241 2		1 528[18]								Nitrosit, 129 30
144	**5-Ethyl-1,2,3,4-tetrahydronaphthalene** (5-Ethyltetralin)	242		1 540	0 973							
145	***n*-Heptylbenzene**	244		1 4875	0 8595							
146	**1-Methylnaphthalene**	244 8	−30 57	1 6174	1 02025	142, or-red, al	153 5 4 5, al	4-*mono* 71, 4,5-*di* 143		68		Styphnate, 135, al
147	**5,6-Dimethyl-1,2,3,4-tetrahydronaphthalene** (5,6 Dimethyltetralin)	252		1 552	0 975							Oxid → melophanic acid, 238-42
148	**6,7-Dimethyl-1,2,3,4-tetrahydronaphthalene** (6,7-Dimethyltetralin)	252	10	1 5360	0 954			5,8 *di* 203				
149	**5,7-Dimethyl-1,2,3,4-tetrahydronaphthalene** (5,7 Dimethyltetralin)	253 1	−6	1 5405	0 9583							Heating with S at 320° → 1,3-Dimethylnaphthalene, b p 263

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS

a) Liquids. (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Picrate	1 3 5 Trinitro benzene derivative	Nitro derivative	Acetamido derivative	Phthalic anhydride derivative	2,4-Dinitro phenyl sulfenyl chloride derivative	Miscellaneous
150	**5,8-Dimethyl-1,2,3,4-tetrahydronaphthalene** (5,8-Dimethyltetralin)	254		1 547	0 967							Heating with S at 230° → 1,4-Dimethylnaphthalene, b p 268
151	**2-Ethylnaphthalene**	257 9	−7 5	1 59761	0 9922	77 0 7 5, al	88 9, 2-PrOH					Styphnate, 88 90
152	**1-Ethylnaphthalene**	258 67	−13 88	1 6062	1 00816	98 5	111 5 12, al					Styphnate 111 3, al
153	**1,7-Dimethylnaphthalene**	263	−13	1 60831	1 0115	121	137					Styphnate, 143
154	**1,6-Dimethylnaphthalene**	263	−14	1 6072	1 003	114 5 or, al	139 yel					Styphnate, 122
155	**1,3-Dimethylnaphthalene**	263	−4 0	1 6078	1 0063	118	135, yel, al					Styphnate, 117 8, w -me al, 2,4,7-Trinitrofluorenone deriv, 142 5, or
156	***n*-Octylbenzene** (1-Phenyloctane)	264 5	−36	1 4845	0 8562			2 4-*di* 2				
157	**1-Allylnaphthalene**	265 7		1 6140	1 0228	69						
158	**1-Isopropylnaphthalene**	267 9	−16	1 5950	0 99565	85 6						Dimer 198 5 9 5 Tetrabromo, 141 2
159	**1,4-Dimethylnaphthalene**	268, 262–4	7 66	1 6127	1 0166	144, or, me al	165 6 yel, me al					Styphnate, 126–7 or me al
160	**1,1-Diphenylethane**	268–70		1 5761	1 0033							Oxid → benzophenone, 49
161	**2-Isopropylnaphthalene**	a) 268 2 b) 262		1 5772 1 5861	0 9795	93 5, 91 3						
162	**2-Propylnaphthalene**	273 5, 277 9		1 5872	0 9770	93 4, or al	99					
163	**1-Propylnaphthalene**	277, 272 5	−10	1 5952	0 9918	91 2	86 7, al					
164	**1,3,7-Trimethylnaphthalene**	280	13 5	1 5759	1 007	144, or, al						Styphnate 151 5 or me al
165	**1-Isopropyl-7-methylnaphthalene** (Apocadalene)	282		1 5884	0 9833	102, or, al						Styphnate, 166 (163–4), yel, al
166	***n*-Nonylbenzene** (1-Phenylnonane)	282	−24	1 4838	0 8558							4-Sulfonamide, 94 5–5 0 Maleic anhydride → 3-(4-Nonylbenzoyl) acrylic acid, 82 3
167	**2-Butylnaphthalene**	283–5, 292	−8 1	1 57774	0 9673	71 3, or-yel, al						
168	**2-*tert*-Butylnaphthalene**	285–90	−4	1 5768	0 9687	102 3						
169	**1-*tert*-Butylnaphthalene**	287 9		1 5726	0 9629	96, yel						
170	**1-Butylnaphthalene**	289 34	−19 76	1 5819	0 97673	104 5, or-yel						

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS

a) Liquids. (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Picrate	1,3,5-Trinitrobenzene derivative	Nitro derivative	Acetamido derivative	Phthalic anhydride derivative	2,4-Dinitrophenyl sulfenyl chloride derivative	Miscellaneous
171	**4,5-Benzindane** (1,2-Cyclopentanonaphthalene)	294 5		1 6290	1 066	110	119 20					2,4,7-Trinitrofluorenone deriv , 133
172	***n*-Decylbenzene** (1-Phenyldecane)	300	−14 38	1 48319	0 85553							
173	**1-Pentylnaphthalene**	307	−22	1 5725	0 9656		75, yel					
174	**2-Pentylnaphthalene**	310	−21	1 5694	0 9561		74, yel					
175	***n*-Undecylbenzene** (*n*-Hendecylbenzene, 1-Phenylundecane)	316	−5	1 4828	0 8553							4-Sulfonamide, 95 7 6 2
176	**1-Hexylnaphthalene**	322	−17 7	1 5647	0 9566		69 74					
177	**2-Hexylnaphthalene**	324	−5 6	1 620	0 9479		67-8, yel					
178	***n*-Dodecylbenzene** (1-Phenyldodecane)	331	3	1 4824	0 8551							4-Sulfonamide, 97 5
179	**1-Heptylnaphthalene**	340		1 5582	0 9491							
180	**2-Heptylnaphthalene**	341	1	1 5556	0 9410							
181	**Tridecylbenzene** (1-Phenyltridecane)	346	10	1 4821	0 8550							
182	**1-Octylnaphthalene**	356	−2 0	1 5532	0 9427							
183	**2-Octylnaphthalene**	357	2 forms stable −0 5, metastable 13	1 5501	0 9356							
184	**1-Nonylnaphthalene**	372		1 5477	0 9371							
185	**2-Nonylnaphthalene**	372	12	1 5454	0 9298							
186	**1-Decylnaphthalene**	387		1 5435	0 9322							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS
b) Solids. (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point, °C	Picrate	Styphnate	*sym*-Trinitrobenzene derivative	2,4,7-Trinitrofluorenone derivative	Nitro derivative	Phthalic anhydride derivative	2,4-Dinitrophenyl sulfenyl chloride derivative	Miscellaneous
1	**1,2,6-Trimethylnaphthalene**	14	146[10]	122-3, al	150-1, al						n_D^{20} 1 6010
2	**Diphenylmethane**	26 7	264 7, 261 2, 120[10]					2,4,2',4'-*tetra* 172			n_D^{20} 1 5770, D_{25}^{25} 1 0056, CrO_3 → Benzophenone, 49
3	**1,2,3-Trimethylnaphthalene**	27 8, al	125-30[12]	143, or, al	143 5, yel	154 6, al					n_D^{25} 1 5725
4	**1,6,7-Trimethylnaphthalene**	28, me al	285, 138[12]	125 6, or, me al	148-9, or, me al	142-3, yel, me al					
5	**2-Isopropylazulene**	31, bl-vlt				*di* 113 4					
6	**1,4-Dimethyl-7-isopropylazulene** (δ-Guaiazulene)	31 5, bl-vlt, al	167-8[12]	122 2 5, bl, al	105-6, bl, me al	151-1 5					D_4^{19} 0 9728 (supercooled) 2,4,6-Trinitrotoluene deriv, 89
7	**2,6-Dimethylphenanthrene**	33-4, me al		135 6, yel, al	148 50, yel, me al						
8	**1,2,5-Trimethylnaphthalene**	33 5, 31-2, al	147 8[11]	138 40, al	131, al	159-60, al					n_D^{20} 1 6110, D_{20}^{20} 1 0103, 2,4,6-Trinitrotoluene deriv, 90 0 5
9	**1-Propylphenanthrene**	34 5, me al		100-1, yel, me al							
10	**5-Isopropylazulene**	34 5				134, 122 3					
11	**2-Propylphenanthrene**	35-6, al	170[0.2]	91 2, al							
12	**2-Methylnaphthalene**	37-8, 34 4	240-2, 110-2[16]	116, al		123, yel	125 6, al	1-*mono* 81			CrO_3 → β-Naphthoic acid, 182
13	**1-Ethyl-5-methylnaphthalene**	40, al	133[10]	97, or, al							
14	**9-Isopropylphenanthrene**	41-2		109-10							
15	**6-Isopropylazulene**	43				124					
16	**2-Ethyl-6-methylnaphthalene**	44 5	145 50[11]	109, or	119, yel	116-7, yel					2,4,6-Trinitrotoluene deriv, 62, yel
17	**2-Isopropylphenanthrene**	44-5, al		108, yel, me al							
18	**6-Isopropyl-1-methylphenanthrene**	45-6		143, or							
19	**2-Ethylazulene**	45 5, 44-5, bl		110 1		107					
20	**2,5-Dimethylphenanthrene**	46 7, al	204-5[15]	127-9, yel, al	132-3, or, al						
21	**1,3,5-Trimethylnaphthalene**	47, me al	139 5[10]	141-2, me al	138, yel						
22	**3-Ethyl-6-methylphenanthrene**	47-8		156-6 5, or							
23	**2-Methylazulene**	47-8		130-1, bl, al		140-1, dk red, al					
24	**1,3,8-Trimethylnaphthalene**	48, me al		127 5, or, al	140 5, al						
25	**4-Methylphenanthrene**	49 50, 95% al		140-1, al	135, or, al						

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS
b) Solids. (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Picrate	Styphnate	*sym* Trinitrobenzene derivative	2 4 7-Trinitrofluorenone derivative	Nitro derivative	Phthalic anhydride derivative	2,4-Dinitrophenyl sulfenyl chloride derivative	Miscellaneous
26	**1,4-Dimethylphenanthrene**	50 1 (cor), me al		143 5, or -yel	135 5 6 5, or						
27	**Bibenzyl** (1,2-Diphenylethane)	53	284			102		4,4 -*di* 180, 2,2',4,4 -*tetra* 169		132 3	D_{30}^{30} 0 9782, CrO_3 → Benzoic acid, 121
28	**Methylenefluorene** (Biphenylenecethylene)	53		152 3							
29	**3,5-Dimethylphenanthrene**	53 4, me al		139, or , me al	124 5 or -yel						
30	**1,3-Dimethylazulene**	54		164 6		164 6, al					
31	**7-Methyl-3,4-benzphenanthrene**	54 0 4 5, al		134 0 4 5, red, al			178 5 8 8				
32	**Pentamethylbenzene**	54 3, 51	231 8	131		121		6-*mono* 154			
33	**1,2,4-Trimethylnaphthalene**	55-6 50, me al	146[12]	148 8 5, or me al	123 5, yel , me al	165 6 5, me al					
34	**3,3'-Dimethylstilbene** (*sym*-Di-*m*-tolylethylene)	55 6		97							
35	**1,4,5,7-Tetramethylnaphthalene**	56	162 5[11]	153			152 8 3 4				
36	**1,2,4,8-Tetramethylnaphthalene**	56 7	150[10]	145 5		167, red, me al					2 4,6-Trinitrotoluene deriv , 88 yel
37	**2,9-Dimethylphenanthrene**	56 7, al		138, yel , al							
38	**1,5-Dimethylphenanthrene**	57 8, me al		134 5, or , me al							
39	**2-Benzylnaphthalene**	58	350	93 4, yel , al			124 3 5 4				D^{0} 1 176
40	**1-Benzylnaphthalene**	58 9	350	103-4, yel							D^{1} 1 166
41	**1,2-Dimethylazulene**	58 9, bl , al		129 30, blk , al		166 7 br -blk , al					
42	**9-Propylphenanthrene**	59	265 70[22]	99, yel , al							
43	**1,7-Dimethyl-4-isopropylnaphthalene**	60, al -w		92, or -red, al	120, yel						
44	**3-Methylphenanthrene**	62-3	140 50[6]	137-8, yel , al							
45	**3,4-Dimethylphenanthrene**	62 3, me al		129-30, or -red, al	142 3, or -red, al						
46	**1-Ethylphenanthrene**	62 5, al		108-9, or , al	144, yel , al						
47	*sym*-**Diphenylacetylene** (Tolane)	62 5, al		111, yel		96, yel					
48	**9-Ethylphenanthrene**	62 5 3 0, 66, bz -pet eth	198 200	123-4, or -red, al							D_4^{78} 1 0603 n_D^{78} 1 6582

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS
b) Solids. (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Picrate	Styphnate	*sym*-Trinitro benzene derivative	2 4,7 Trinitrofluorenone derivative	Nitro derivative	Phthalic anhydride derivative	2,4 Dinitro phenyl sulfenyl chloride derivative	Miscellaneous
49	**1,4,5-Trimethylnaphthalene**	63	145^{12}	144 5, red, al	129 30						
50	**4-Methylfluorene**	63, al									In H_2SO_4 sol → grn
51	**1,4,6,7-Tetramethylnaphthalene**	63 4, al		148 9			172 4 3 4				
52	**1,2,3-Trimethylphenanthrene**	63 8 4 8		187 8, or		200 7 1 5, yel, bz -al					
53	**1,8-Dimethylnaphthalene**	65 63	140^{18}	156 148	160						
54	**8-Methyl-3,4-benzphenanthrene**	65 6, al		107 8, red, al							
55	**2-Ethylphenanthrene**	67 8, me al 64 5		95 5 6 0, yel, al, 92 3			180 7 0 9				
56	**3,4-Benzphenanthrene**	68, al		120 8-8 5, red, al			170 8 1 1				
57	**1,3,7-Trimethylphenanthrene**	68 9 me al		163 4 al	160 1						
58	**4-Isopropyl-1-methylphenanthrene**	68 8 5 me al		113 6 4 or, al							
59	**4,8-Dimethylazulene**	69 70, bl, al		157-8, blk al		179 80 red-br, al					
60	**Biphenyl**	69 2 71	254 5 145^{22}					4 4'-*di* 237 229, 2,2',4,4'-*tetra* 150	225	142 3	n_4^{20} 1 475 D_4^{20} 0 866
61	**2-Methyl-3,4-benzphenanthrene**	70 4-1 0 al		141 8 3 2, red, bz -al		145 bz pet eth	158 8 5, or red, aq al				
62	**3-Methylpyrene**	71 2, al		211-2, br -red, bz							Conc H_2SO_4 sol → yel with grn fluorescence on heating → olive grn with vlt fluorescence
63	**1,4,7-Trimethylphenanthrene**	72 3		141 2, me al	129 30						
64	**1,4-Dimethylanthracene**	74, al		140							
66	**4,9-Dimethyl-1,2-benzanthracene**	75 me al		116, br, me al		124-5, red, me al					
67	**Benzalfluorene** (ω-Phenyldibenzfulvene)	76, al		115 6							Dibromide, 116 d
68	**1,3-Dimethylphenanthrene**	76 7, ac a		153 5, or, al	165 6						
69	**1-Methyl-3,4-benzphenanthrene**	77 8	$210^{0\ 4}$	112-3, red, al			171 8 2 2				
70	**3-Isopropyl-1-methylphenanthrene**	79	$180^{1\ 5}$	150	155						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS
b) Solids. (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Picrate	Styphnate	*sym* Trinitrobenzene derivative	2,4,7-Trinitrofluorenone derivative	Nitro derivative	Phthalic anhydride derivative	2,4-Dinitrophenyl sulfenyl chloride derivative	Miscellaneous
71	**1,2′-Binaphthyl**	79 80, 76		127 0–7 5 (cor), or			145 0 6 9				
72	**2,3-Dimethylphenanthrene**	79 80		146 7, or -red, al	147 8, or , al						
73	**1,2,4,5-Tetramethylbenzene** (Durene)	79 2, 80	196 8					3,6-*di* 205	263		
74	**1-Ethyl-2-methylphenanthrene**	80, me al		134 5, me al		152 5–3 0					
75	**1,5-Dimethylnaphthalene**	80 0 0 5, 85% al		140							
76	**6-Methyl-3,4-benzphenanthrene**	80–1, al	206–8[2]	118 0–8 5, red, me al			144 2–4 5				
77	**Naphthalene**	80 3	218	149		153	153 4	1-*mono* 61, 57	172	173 4	
78	**1,3,6,8-Tetramethylnaphthalene**	81	115–6[2]	151–2		175–6					
79	**1-Ethyl-7-methylphenanthrene** (Homopimanthrene)	81, al		115–6, yel , me al							Quinoxaline deriv , 154, ac a
80	**9-Methylanthracene**	81 5	196–7[12]	137 d , red-br							D_4^{99} 1 065, n_D^{99} 1 6959, Irradiation in acetone → dimer, 228 0–8 5 Photooxide, ca 80, exp
81	**1-Isopropyl-7-methylphenanthrene**	82 3	170[1]	119 20, or	148 9, yel	163 4, yel					
82	**6-Methylazulene**	83, bl-vlt		137, 125		141					
83	**1,3-Dimethylanthracene**	83		136							bl fluorescence
84	**2,2′-Dimethylstilbene** (*sym*-Di-*o*-tolylethylene)	83	176 80[10]	102							
85	**1-Methylanthracene**	85 6, me al	199 200	115 6 6 2, red, me al	176 4 7 0, red, me al		219 0–9 8, red, bz				D_4^{99} 1 0471 n_D^{99} 1 6802, Irradiation → dimer, 246
86	**1,7-Dimethylphenanthrene**	86		132, me al	159, me al						
87	**1,6-Diphenylnaphthalene**	86 7		106–8							
88	**1,6-Dimethylphenanthrene**	87–8, me al		134, yel , al							
89	**1,9-Dimethylphenanthrene**	88, al		163 5, or -yel , me al	181						
90	**9-Methylphenanthrene**	90 1, aq al		152 3, al							
91	**1,2,10-Trimethylanthracene**	90 6 1 4, yel		138 5 9 5, al		169 6–170 2, al					
92	**7-Ethyl-1-methylphenanthrene**	91 0 1 5, 84 5			141–2	135–6					
93	**Triphenylmethane**	92	358					4,4′,4″-*tri* 206			Br_2 → bromo deriv , 152
95	**5-Isopropylnaphthanthracene**	92, ac, a		157							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS

b) Solids. (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point °C	Picrate	Styphnate	*sym* Trinitrobenzene derivative	2,4,7-Trinitrofluorenone derivative	Nitro derivative	Phthalic anhydride derivative	2,4-Dinitrophenylsulfenyl chloride derivative	Miscellaneous
96	**3,9-Dimethyl-1,2-benzanthracene**	93		137–8, red, al		145, red, bz-lgr					
97	**5,6-Benzindane** (2,3-Cyclopentenonaphthalene)	94		120–1							
98	**12-Isopropylnaphthanthracene**	94.5 ac a		157.8							
99	**Acenaphthene**	96.2, yel al	278	162, or-red, al		168, yel, al	175.6	5-*mono* 101	198	187.9 d	n_D^{99} 1.6066, D_4^{99} 1.0242 1,2-Dibromide, 121.3
100	**2,7-Dimethylnaphthalene**	96.7, al	262	136.0–6.5, yel, me al	158.0–9.5, yel, me al						
101	**7-Isopropyl-1-methylfluorene**	96.5–7.0, al						*di* ca 245			
102	**Azulene**	98.5–99	270 d, 115 35[10]	120 d		167					Heat at 270° → Naphthalene, 80.3 2,4,6-Trinitrotoluene deriv, 95.5–100
103	**Retene** (7-Isopropyl-1-methylphenanthrene)	100.5–101, al	390, 158 6.5[0.2]	124–5	141.2	139					D 1.035
104	**Phenanthrene**	101, al, 96.3	340, 332	144 132.8		158, 145	197			250.1	n_D 1.5973 D 1.182
105	**2,7-Dimethylphenanthrene**	101.2, me al		152.3, or, al							
106	**2,3,6-Trimethylnaphthalene**	102, 92.3	286, 146–8[14]	130, yel, me al	165, yel, me al						
107	**2-Phenylnaphthalene**	102–3					169.5 70.5				
108	**1,2,3,4-Tetrahydroanthracene**	103–5					182.4				
109	**2,3-Dimethylnaphthalene** (Guaiene)	104.0 4.5 (subl), al	265–6	123.4							D_4^{20} 1.008
110	**Ethylidenefluorene**	104, ac a		155.6							Dibromide, 93.5
111	**1,7-Dimethylfluorene** (Gibberene)	107.0 7.5		85–6, or-red		98, yel, al					In H_2SO_4 sol → bl
112	**1,1′-Dinaphthylmethane**	110, al	>360, 270[14]	142		141.5	216				
113	**Fluoranthrene**	110		185.6			216				
114	**2,6-Dimethylnaphthalene**	111	261–2	143			156				
115	**2,4-Dimethylphenanthrene**	111, al		138–9, 142, me al							
116	**Fluorene**	113.5, 116–7	293–5	87, 77		105	179	2-*mono* 156, 2,7-*di* 199	228		CrO_3 → Fluorenone, 84
117	**4,10-Dimethyl-1,2-benzanthracene**	114, pa yel, me al		162, blk							
118	**4H-Cyclopenta(def)phenanthrene** (Phenanthrindene)	116, al	353	166							Benzylidene deriv, 108
119	**1,3,8-Trimethylphenanthrene**	116		174–5		188	199				
120	**11-Methylnaphthanthracene**	117–8		159–60, dk red		170, or	238.2 8.6				

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS
b) Solids. (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Picrate	Styphnate	*sym*-Trinitrobenzene derivative	2,4,7-Trinitrofluorenone derivative	Nitro derivative	Phthalic anhydride derivative	2,4-Dinitrophenyl sulfenyl chloride derivative	Miscellaneous
121	**5-Methylchrysene**	117 2 7 8, bz - al		142 6 3 0, or - red, al		172 6 3 6, bz - al					
122	**1,2,5,6-Tetramethylnaphthalene**	118	150 60^{10}	156 7 red	166, bz	180 0 0 5, bz					
123	**Cyclohept(fg)acenaphthene** (Acepleiadene)	118 20 (subl), red, al		150 d							Maleic anh add comp , 248-50, bz
124	**1,2,7-Trimethylphenanthrene**	120 1, al		148 9	169 70						
125	**1',10-Dimethyl-1,2-dibenzanthracene**	122 3, al		147 8, red, al							In H_2SO_4, sol → red
126	**9,10-Dimethyl-1,2-benzanthracene**	122 3		112 3, blk , al *dt* 102 6, red, al							Highly carcinogenic
127	**Benz(bc)aceanthrylene**	122-3, al		141 5 2 0, dk red , al		162 5 3 0 or , al					
128	**1-Methylphenanthrene**	123, aq al		139, yel , al	152 3, yel						
129	**1,6,7-Trimethylphenanthrene**	123 4 al		165 6, or	111 2						
130	**1,1'-Diacenaphthene**	(a) 124, al , (b) 169, pet eth		*dt* 270, red							
131	***trans*-Stilbene**	124, al	305^{720}	94 5		115 20					
132	**3,4-Benzfluorene**	124 5, al		130 1, red, al			191 8				
133	**9-Isopropylnaphthanthracene**	125, al		152							
134	**6-Methylnaphthanthracene**	126 2 7 2, al		149 50, red-br , al			221 4 1 8 163-4, al				
135	**5,8-Dimethyl-1,2-benzanthracene**	131, bz - al		175, red, al							
136	**8-Isopropylnaphthanthracene**	132 3		118							
137	**1,4,5,8-Tetramethylnaphthalene**	132 3		154 6 5 4	143 4 4 2		158-9				
138	**12-Methylnaphthanthracene**	138, yel		115 6, red			234 5 5 0, 209 5 9 7, red, al				
139	**2-Methyl-1',2'-benzpyrene**	138 9, pa yel , me al , after fusing, 140 0 0 2		184 5, br , bz - lgr		211 5- 2 0, red, bz -lgr					
140	**1,5-Dimethylanthracene**	139 40, pa yel		166 7, scar , al							
141	**7-Methylnaphthanthracene**	140		174, dk red			236 1- 6 5				

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS

b) Solids. (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Picrate	Styphnate	*sym*-Trinitrobenzene derivative	2,4,7-Trinitrofluorenone derivative	Nitro derivative	Phthalic anhydride derivative	2,4-Dinitrophenyl sulfenyl chloride derivative	Miscellaneous
142	**3,6-Dimethylphenanthrene**	141, al		172 3, or -yel, me al							
143	**5-Methyl-3,4-benzphenanthrene**	141 4 1 9					130 6 1 4, red				
144	**1,4-Dimethylchrysene**	142		141, red, al							
145	**1,2-Dimethylphenanthrene**	142 3, al		148, or, al	153, yel, al						
146	**8,10-Dimethyl-1,2-benzanthracene**	146, bz -al		166, red, al							
147	**1,2,8-Trimethylphenanthrene**	146 7, al	210 20[15]	164 5, or, al		193 0 3 5 al					
148	**3-Methyl-1′,2′-benzpyrene**	146 7 8 1, yel, al -eth		179 5 80 0, br -red, bz -lgr		210 5 11 0, bz -lgr					
149	**9-Methyl-1′,2′-benzpyrene**	146 8 8 0, yel, hexane				218 5 9 5, red, bz -lgr					
150	**9-Phenylfluorene**	147 8, al						*di* ca 240 *tetra* ca 235 d			Bromide, *di* 181 2, *tri* 167 71
151	**2-Methylnaphthanthracene**	149 50, al		180			218 7 9 2				
152	**Pyrene**	149 50, pa yel	385	222, red, al 220, 227			242 3				
153	**9-Methylnaphthanthracene**	150 5 1 5, al		157 8			225 1 5 4				
154	**4-Methylchrysene**	151 0 1 5, bz-al		two forms 135 0 5 5, red, bz -lgr, 137 5 8 0, or, bz -lgr							
155	***trans-trans*-1,4-Diphenyl-1,3-butadiene** (*trans-trans*-Distyryl)	152 5	350	152 3							Maleic anh add comp, 198-200
156	**Cinnamalfluorene**	155, pa yel, ac a		*di* 178 9							Tetrabromide, ca 160 d
157	**5-Methylnaphthanthracene**	155 9 6 9, bz -pet eth		153			235 4 5 6				
158	**1,2-Benzanthracene**	159-60		133			160				
159	**8-Methylnaphthanthracene**	160 0-0 6		166			243 2 3 6				
160	**1,1′-Binaphthyl**	160 5	240 4[12]	145							
161	**Di-1-naphthastilbene** (*sym* -Di-1-naphthylethylene)	161, pa yel, al		*tri* 210							

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS

b) Solids. (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Picrate	Styphnate	*sym* Trinitrobenzene derivative	2 4 7-Trinitrofluorenone derivative	Nitro derivative	Phthalic anhydride derivative	2 4 Dinitrophenyl sulfenyl chloride derivative	Miscellaneous
162	**6-Methylchrysene**	161 0 1 4, et ac -al		170 0 0 6, or , bz -al		189 8 190 6, yel , bz -al					
163	**3-Methylnaphthanthracene**	163 0 3 9, al		146 0 6 8			239 0 9 6				
164	**2,6-Dimethyl-1,2-benzanthracene**	164, ac a		199 200							
165	**Cyclopentadienophenanthrene**	164 5		146 7		172 3					In H_2SO_4 sol → bl
166	**10,11-Benzfluoranthene**	165, 166,		194 5		220 0 0 5					
167	**Hexamethylbenzene**	165	264	170		174					
168	**3-Methylchrysene**	170 0 0 5, bz - pet-eth		164 0 4 5, grn , al							
169	**Cholanthrene**	170–1, 173 (subl), pa yel , bz -al		167 8, vlt -blk , bz			245 6				
170	**6-Methyl-1′,2′-benzpyrene**	171 0 1 5, yel , bz -lgr		181 5 2 5 br bz -lgr	209 10, red bz lgr						
171	**6,7-Dimethyl-1,2-benzanthracene**	174, et ac		170							
172	**1,2-Benzpyrene**	176 5 7 5, pa yel , bz - me al	310 2^{10}	197 8, vlt -blk							
173	**5,10-Dimethyl-1,2-benzanthracene**	177, bz - al		174, red-blk , bz							
174	**4,5-Benzpyrene**	178–9, bz		229 30, red, bz							
175	**9,10-Dimethylanthracene**	180 1, al		176–7 d							
176	**10-Methylnaphthanthracene**	183 0– 3 6, yel , al		159 0 9 4							2 4,6 Trinitrotoluene deriv , 224 8 5 0
177	**5,6-Dimethyl-1,2-benzanthracene**	187 8, al		191 3, red, al							
178	**2,2′-Binaphthyl**	188, 181	452	184			171				Lt bl fluorescence, $KMnO_4$ → Phthalic acid, 206 8
179	**1,2-Benzfluorene** (Chrysofluorene)	189–90, ac a , 183–4	413, 398 400	*di* 127 5, 124 6		144-5	213 5 5 5				
180	**1,8-Dimethylphenanthrene**	191–2, bz		151 2, yel			193 4				
181	**8-Methyl-1′,2′-benzpyrene**	192–3, yel , bz		205, dk br , bz		233 d , red, bz					
182	**Bifluorenylidene** (Dibiphenyleneethylene)	194 5 (cor), red		177 8				two *di*-forms 171, dk red, 170, or red			Dibromide, 312, red, bz
183	**1,2,7,8-Dibenzanthracene**	196, bz		212, brt red							Bl -grn fluorescence in sol

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IV. ORGANIC DERIVATIVES OF AROMATIC HYDROCARBONS

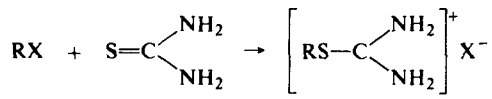
b) Solids. (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Picrate	Styphnate	*sym*-Trinitrobenzene derivative	2,4,7-Trinitrofluorenone derivative	Nitro derivative	Phthalic anhydride derivative	2,4-Dinitrophenyl sulfenyl chloride derivative	Miscellaneous
184	**4-Methylnaphthanthracene**	197 4-8 0, al		139 40, lt red			228 2-8 8				
185	**1,2,3,4-Dibenzanthracene**	200 2, pa yel, ac a		207, red							In conc H_2SO_4 sol → pa vlt -red
186	**Di-2-fluorenylmethane**	201 2, al				-		*di* 256 7			$Na_2Cr_2O_7$ → Di-2-fluorenyl ketone, 297-8, yel, ac a
187	**2,3-Benzfluorene**	208 9					221 2-2 0				
188	**5-Methyl-1′,2′-benzpyrene**	215 7-6 2, yel, eth -al		207 8, vlt -blk, bz -lgr		230 1, red, bz -lgr					
189	**Anthracene**	216 2	340 (cor), 226 5[53]	138		164	194				D_4^{27} 1 25, Dibromide, 122, CrO_3 → Anthraquinone, 273
190	**11,12-Benzfluoranthene**	217	480	170 1		182	236 7				
191	**4-Methyl-1′,2′-benzpyrene**	217 5 8 0, yel		203 4, vlt -br, bz							
192	**2,8-Dimethylchrysene**	218, bz		171 2, bz	204, or, bz	195, yel, bz					
193	**2-Methylchrysene**	224 5 5 5, bz -al		143 6, yel, al							
194	**6,12-Dimethylchrysene**	237			207 d, bz	222					
195	**1,2-Benzphenanthrene** (Chrysene)	254, bz	448	273		186	248 9		214		Dibromide, 275
196	**Di-2-naphthastilbene** (*sym*-Di-2-naphthylethylene)	254 5, bz		215							
197	**1-Methylchrysene**	254 5 (cor), (vacuum), bz				174-6, yel, bz					
198	**2,3,6,7-Dibenzphenanthrene**	257, grn -yel		184, or -red							Bl fluorescence in sol, intense yel -grn in u v
199	**2,3,5,6-Dibenzphenanthrene**	261, grn -yel, ac a		*di* 213, or -red							Bl fluorescence in bz sol, grn fluorescence in u v
200	**1,2,5,6-Dibenzanthracene**	262, met, ac a		*di* 214, or							
201	**Perylene**	273 4					270-1				
202	**Picene** (1,2,7,8-Dibenzphenanthrene)	365 6, xyl	518 20				257 8				Dibromide, 295, 2,7-Dianthraquinone add comp, 299-300
203	**1,2,3,4,5,6,7,8-Tetrabenzanthracene**	428 9					318-9, red				
204	**Coronene** (Hexabenzobenzene)	438-40 (cor), yel, bz	525	>250 d, red, bz		>280 d, or, bz					

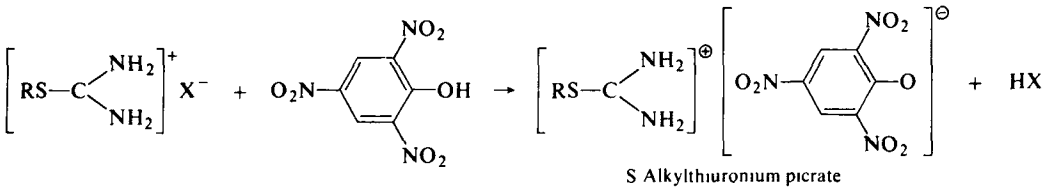
*Derivative data given in order m p, crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLE V

*S-Alkylthiuronium picrate (S-Alkylisothiourea picrate)**



S-Alkylthiuronium salt



S Alkylthiuronium picrate

From the alkyl halide with thiourea in 95% ethanol, followed by addition of picric acid in ethanol

For directions and examples see Linstead, pp 82 3, Shriner, p 245, Vogel, pp 291 2, Wild, p 43, E L Brown and N Campbell, *J Chem Soc*, 1699 (1937), W J Levy and N Campbell, *J Chem Soc*, 1442 (1939)

From the alkyl halide with thiourea in ethylene glycol, followed by addition of picric acid in ethanol

See Cheronis, p 550, H M Crosby and J B Entrikin, *J Chem Ed*, **41**, 360 (1964)

1-Naphthylamide (α-Naphthalide) *

$$RX + Mg \rightarrow RMgX$$

$$RMgX + 1\text{-}C_{10}H_7N{=}C{=}O \rightarrow 1\text{-}C_{10}H_7N{=}\overset{\overset{R}{|}}{C}OMgX \xrightarrow{H_2O} \underset{\text{1-Naphthylamide}}{1\text{-}C_{10}H_7NHCOR} + Mg(OH)X$$

From the Grignard reagent (prepared from the alkyl halide and magnesium in dry ether) with 1-naphthylisocyanate in ether

For directions and examples see Cheronis, pp 551, 553 Linstead, p 83 Shriner, p 244, Vogel, pp 290-1, Wild, pp 35 37 H Gilman and M Furry, *J Amer Chem Soc*, **50**, 1214 (1928), H W Underwood and J C Gale, *J Amer Chem Soc*, **56**, 2117 (1934)

Anilide *

$$RX + Mg \rightarrow RMgX$$

$$RMgX + C_6H_5N{=}C{=}O \rightarrow C_6H_5N{=}\overset{\overset{R}{|}}{C}OMgX \xrightarrow{H_2O} \underset{\text{Anilide}}{C_6H_5NHCOR} + Mg(OH)X$$

From the Grignard reagent (prepared from the alkyl halide and magnesium in dry ether) with phenylisocyanate in ether

For directions and examples see Cheronis, pp 551, 554, Linstead, p 83, Shriner, p 244, Vogel, pp 290 1, Wild, pp 35-7, A M Schwartz and J R Johnson, *J Amer Chem Soc*, **53**, 1063 (1931), H W Underwood and J C Gale, *J Amer Chem Soc*, **56**, 2117 (1934)

Alkylmercuric halide *

$$RX + Mg \rightarrow RMgX$$

$$RMgX + HgX_2 \rightarrow \underset{\substack{\text{Alkyl}\\\text{mercuric}\\\text{halide}}}{RHgX} + MgX_2$$

From the Grignard reagent (prepared from the alkyl halide and magnesium in dry ether) with the mercuric salt of the same halogen in ether

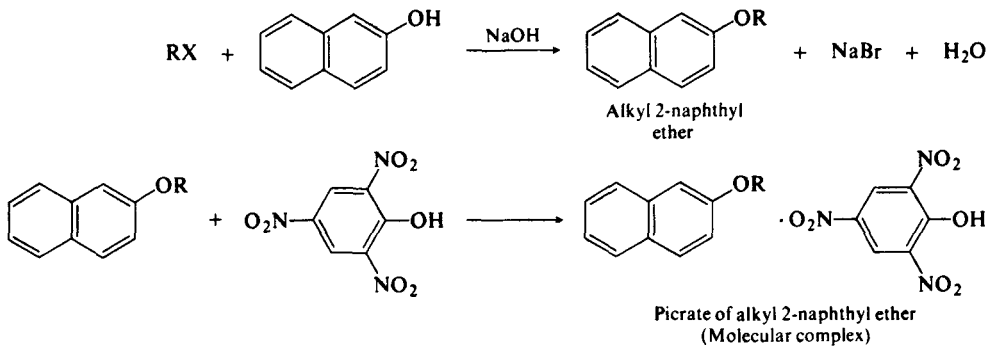
For directions and examples see Cheronis, pp 551, 554, Shriner, p 244, Vogel, p 291, Wild, p 38, C S Marvel, C Gauerke and E L Hill, *J Amer Chem Soc*, **47**, 3009 (1925), E L Hill, *J Amer Chem Soc*, **50**, 167 (1928), K H Slotta and K R Jacobi, *J prakt Chem*, **120**, 249 (1929)

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

EXPLANATIONS AND REFERENCES TO TABLE V (Continued)

*Picrate of alkyl 2-naphthyl ether (Molecular complex).**



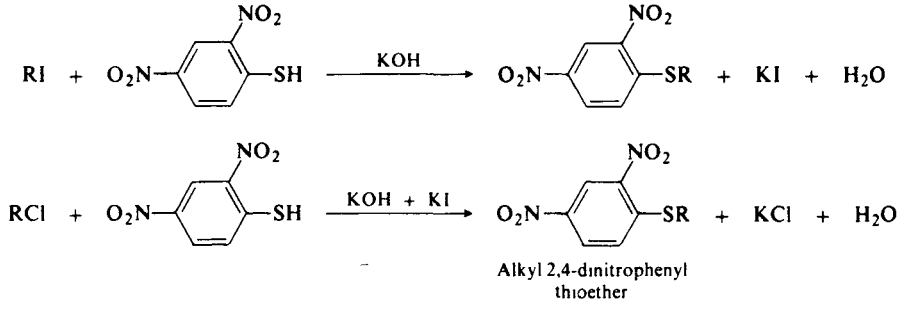
The alkyl 2-naphthyl ether is obtained from the alkyl halide with 2-naphthol in ethanolic sodium or potassium hydroxide.

For directions and examples see: Cheronis, p. 551; Linstead, p. 83; Shriner, p. 244; Vogel, p. 292; Wild, p. 44.

The picrate is obtained from the alkyl 2-naphthyl ether and picric acid in chloroform or ethanol.

See: Cheronis, p. 551; Linstead, p. 83; Vogel, p. 292; Wild, p. 44; O. L. Baril and G. A. Megrdichian, *J. Amer. Chem. Soc.*, **58**, 1415 (1936); V. H. Dermer and O. C. Dermer, *J. Org. Chem.*, **3**, 289 (1938).

Alkyl 2,4-dinitrophenyl thioether (Alkyl 2,4-dinitrophenyl sulfide).



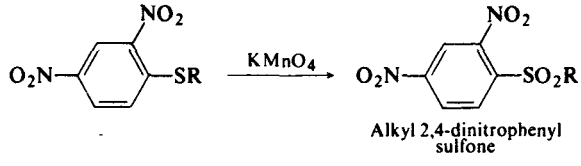
From the alkyl bromide or iodide with 2,4-dinitrothiophenol in butyl carbitol (2-(2-butoxyethoxy)ethanol) and aqueous potassium hydroxide.

For directions and examples see: Cheronis, p. 557; R. W. Bost, P. K. Starnes and E. L. Wood, *J. Amer. Chem. Soc.*, **73**, 1968 (1951).

From the alkyl chloride with 2,4-dinitrothiophenol in butyl carbitol (2-(2-butoxyethoxy)ethanol) with potassium iodide and aqueous potassium hydroxide.

See: Cheronis, p. 557; R. W. Bost, P. K. Starnes and E. L. Wood, *J. Amer. Chem. Soc.*, **73**, 1968 (1951).

Alkyl 2,4-dinitrophenyl sulfone.



From the alkyl 2,4-dinitrophenyl thioether (prepared from the alkyl halide as above) in glacial acetic acid, with aqueous potassium permanganate.

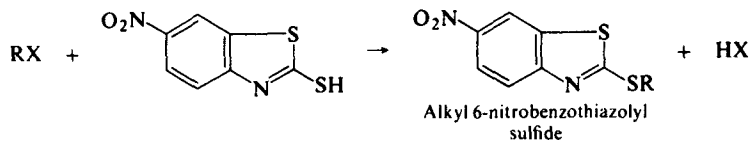
For directions and examples see: R. W. Bost, J. O. Turner and R. D. Norton, *J. Amer. Chem. Soc.*, **54**, 1985 (1932).

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

EXPLANATIONS AND REFERENCES TO TABLE V (Continued)

6-Nitro-2-mercaptobenzothiazole derivative.

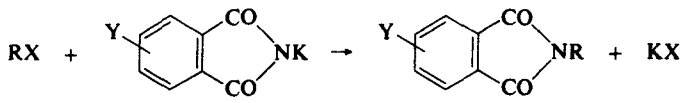


Alkyl 6-nitrobenzothiazolyl sulfide

From the alkyl halide (especially a dihalide) and 6-nitro-2-mercaptobenzothiazole in butyl carbitol (2-(2-butoxyethoxy)ethanol) and aqueous sodium hydroxide.

For directions and examples see: Cheronis, p. 557; H. B. Cutter and H. R. Golden, *J. Amer. Chem. Soc.*, **69**, 831 (1947); H. B. Cutter and A. Kreuchunas, *Anal. Chem.*, **25**, 198 (1953).

Substituted N-alkylphthalimides.



Substituted potassium phthalimide

Substituted N-alkylphthalimide

From the alkyl halide with the potassium salt of the substituted phthalimide.

For directions and examples see: Wild, p. 41.

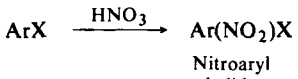
From the alkyl halide with the potassium salt of the substituted phthalimide or with the substituted phthalimide and potassium carbonate in dimethylformamide.

See: J. H. Billman and R. V. Cash, *J. Amer. Chem. Soc.*, **75**, 2499 (1953).

From the alkyl halide with the substituted phthalimide and potassium hydroxide in methanol-dioxane mixture.

See: C. H. Allen and R. V. V. Nicholls, *J. Amer. Chem. Soc.*, **56**, 1409 (1934).

*Nitro derivative.**



Nitroaryl halide

From the aromatic halide with fuming and concentrated nitric acids.

For directions and examples see: Wild, p. 450.

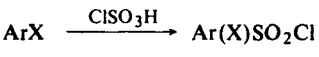
From the aromatic halide with 100% nitric acid.

See: Cheronis, pp. 559–561, 563.

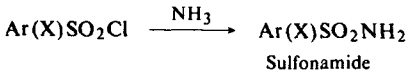
From the aromatic halide with nitric and sulfuric acids.

See: Cheronis, pp. 560, 563; Vogel, p. 543.

*Sulfonamide.**



Sulfonyl chloride



Sulfonamide

The sulfonyl chloride is prepared from the aromatic halide and chlorosulfonic acid in chloroform or without solvent. The sulfonamide is obtained from the sulfonyl chloride with concentrated ammonia or dry ammonium carbonate.

For directions and examples see: Cheronis, pp. 564, 638, 639; E. H. Huntress and F. H. Carten, *J. Amer. Chem. Soc.*, **62**, 511 (1940).

NOTE: For additional information regarding directions and examples for the derivatization of aromatic halides (through the above reactions or additional ones, e.g., side-chain oxidation) see explanations and references to Table IV, pp. 32, 33, 34.

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

TABLE V. ORGANIC DERIVATIVES OF HALIDES

A) Alkyl and cycloalkyl halides 1. Chlorides

a) Liquids (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	n_D^{20}	D_4^{20}	S-Alkyl thiuronium picrate	1 Naphthyl amide	Anilide	Alkyl mercuric halide	Picrate of 2-naphthyl ether	2,4-Dinitrophenyl thioether	2,4-Dinitrophenyl sulfone	Miscellaneous
1	**Methyl chloride**	−24			224	160	114	167		128	185, 189	Methyl-2-naphthyl ether, 70
2	**Vinyl chloride**	−14			104							Polymerizes to solid on irradiation
3	**Ethyl chloride**	13		$0\ 917_0^0$	188	126	104	192	104	115	156, 160	
4	**Isopropyl chloride**	36 5	1 378	0 859	196,148		103		95			
5	**1-Chloropropene**	37					114					
6	**Allyl chloride**	44 5	1 416	0 940	155		114		99			3-Nitrophthalimide deriv , 100-1
7	***n*-Propyl chloride**	46 5	1 388	0 889	181, 176	121	92	147	81	84	126	
8	***tert*-Butyl chloride**	51	1 386	0 846	160-1	147	128	122-3				
9	**Chloroprene**	59	1 458	0 9583								Heating with maleic anh *and boiling the adduct in* water → 4-chloro-1,2,3,6-tetrahydrophthalic acid, 173-5
10	***sec*-Butyl chloride**	68	1 397	0 874	190, 166	129	108	30 5	86	66	120	
11	**Isobutyl chloride**	69	1 398	0 881	174	125	109		85	76	105	
12	**Methallyl chloride** (3-Chloro-2-methyl-1-propene)	72	1 4340	0 9475								Phthalimide deriv , 89-90
13	***n*-Butyl chloride**	78	1 402	0 886	180, 177	112	63	128	67	66	92	
14	**Neopentyl chloride**	85		0 879			130-1	117-8				
15	***tert*-Amyl chloride**	86	1 405	0 865		138	92					
16	**3-Chloro-1-pentene**	93-4	1 4254	0 8978								Phthalimide deriv , 78 9
17	**DL-3-Chloro-2-methyl-1-butene**	94	1 4304	0 9088								Br_2 → dibromo deriv , 197-8
18	**Trimethylvinyl chloride** (3-Chloro-2-methyl-2-butene)	94	1 4320	0 925 (0 905)								Br_2 in ether → dibromo deriv , 197
19	**DL-2-Chloropentane**	97	1 4079	0 8695		102 3	94 6					
20	**3-Pentyl chloride** (3-Chloropentane)	97	1 4082	0 8723		117-8	127, 122					
21	**Isoamyl chloride**	100	1 409	0 872	179, 173	111	108	86	94	80	124	
22	***n*-Amyl chloride** (*n*-Pentyl chloride)	106	1 412	0 882	154	112	96	110	67	80	83	
23	**1-Chloro-2-pentene**	109-10	$1\ 435^{21}$	$0\ 908_4^{21\ 5}$								Phthalimide deriv , 69-70
24	**2-Chloro-2-methylpentane**	110 3	1 4126	0 863		116-8	71-4					
25	**3-Chloro-2,2-dimethylbutane** (Pinacolyl chloride)	112	1 4181	0 8767				89-90				
26	**Cyclopentyl chloride**	114-5	1 4510	1 005				108				
27	**4-Chloro-2,2-dimethylbutane**	115	1 4160	0 8670			138-9	133				
28	**3-Chloro-3-methylpentane**	115-7	1 421	0 89			87-8					
29	**2-Chloro-2,3-dimethylbutane**	117-9		$0\ 8769^{22}$								Carbonation of Grignard and conversion of acid to amide, 125-7, Br_2 → 2,3-dibromo deriv , 166-8 (173-4)
30	**3-Hexyl chloride** (3-Chlorohexane)	123	1 4163	$0\ 870_{20}^{20}$								Grignard reagent + O_2 → 3-hexanol $\xrightarrow{CrO_3/H_2SO_4}$ 3-hexanone, 2,4-Dinitrophenylhydrazone, 147 8 Semicarbazone, 110 11

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

A) Alkyl and cycloalkyl halides 1. Chlorides

a) Liquids (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	n_D^{20}	D_4^{20}	S Alkyl thiuronium picrate	1 Naphthyl amide	Anilide	Alkyl mercuric halide	Picrate of 2 naphthyl ether	2 4 Dinitrophenyl thio ether	2 4 Dinitro phenyl sulfone	Miscellaneous
31	**2-Hexyl chloride** (2-Chlorohexane)	123 4	1 4142[21]	0 8694$_4^{21}$			91-2					
32	**1-Chloro-2-ethylbutane**	125-7	1 4230	0 8914			81 2 83-4					
33	**3-Chloro-2,2,3-trimethylbutane**	133										Carbonation of Grignard → acid, 80
34	***n*-Hexyl chloride**	133	1 420	0 878	157	106	69	125		74	97	
35	**Cyclohexyl chloride**	143	1 462	0 989		188	146					6-Nitro-2-mercaptobenzothiazole deriv 100-1 2 sulfone, 189
36	**5-Chloro-2,3-dimethylpentane**	152	1 4299	0 8825			80 1					
37	***n*-Heptyl chloride**	159	1 426	0 877	142	95	57	120		82	101	
38	**Benzyl chloride**	179	1 539	1 100	188	166	117	104	123	130	178, 182	Quaternary salt with dimethyl aniline, 110
39	***n*-Octyl chloride**	180, 184	1 431	0 875	134	91	57	115		78	98	
40	**β-Phenylethyl chloride**	190					97		84			
41	**4-Methylbenzyl chloride**	192	1 5380	1 0512								Phthalimide, 120 117 Carbonation of Grignard → 4-tolylacetic acid, 92
42	**α-Phenylethyl chloride**	195					133					
43	**3-Methylbenzyl chloride**	195-6	1 5327[25]	1 064$_{20}^{20}$								Phthalimide deriv , 117-8, Carbonation of Grignard → 3-tolylacetic acid, 61
44	**2-Methylbenzyl chloride**	197 9										Phthalimide deriv , 148-9, Heating with pyridine → alkyl pyridinium chloride 183
45	**β-Chlorostyrene**	197-9	1 571[25]	1 109								Br_2 in chl → dibromo deriv , 32, Oxid → benzoic acid, 122
46	***n*-Nonyl chloride**	202	1 434	0 870	131					86	92	
47	**2-Chlorobenzyl chloride**	213-4										5-Nitro deriv 66 Carbonation of Grignard → 2-chlorophenylacetic acid, 94-5
48	**4-Chlorobenzyl chloride**	214, 222					166					Oxid → 4-chlorobenzoic acid, 242
49	**3-Chlorobenzyl chloride**	216		1 2695$_4^{15}$								Oxid → 3-chlorobenzoic acid, 158, 155, Heating with 2,4-dichlorophenol in toluene → 2-(3-chlorobenzyl)-4,6-dichlorophenol, 59-60
50	***n*-Decyl chloride**	223	1 437	0 868	137							
51	**4-Isopropylbenzyl chloride**	226-9										Carbonation of Grignard → acid, 52
52	***n*-Undecyl chloride** (*n*-Hendecyl chloride)	241	1 440	0 868	139							
53	***n*-Dodecyl chloride** (Lauryl chloride)	243-4	1 4425	0 8673				114				Refluxed with pyridine → alkyl pyridinium chloride, 92
54	**Cetyl chloride** (Hexadecyl chloride)	286 d			155			102				3-Nitrophthalimide deriv , 101, Alkyl saccharin deriv , 98

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

A) Alkyl and cycloalkyl halides 1. Chlorides

b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point, °C	S-Alkyl thiuronium picrate	1-Naphthyl amide	Anilide	Alkyl mercuric halide	Picrate of 2-naphthyl-ether	2,4-Dinitrophenyl thioether	2,4-Dinitrophenyl sulfone	Miscellaneous
1	**1,3-Bis(chloromethyl)benzene** (*m*-Xylylene dichloride)	32–4	250–5								Diphthalimide deriv , 237
2	**4-Bromobenzyl chloride**	36–8, 50	236	219							Oxid → 4-bromobenzoic acid, 251
3	**2,4,6-Trimethylbenzyl chloride**	37	130[22]								Hydrolysis → 2,4,6-trimethylbenzyl alcohol, 88–9, Phthalimide deriv , 209–10
4	**2,6-Dichlorobenzyl chloride**	39–40									Carbonation of Grignard → 2,6-dichlorophenylacetic acid, 157 8
5	**1-Chloro-2,2,3,3-tetramethylbutane**	52–3					170–1				Grignard treated with O_2 at −5 → carbinol, 149–50
6	**1,2-Bis(chloromethyl)benzene** (*o*-Xylylene dichloride)	54–5	239–41								Oxid → phthalic acid, 200–6
7	**4-Nitrobenzyl chloride**	71									Oxid → 4-nitrobenzoic acid, 241
8	**1,4-Bis(chloromethyl)benzene** (*p*-Xylylene dichloride)	98–100	240–5								Heating with benzyl alcohol + KOH → dibenzyl ether, 67, Boiling with $Pb(NO_3)_2$ → terephthaldehyde, 115
9	**Triphenylmethyl chloride** (Trityl chloride)	113									Boiling with H_2O → triphenyl carbinol, 162

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

A) Alkyl and cycloalkyl halides 2. Bromides

a) Liquids (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	n_D^{20}	D_4^{20}	S-Alkyl thiuronium picrate	1 Naphthyl amide	Anilide	Alkyl mercuric halide	Picrate of 2-naphthyl ether	2,4-Dinitrophenyl thioether	2,4-Dinitrophenyl sulfone	Miscellaneous
1	**Methyl bromide**	3 5			224	160	114	172 160		128	185 189	
2	**Vinyl bromide**	16					104					
3	**Ethyl bromide**	38	1 425	1 460	188	126	104	193 198	104	115	156, 160	
4	**1-Bromopropene**	60	1 452	1 4133			114					
5	**Isopropyl bromide**	60	1 425	1 314	196,148		103	93	92	95	140	
6	**Allyl bromide**	71	1 46545	1 398	155		114		99	71		
7	***n*-Propyl bromide**	71	1 4341	1 353	181, 177	121	92	138	75	84	126	
8	***tert*-Butyl bromide**	72 3		1 211		147	128					
9	**Isobutyl bromide**	91	1 435	1 253	174 167	125	109	55	84	76	105	
10	***sec*-Butyl bromide**	91	1 437	1 256	190, 166	129	108	39	85	66	120	
11	***n*-Butyl bromide**	101	1 440	1 274	180, 177	112	63	136, 129	67	66	92	
12	***tert*-Amyl bromide**	108	1 442	$1\ 198\frac{18}{4}$		138	92					
13	**Neopentyl bromide**	109		1 225			126					
14	**DL-2-Pentyl bromide**	117, 113	1 442	1 212		102 3	93					
15	**3-Pentyl bromide**	118	1 443	1 211			124					
16	**Isoamyl bromide**	120-1	1 442	1 213	179, 173	111	108	80	94	80	124	
17	***n*-Amyl bromide** (*n*-Pentyl bromide)	129	1 445	1 219	154	112	96	127, 122	67	80	83	
18	**Cyclopentyl bromide**	137	1 489	1 387								
19	**2-Hexyl bromide** (2-Bromohexane)	146	$1\ 4832^{25}$	1 1658			91-2					
20	***n*-Hexyl bromide**	155 157	1 448	1 175	157	106	69	127 119		74	97	
21	**Cyclohexyl bromide**	165	1 495	1 336		188	146	153				
22	***n*-Heptyl bromide**	180 174	1 451	1 140	142	95	57	118		82	101	
23	**Benzyl bromide**	198		1 438	188	166	117	119	123	130	178, 182	
24	***n*-Octyl bromide**	201, 204	1 453	1 112	134	91	57	109		78	98	
25	**α-Phenylethyl bromide**	205					133					
26	**β-Phenylethyl bromide**	218	1 556	1 359			97	169	84			
27	***n*-Nonyl bromide**	220	1 454	1 090	131			109		86	92	
28	**β-Bromostyrene**	221				217	115	91				
29	***n*-Dodecyl bromide** (Lauryl bromide)	130^{6}	1 458	1 038				108				
30	***n*-Tetradecyl bromide**	179^{20}	1 460	1 017						94	104	m p 5

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

A) Alkyl and cycloalkyl halides 2. Bromides

b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point, °C	S-Alkyl thiuronium picrate	1-Naphthyl amide	Anilide	Alkyl mercuric halide	Picrate of 2-naphthyl ether	2,4-Dinitrophenyl thioether	2,4-Dinitrophenyl sulfone	Miscellaneous
1	***n*-Hexadecyl bromide** (Cetyl bromide)	14	201[9]	155, 137			101 2		95	105	n_D^{20} 1 462, D_4^{20} 1 001
2	**2-Bromobenzyl bromide**	31		222							CrO_3 → 2-bromobenzoic acid, 150
3	**3-Bromobenzyl bromide**	41		205							CrO_3 → 3-bromobenzoic acid, 155
4	**2-Nitrobenzyl bromide**	46–7									Oxid → 2-nitrobenzoic acid, 146–8
5	**4-Chlorobenzyl bromide**	51		194							CrO_3 → 4-chlorobenzoic acid, 242
6	**3-Nitrobenzyl bromide**	58–9									Oxid → 3-nitrobenzoic acid, 141
7	**4-Bromobenzyl bromide**	62		219							CrO_3 → 4-bromobenzoic acid, 251
8	**4-Nitrobenzyl bromide**	99									Oxid → 4-nitrobenzoic acid, 240

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

A) Alkyl and cycloalkyl halides 3. Iodides

a) Liquids (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	n_D^{20}	D_4^{20}	S-Alkyl thiuronium picrate	1-Naphthyl amide	Anilide	Alkyl mercuric halide	Picrate of 2-naphthyl ether	2,4-Dinitrophenyl thioether	2,4-Dinitrophenyl sulfone	Miscellaneous
1	**Methyl iodide**	43	1 532	2 282	224	160	114	152, 145	117	128	185, 189	
2	**Vinyl iodide**	56					104					
3	**Ethyl iodide**	72	1 514	1 940	188	126	104	186, 182	104	115	156, 160	
4	**Isopropyl iodide**	90	1 499	1 703	196, 148		103		92	95	140	
5	***n*-Propyl iodide**	102–3	1 505	1 743	181, 176	121	92	113	75	84	126	
6	**Allyl iodide**	103	1 578	1 777	155	121	114	112	99			
7	***tert*-Butyl iodide**	103, 98			188	147	128					
8	***sec*-Butyl iodide**	120	1 499	1 592	190, 166	129	108		85	66	120	
9	**Isobutyl iodide**	120	1 496	1 602	174, 167	125	109	72	84	76	105	
10	***tert*-Amyl iodide**	128		1 479		138	92					
11	***n*-Butyl iodide**	130	1 499	1 616	180, 177	112, 110	63	117	67	66	92	
12	**2-Pentyl iodide**	142	1 496	1 510			93					
13	**3-Pentyl iodide**	142	1 497	1 511			124					
14	**Isoamyl iodide**	148	1 493	1 503	179, 173	111	108	122	94	80	124	
15	***n*-Amyl iodide** (*n*-Pentyl iodide)	155	1 496	1 512	154	112	96	110	67	80	83	
16	**Cyclopentyl iodide**	166–7	1 5447	1 7096								
17	**Cyclohexyl iodide**	179, sl d		$1\ 626_{15}^{15}$		188	146					
18	***n*-Hexyl iodide**	179	1 493	1 437	157	106	69	110		74	97	
19	***n*-Heptyl iodide**	204	1 490	1 373	142	95	57	103		82	101	
20	***n*-Nonyl iodide**	220			131					86	92	
21	***n*-Octyl iodide**	225–6	1 489	1 330	134					78	98	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

A) Alkyl and cycloalkyl halides 3. Iodides

b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point, °C	S-Alkyl thiuronium picrate	1-Naphthyl amide	Anilide	Alkyl mercuric halide	Picrate of 2-naphthyl ether	2,4-Dinitrophenyl thioether	2,4-Dinitrophenyl sulfone	Miscellaneous
1	***n*-Hexadecyl iodide** (Cetyl iodide)	22		155, 137			82		95	105	
2	**Benzyl iodide**	24		188	166	117		123	130	178, 182	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

B) Dihalides and polyhalides (non-aromatic)

1. Fluorides (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point °C	n_D^{20}	D_4^{20}	Miscellaneous
1	**Perfluorocyclopentane**	22		$1\ 648_4^{25}$	m p 10
2	**1,3-Difluoropropane**	41 2	$1\ 3190^{26}$	$1\ 0057_4^{25}$	
3	**Perfluorocyclohexane**	50			m p 49
4	**Perfluoro-*n*-hexane**	57	$1\ 2515^{22}$	$1\ 6995_4^{25}$	
5	**Perfluoro-2-methylpentane**	58	$1\ 2564^{22}$	1 7326	
6	**Perfluoro-*n*-heptane**	84	1 2770	$1\ 801_4^{25}$	
7	**Perfluoro-*n*-nonane**	127	$1\ 2865^{25}$	$1\ 860_4^{25}$	
8	**Perfluoro-*n*-decane**	150	$1\ 2890^{25}$	$1\ 873_4^{25}$	m p 36
9	**Perfluoro-*n*-undecane** (Perfluoro-*n*-hendecane)	161	$1\ 2960^{25}$	$1\ 919_4^{25}$	m p 57

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

B) Dihalides and polyhalides (non-aromatic)

2. Chlorides a) Liquids (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	n_D^{20}	D_4^{20}	Miscellaneous
1	**Dichloromethane** (Methylene chloride)	41	1 4237	1 336	6-Nitro-2-mercaptobenzothiazole deriv , 232-3, Di-(2-naphthyl) ether, 133 S-Alkyl *bis*-(thiuronium picrate), 267
2	***trans*-1,2-Dichloroethylene**	48	1 452	1 2569	Br_2 → dibromo deriv , 190 5
3	**1,1-Dichloroethane**	57	1 4164	1 175	1,1-Di-(1-naphthyl)ether, 117
4	***cis*-1,2-Dichloroethylene**	60	$1\ 4428^{25}$	1 282	Br_2 → dibromo deriv , 190-5
5	**Chloroform**	61	1 446	1 489	Gives carbylamine test with primary amines
6	**2,2-Dichloropropane**	70	1 4117	1 093	
7	**1,1,1-Trichloroethane**	74	1 4380	1 349	
8	**Carbon tetrachloride**	77	1 4630	1 595	
9	**Ethylene dichloride** (1,2-Dichloroethane)	84	1 4443	1 256	1 2-Di-(2-naphthyl)ether 217
10	**1,1,2-Trichloroethylene**	87	1 4773	1 464	HgO + NaOEt + KCN in al shaken 1 hr at 40 60 → mercury *bis*-(trichloroethylenide), $Hg(—CCl=CCl_2)_2$, 83, eth
11	**1,2-Dichloropropane**	96	1 4388	1 155	1,2-Di-(2-naphthyl)ether, 152, 1,2-Diphenyl ether, 32
12	**1-Bromo-2-chloroethane**	106-7			6-Nitro-2-mercaptobenzothiazole deriv , 202 3 Di-(2-naphthyl)ether, 217
13	**1,1,2-Trichloroethane**	114	1 4707	1 443	
14	**1,1,2,2-Tetrachloroethylene** (Perchloroethylene)	121	1 5055	1 623	With paraformaldehyde + conc H_2SO_4 → α,α-di-chloro-β-hydroxypropionic acid 88 9
15	**1,2-Dichlorobutane**	123-4	1 440		6-Nitro-2-mercaptobenzothiazole deriv , 164-5
16	**1,3-Dichloropropane**	125	1 449	$1\ 189_4^{18}$ $1\ 177_4^{25}$	1,3-Di-(1 naphthyl)ether, 103-4 1 3-Di-(2-naphthyl) ether 148 9 1,3-Diphenyl ether 60
17	**1,3-Dichloro-2-methylpropane**	135 6	$1\ 4627^{19}$	$1\ 131_{20}^{20}$	
18	**1-Bromo-3-chloropropane**	143 4	1 4861	1 594	1,3-Di-(1-naphthyl) ether, 103-4 1,3-Di-(2-naphthyl) ether, 148-9 1,3-Diphenyl ether, 60
19	**1,1,2,2-Tetrachloroethane**	146	1 4942	1 600	
20	**1,2,3-Trichloropropane**	158	1 4585	1 417	
21	**Pentachloroethane**	161	1 504	1 681	
22	**Benzalchloride**	207, 214	1 5515	$1\ 295^{16}$	Oxid → benzoic acid, 122, Hydrolysis → benzaldehyde, 2,4-Dinitrophenylhydrazone 237, Semicarbazone, 222
23	**Benzotrichloride**	221		$1\ 374_{15}^{17}$	Hydrolysis → benzoic acid, 122
24	**2-Chlorobenzalchloride** (2-Chlorobenzylidene chloride)	228-9	$1\ 5670^{16}$	$1\ 399_{15}^{15}$	Oxid → 2-chlorobenzoic acid, 141 Hydrolysis → 2-chlorobenzaldehyde, 2,4-dinitrophenylhydrazone, 213 209
25	**3-Chlorobenzalchoride** (3-Chlorobenzylidene chloride)	237-40			Oxid → 3-chlorobenzoic acid, 158 Hydrolysis → 3-chlorobenzaldehyde, 2,4-dinitrophenylhydrazone, 256 248
26	**4-Chlorobenzalchloride** (4-Chlorobenzylidene chloride)	237			Oxid → 4-chlorobenzoic acid, 240, Hydrolysis → 4-chlorobenzaldehyde, 47 2,4-dinitrophenylhydrazone, , 265

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES
B) Dihalides and polyhalides (non-aromatic) 2. Chlorides
b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point °C	Boiling point, °C	Miscellaneous
1	**3,4-Dichlorobenzotrichloride**	26		Hydrolysis → 3,4-Dichlorobenzoic acid, 202
2	**DDT** (2,2-Bis-(4-chlorophenyl)-1,1,1-trichloroethane)	108	260	Heating with Cl_2 + trace PCl_3 in CCl_4 → 1,1,1,2-tetrachloro deriv, 91-2, Nitration → nitro deriv, 148, $AlCl_3$ + benzene → 1,1,2,2-tetraphenylethane, 211
3	**γ-Benzene hexachloride** (Gammexane, 666)	112		
4	**α-Benzene hexachloride**	157	288	Heat above m p → HCl + 1,2,4-trichlorobenzene, 17, b p 213, mononitro deriv, 56, dinitro, 103
5	**Hexachloroethane**	187 subl	185	
6	**β-Benzene hexachloride**	310		Unreactive to boiling pyridine, Unattacked by boiling HNO_3 or H_2SO_4

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

B) Dihalides and polyhalides (non-aromatic)

3. Bromides a) Liquids (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	n_D^{20}	D_4^{20}	Miscellaneous
1	**Dibromomethane** (Methylene bromide)	98-9	1 538	2 496	6-Nitro-2-mercaptobenzothiazole deriv , 232 3, S-Alkyl *bis*-(thiuronium picrate), 267
2	**1,1-Dibromoethane**	112	1 5128	2 055	6-Nitro-2-mercaptobenzothiazole deriv , 145 6 1,1-Di-(1 naphthyl) ether, 117
3	**1,2-Dibromoethane**	132	1 5379	2 179	m p 10, 6-Nitro-2-mercaptobenzothiazole deriv 201 2 1,2-Di-(2-naphthyl) ether 217
4	**DL-1,2-Dibromopropane**	141-2	1 5203	1 933	6-Nitro-2-mercaptobenzothiazole, 194 5, 1 2-Di-(2-naphthyl) ether, 152, 1,2-Diphenyl ether, 32
5	**1,2-Dibromo-2-methylpropane**	149	1 512	1 783	
6	**1,2-Dibromo-1-butene**	150		1 887	
7	**Bromoform**	150-1	1 598	2 890°	m p 8
8	**1,3-Dibromopropene**	156	$1\ 538^{25}$	2 097°	
9	**1,1-Dibromo-2-methylpropene**	156 7	1 530	$1\ 866_{20}^{0}$	
10	**2,3-Dibromobutane**	157	1 515	1 792	
11	**1,2-Dibromobutane**	166		1 820	6-Nitro-2-mercaptobenzothiazole deriv , 164 5
12	**1,3-Dibromopropane**	167 8	1 523	1 982	1,3-Di-(1-naphthyl) ether, 103-4 1 3 Di-(2-naphthyl) ether 148 9 1,3-Diphenyl ether, 60
13	**1,3-Dibromo-2-butene**	168-9	1 548	1 877	
14	**1,3-Dibromobutane**	174	1 507	1 820°	
15	**1,1,2-*Tribromoethane***	189	1 5933	2 6211	
16	**1,4-Dibromobutane**	197-8		1 847°	*p*-toluidine (3 moles) $\xrightarrow{\text{heat}}$ N-4 tolylpyrrolidine, 42 dil al
17	**1,2,3-Tribromopropane**	220	1 582	2 402	
18	**1,5-Dibromopentane**	221	$1\ 514^{15}$	$1\ 694_4^{25}$	6-Nitro-2-mercaptobenzothiazole deriv , 132 3 S-Alkyl *bis*-(thiuronium picrate) 247
19	**1,1,2,2-Tetrabromoethane**	243-4	1 638	2 967	
20	**1,8-Dibromooctane**	270-2	$1\ 501^{15}$	$1\ 468^{15}$	m p 15-6, S-Alkyl *bis*-(thiuronium picrate), 214
21	**1,9-Dibromononane**	285-8		$1\ 415^{15}$	m p −2 5, S-Alkyl *bis*-(thiuronium picrate), 193

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

B) Dihalides and polyhalides (non-aromatic)

3. Bromides b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point °C	Boiling point °C	Miscellaneous
1	**1,7-Dibromoheptane**	42	263	S-Alkyl *bis*-(thiuronium picrate), 208
2	**Carbon tetrabromide**	92	190	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

B) Dihalides and polyhalides (non-aromatic)

4. Iodides a) Liquids (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	n_D^{20}	D_4^{20}	Miscellaneous
1	**Di-iodomethane** (Methylene iodide)	181	1 7425	3 325	6-Nitro-2-mercaptobenzothiazole deriv , 232 3, Di-(2-naphthyl) ether, 133, S-Alkyl *bis*-(thiuronium picrate), 267
2	**1,3-Di-iodopropane**	224	1 6423	2 5755	1,3-Di-(1-naphthyl) ether, 103–4, 1,3-Di-(2-naphthyl) ether, 148–9, 1,3-Diphenyl ether, 60

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

B) Dihalides and polyhalides (non-aromatic)

4. Iodides b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point °C	Boiling point, °C	Miscellaneous
1	**1,2-Di-iodoethane**	81		6-Nitro-2-mercaptobenzothiazole deriv , 202 3, 1,2-Di-(2-naphthyl) ether, 217
2	**Iodoform**	119		Comp with quinoline, 65

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES
C) Aryl halides 1. Fluorides (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	D_4^{20}	Nitro derivative		Sulfonamide		Miscellaneous
						M P	Position of nitro groups	M P	Position of sulfonamide group	
1	**1,3-Difluorobenzene**	82		1 4404[18]	1 1473$_4^{25}$	74	1 3			
2	**Fluorobenzene**	87		1 466	1 024			125	4	
3	**1,4-Difluorobenzene**	88		1 4423[18]	1 1632$_4^{25}$					Boiling with NaOH → 4-fluorophenol, 48, b p 186–8, n_D^{56} 1 5010, D^{56} 1 1889
4	**1,2-Difluorobenzene**	92	−34	1 4451[18]	1 1496$_4^{25}$					
5	**2-Fluorotoluene**	114						105	5	Oxid → 2-fluorobenzoic acid, 127
6	**3-Fluorotoluene**	116						174	6	Oxid → 3-fluorobenzoic acid, 124
7	**4-Fluorotoluene**	117		1 496	0 998			141	2	Oxid → 4-fluorobenzoic acid, 182
8	**1-Fluoronaphthalene**	214		1 594	1 134					Picrate, 113
9	**2-Fluoronaphthalene**		60							Picrate, 101

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

C) Aryl halides 2. Chlorides a) Liquids (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Nitro derivative		Sulfonamide		Miscellaneous
						M P	Position of nitro groups	M P	Position of sulfonamide group	
1	**Chlorobenzene**	132		1 525	1 107	52	2,4	144	4	2,4-Dinitrobenzenesulfenyl chloride adduct, 123 4
2	**2-Chlorotoluene**	159		1 524	1 082	63	3,5	128	5	Oxid → 2-chlorobenzoic acid, 141
3	**3-Chlorotoluene**	162		1 521	1 072	91	4,6	185	6	Oxid → 3-chlorobenzoic acid, 158
4	**4-Chlorotoluene**	162	7	1 521	1 071	38	2	143	2	Oxid → 4-chlorobenzoic acid, 240
5	**1,3-Dichlorobenzene**	173		1 546	1 288	103	4,6	182	6	
6	**1-Chloro-2-ethylbenzene**	178, 180		1 5218	1 057					Oxid → 2-chlorobenzoic acid, 141
7	**1,2-Dichlorobenzene**	179		1 552	1 305	110	4,5	135, 140	4	
8	**1-Chloro-3-ethylbenzene**	184		1 5199	1 053					Oxid → 3-chlorobenzoic acid, 158
9	**1-Chloro-4-ethylbenzene**	184, 180–1		1 5175	1 045					Oxid → 4-chlorobenzoic acid, 240
10	**2-Chloro-1,4-dimethylbenzene**	184–5	2		$1\ 059_{20}^{20}$	77, 101	5, 5,6	155	5	Sulfonyl chloride, 50
11	**1-Chloro-2-vinylbenzene** (*o*-Chlorostyrene)	189		1 5649	1 100					Polymerizes on heating with benzoyl peroxide
12	**1-Chloro-2,3-dimethylbenzene**	190								Oxid → 3-chloro-2-methylbenzoic acid, 159
13	**1-Chloro-2-isopropylbenzene**	191		1 5168	1 0341					Oxid → 2-chlorobenzoic acid, 141
14	**1-Chloro-2,4-dimethylbenzene**	192, 187		$1\ 5230^{25}$	$1\ 0598_{20}^{20}$	42	6	195	6	Oxid $\xrightarrow{CrO_3/H_2SO_4}$ 4-chloro-3-methylbenzoic acid, 209 10, Oxid $\xrightarrow{\text{aq } KMnO_4}$ 4-chloroisophthalic acid, 294 5
15	**1-Chloro-4-vinylbenzene** (*p*-Chlorostyrene)	192		1 5660	1 0868					Polymerizes on heating with peroxide
16	**1-Chloro-3,4-dimethylbenzene**	194–5	−6		$1\ 069_{15}^{15}$	63	5	207	5	$Cl_2 \xrightarrow{Fe}$ 1,2-dichloro-4 5-dimethylbenzene, 76
17	**1-Chloro-4-isopropylbenzene** (*p*-Chlorocumene)	198		1 5117	1 0208			91		Oxid → 4-chlorobenzoic acid, 240
18	**2,6-Dichlorotoluene**	199		1 5510	1 2686	50, 121	3, 3,5			Chlorosulfonic acid in chl → 3-sulfonyl chloride 54 6, 60 Oxid → 2,6-dichlorobenzoic acid 139
19	**2,5-Dichlorotoluene**	199	4–5		$1\ 2535_{20}^{20}$	50 1, 100–1	4, 4,6			Oxid $\xrightarrow{\text{dil } HNO_3}$ 2,5-dichlorobenzoic acid, 154
20	**2,4-Dichlorotoluene**	200		1 549	1 249	104	3,5			Oxid → 2,4-dichlorobenzoic acid, 164
21	**3,5-Dichlorotoluene**	201				61 2, 99–100	2, 2,6	168 9	2	Oxid → 3,5-dichlorobenzoic acid, 188
22	**2-Chloro-1,3,5-trimethylbenzene**	204–6		$1\ 5212^{30}$	$1\ 0337^{30}$	178	4,6	165–6		Oxid $\xrightarrow{\text{aq } KMnO_4}$ 2-chlorobenzene tricarboxylic acid, 285 (anh), 278 (hyd)
23	**2,3-Dichlorotoluene**	207		1 5511		51, 71–2	4, 4,6			Oxid $\xrightarrow{\text{alk } KMnO_4}$ 2,3-dichlorobenzoic acid, 163
24	**3,4-Dichlorotoluene**	209		1 5471	1 2526	63, 91–2	6, 2,6			Oxid → 3,4-dichlorobenzoic acid, 206
25	**1,2,4-Trichlorobenzene**	213	17			56, 103	5, 3,5	>200		Sulfonyl chloride, 31–4
26	**2-Chloro-4-isopropyl-1-methylbenzene** (2-Chloro-*p*-cymene)	217		$1\ 5178^{17}$	$1\ 015_4^{17}$	109–10	5,6			Boiling with dil HNO_3 → 3-chloro-4-methylbenzoic acid, 196
27	**3-Chloro-4-isopropyl-1-methylbenzene** (3-Chloro-*p*-cymene)	217		$1\ 5179^{18}$	$1\ 018_4^{18}$	102–3, 106	2,6			
28	**1-Chloronaphthalene**	259		1 633	1 191	180	4,5			Picrate, 137
29	**3-Chlorobiphenyl**	284–5	16			202–3	4,4′			Oxid → 3-chlorobenzoic acid, 158, 155

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

C) Aryl halides 2. Chlorides b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point, °C	Nitro derivative		Sulfonamide		Miscellaneous
				M P	Position of nitro groups	M P	Position of sulfonamide group	
1	**2-Chlorobenzotrichloride**	29	283					Hydrolysis → 2-chlorobenzoic acid, 142
2	**2,4,6-Trichlorotoluene**	33 4, 38		54 50 178 80	3, 3 5			Oxid → 2,4,6-trichlorobenzoic acid, 160-1
3	**2-Chlorobiphenyl**	34	273					Oxid → 2-chlorobenzoic acid, 141
4	**1,2-Dichloronaphthalene**	35	296	169	*di*			n_D^{18} 1 6337, D_4^{18} 1 3147 Oxid $\xrightarrow{CrO_3/ac\ a}$ 5,6-dichloro-1,4-naphthoquinone, 181
5	**2,3,4-Trichlorotoluene**	41	231[761]	60, 140-1	5 or 6, 5,6			Oxid → 2,3,4-trichlorobenzoic acid, 186-7
6	**1,2,3,4-Tetrachlorobenzene**	44-5	254	63 5, 151	5, 5,6			
7	**3,4,5-Trichlorotoluene**	44-5	245[768]	81 2, 163-4	2, 2,6			Oxid → 3,4,5-trichlorobenzoic acid, 203, $Cl_2 \xrightarrow{Al/Hg}$ 2,3,4,5-tetrachlorotoluene, 97-8
8	**2,3,5-Trichlorotoluene**	45-6	232	58 9, 149-50	4 or 6, 4,6			Oxid $\xrightarrow{dil\ HNO_3}$ 2,3,5-trichlorobenzoic acid, 162
9	**1,6-Dichloronaphthalene**	48		119	4	216	4	
10	**1,2,3,5-Tetrachlorobenzene**	50-1	246	40-1, 161-2	4, 4,6			
11	**1,2,3-Trichlorobenzene**	52 3	218-9	56, 92-3	4, 4,6	226-30	4	Sulfonyl chloride, 65
12	**1,4-Dichlorobenzene**	53	173	54	2	180 186	2	
13	**4,4'-Dichlorodiphenylmethane**	55	337	198-9	3,3'			Oxid $\xrightarrow{CrO_3/ac\ a}$ 4,4'-dichlorobenzophenone, 145
14	**2-Chloronaphthalene**	56, 61	265	175	1,8	126		Picrate, 81
15	**2,2'-Dichlorobiphenyl**	60		203-5	5,5'			
16	**1,3-Dichloronaphthalene**	61	291[775]	150 and 158	*di*			Oxid $\xrightarrow{dil\ HNO_3}$ phthalic acid, 200-6
17	**1,3,5-Trichlorobenzene**	63	208	68	2	210 2		Sulfonyl chloride, 35-40
18	**1,7-Dichloronaphthalene**	63-4	286	138-9		226	4	Sulfonyl chloride, 118
19	**1-Bromo-4-chlorobenzene**	67	197	72	2			
20	**1,4-Dichloronaphthalene**	68	286[740]	92	8	244	6	Oxid $\xrightarrow{CrO_3/ac\ a}$ 5,8-dichloro-1,4-naphthoquinone, 173 4 Boiling HNO_3 (D = 1 3) → 3 6-dichlorophthalic acid, 194 185
21	**2,5-Dichloro-1,4-dimethylbenzene** (2,5-Dichloro *p*-xylene)	68	224					Oxid → 2,5-dichloroterephthalic acid, 306
22	**4-Chlorobiphenyl**	77	293					Oxid → 4-chlorobenzoic acid, 240
23	**2,4,5-Trichlorotoluene**	82	230[715]	89-90, 226 7	3, 3,6			Oxid → 2,4,5-trichlorobenzoic acid, 168
24	**Pentachlorobenzene**	86, 84	276	143, 146	6			
25	**1,8-Dichloronaphthalene**	89				228	4	Sulfonyl chloride, 141
26	**1,5-Dichloronaphthalene**	107		142	8	204	3	Oxid $\xrightarrow{CrO_3/ac\ a}$ 3-chlorophthalic acid, 185 7 Picrate, 87
27	**2,7-Dichloronaphthalene**	114 5		141 2	*mono*	218	3	Oxid $\xrightarrow{dil\ HNO_3}$ 4-chlorophthalic acid, 157
28	**2,6-Dichloronaphthalene**	135-6	285			269	4	Sulfonyl chloride, 136, Cl_2 in chl → 1,2,6-trichloronaphthalene, 92 Oxid $\xrightarrow{CrO_3/ac\ a}$ 1 4-naphthoquinone deriv 148 9
29	**1,2,4,5-Tetrachlorobenzene**	140	245	99, 232	3, 3,6			Chlorosulfonic acid → hexachlorobenzene, 229
30	**4,4'-Dichlorobiphenyl**	149						Oxid → 4-chlorobenzoic acid, 240

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

C) Aryl halides 2. Chlorides b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Nitro derivative		Sulfonamide		Miscellaneous
				M P	Position of nitro groups	M P	Position of sulfonamide group	
31	**5,6,7,8-Tetrachlorotetralin**	174	180^{26}					Br_2 in CS_2 → 1,2-dibromo-5,6,7,8-tetrachloronaphthalene, 142
32	**1,2,3,4-Tetrachlorotetralin**	182, 187						Oxid $\xrightarrow{CrO_3/ac\ a}$ 2,4-dichloro-1-naphthol, 106–7 Boiling HNO_3 → phthalic acid, 200–6
33	**Octachloronaphthalene**	198, 200	442					Oxid $\xrightarrow{fuming\ HNO_3}$ hexachloro-1,4-naphthoquinone, 222 $SbCl_5$ in CCl_4 → cherry-red color
34	**9,10-Dichloroanthracene** (*meso*-Dichloroanthracene)	209–10, yel				279	2	Sulfonyl chloride, 221–5, Oxid → 9,10-anthraquinone, 286, Maleic anh adduct, 258 9
35	**Hexachlorobenzene**	229, subl, 226	309					Boiling with fuming HNO_3 + conc H_2SO_4 → tetrachloro-1,4-benzoquinone (chloroanil), 290

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

C) Aryl halides 3. Bromides a) Liquids (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Nitro derivative		Sulfonamide		Miscellaneous
						M P	Position of nitro groups	M P	Position of sulfonamide group	
1	**Bromobenzene**	156		1 560	1 494	70–2	2,4	166 161	4	1-Naphthylamide, 161, 2,4-Dinitrobenzenesulfenyl chloride adduct 140–1
2	**2-Bromotoluene**	182			1 425	82	3,5	146	5	Oxid → 2-bromobenzoic acid, 150
3	**3-Bromotoluene**	184			1 410	103	4,6	168	6	Oxid → 3-bromobenzoic acid, 155
4	**1-Bromo-2-ethylbenzene**	199		1 5486	1 355					Oxid → 2-bromobenzoic acid, 150
5	**1-Bromo-4-ethylbenzene**	205		1 5448	1 342					Oxid → 4-bromobenzoic acid, 251
6	**1-Bromo-2-vinylbenzene** (*o*-Bromostyrene)	210		1 5927	1 4160					Polymerizes on heating with benzoyl peroxide
7	**1-Bromo-2-isopropylbenzene**	210		1 5408	1 3020					Oxid → 2-bromobenzoic acid, 150
8	**1-Bromo-4-vinylbenzene** (*p*-Bromostyrene)	212		1 5947	1 398					Polymerizes on heating with benzoyl peroxide, Oxid → 4-bromobenzoic acid, 251
9	**1-Bromo-2,3-dimethylbenzene**	217								Oxid → 3-bromophthalic acid, 188
10	**1,3-Dibromobenzene**	219		1 606	1 952	61	4	190	6	
11	**1-Bromo-4-isopropylbenzene**	219		1 5361	1 2854					Oxid → 4-bromobenzoic acid, 251
12	**1,2-Dibromobenzene**	219		1 609	1 956	114	4,5	176	4	
13	**2-Bromocymene**	234			1 267	97				Anilide, 143
14	**2,5-Dibromotoluene**	236			1 811					Oxid → 2,5-dibromobenzoic acid, 157
15	**3,4-Dibromotoluene**	240			1 81					Oxid → 3,4-dibromobenzoic acid 235
16	**1-Bromonaphthalene**	281		1 658	1 484	85	4	191 3	4	Picrate, 134, Carbonation of Grignard → 1-naphthoic acid, 162
17	**2-Bromobiphenyl**	297								Oxid → 2-bromobenzoic acid, 150

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES
C) Aryl halides 3. Bromides b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point, °C	Nitro derivative		Sulfonamide		Miscellaneous
				M P	Position of *nitro* groups	M P	Position of sulfonamide group	
1	**4-Bromotoluene**	28–9	184					Oxid → 4-bromobenzoic acid, 251
2	**2-Bromonaphthalene**	59	281			208	8	Picrate, 86, 79, 2,4,7-Trinitrofluorenone adduct, 138–40
3	**1,2-Dibromonaphthalene**	67						Oxid → 3,4-dibromophthalic acid, 196
4	**1,4-Dibromonaphthalene**	82						Oxid → 3,6-dibromophthalic acid, 135
5	**1,4-Dibromobenzene**	89	219	84	2,5	195	2	
6	**4-Bromobiphenyl**	89	310					Oxid → 4-bromobenzoic acid, 251
7	**1,3,5-Tribromobenzene**	120	271			222	2	
8	**4,4'-Dibromobiphenyl**	164						Oxid → 4-bromobenzoic acid, 251
9	**1,2,4,5-Tetrabromobenzene**	180		168	3			

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES

C) Aryl halides 4. Iodides a) Liquids (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point °C	Melting point, °C	n_D^{20}	D_4^{20}	Nitro derivative		Sulfonamide		Miscellaneous
						M P	Position of nitro groups	M P	Position of sulfonamide group	
1	**Iodobenzene**	188-7		1 620	1 831	171	4			Br_2 → 1-Bromo-4 iodobenzene 91
2	**3-Iodotoluene**	204			1 698	108	4,6			Oxid → 3-iodobenzoic acid, 187
3	**2-Iodotoluene**	211			1 698	103	6			Oxid → 2-iodobenzoic acid, 162
4	**1-Iodo-4-isopropylbenzene**	236-8								Cl_2 in chl → dichloride ($ArICl_2$) 110
5	**1-Iodonaphthalene**	305								Picrate, 128

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE V. ORGANIC DERIVATIVES OF HALIDES
C) Aryl halides 4. Iodides b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point, °C	Nitro derivative		Sulfonamide		Miscellaneous
				M P	Position of nitro groups	M P	Position of sulfonamide group	
1	**4-Iodotoluene**	35	211					HNO_3 at 200° → 4-iodobenzoic acid, 270
2	**1-Iodo-2,4,5-trimethylbenzene**	37	256–8					Cl_2 in chl → dichloride ($ArICl_2$), 66
3	**1,3-Di-iodobenzene**	40	285					
4	**2-Iodonaphthalene**	55	309					Picrate, 95
5	**4-Iodobiphenyl**	114	320 d					Cl_2 in chl → dichloride ($ArICl_2$), 102
6	**1,4-Di-iodobenzene**	129	289	171	2,5			

*Derivative data given in order m p , crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLE VI

Phenylurethane.

$$ROH + C_6H_5N{=}C{=}O \rightarrow C_6H_5NHCOOR$$

Phenylurethane
(Phenylcarbamate)

From the dry alcohol with phenylisocyanate without solvent.

For directions and examples see: Linstead, pp. 34–35; Shriner, p. 211; Vogel, p. 264; B. T. Dewey and N. F. Witt, *Ind. Eng. Chem., Anal. Ed.*, **12**, 459 (1940); **14**, 648 (1942).

From the dry alcohol with phenylisocyanate in petrol ether.

See: Wild, pp. 55–57.

*1-Naphthylurethane (α-Naphthylcarbamate).**

$$ROH + 1\text{-}C_{10}H_7N{=}C{=}O \rightarrow 1\text{-}C_{10}H_7NHCOOR$$

1-Naphthylurethane
(α-Naphthylcarbamate)

From the dry alcohol with 1-naphthylisocyanate without solvent.

For directions and examples see: Cheronis, pp. 475–479; Linstead, pp. 34–35; Shriner, p. 211; Vogel, p. 264; V. T. Bickel and H. E. French, *J. Amer. Chem. Soc.*, **48**, 747 (1926); H. E. French and A. F. Wirtel, *J Amer. Chem. Soc.*, **48**, 1736 (1926).

From the dry alcohol with 1-naphthylisocyanate in petrol ether.

See: Cheronis, pp. 476–477; Wild, pp. 55–57.

p-Xenylurethane (4-Biphenylylurethane).

$$ROH + p\text{-}C_6H_5C_6H_4N{=}C{=}O \rightarrow p\text{-}C_6H_5C_6H_4NHCOOR$$

p-Xenylurethane
(4-Biphenylylcarbamate)

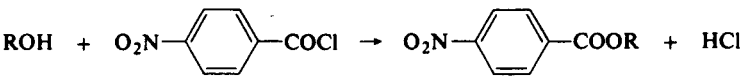
From the alcohol with *p*-xenylisocyanate in toluene.

For directions and examples see: G. T. Morgan and A. E. J. Pettet, *J. Chem. Soc.*, 1124 (1931); B. Witten and E. E. Reid, *J. Amer. Chem. Soc.*, **69**, 2470 (1947).

From the alcohol with *p*-xenylisocyanate in a benzene—petrol ether mixture.

See: M. J. van Gelderen, *Rec. Trav. chim.*, **52**, 969 (1933).

*p-Nitrobenzoate.**



p-Nitrobenzoate

From the alcohol in excess and *p*-nitrobenzoyl chloride.

For directions and examples see: Cheronis, pp. 467–469, 471; Shriner, p. 212; Vogel, p. 263; Wild, p. 52; M. D. Armstrong and J. E. Copenhaver, *J. Amer. Chem. Soc.*, **65**, 2252 (1943).

From an aqueous solution of the alcohol with *p*-nitrobenzoyl chloride in a ligroin-benzene mixture.

See: Cheronis, pp. 468–469, 472.

From the alcohol with *p*-nitrobenzoyl chloride in pyridine.

See: Shriner, p. 212; Wild, p. 52; L. F. King, *J. Amer. Chem. Soc.*, **61**, 2383 (1939).

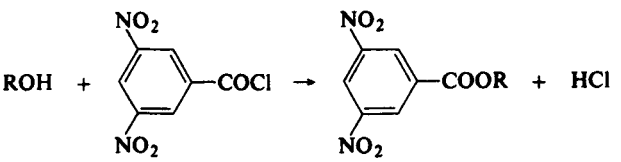
From the alcohol with *p*-nitrobenzoyl chloride in aqueous sodium hydroxide.

See: Wild, p. 52.

From the alcohol with *p*-nitrobenzoyl chloride in an aqueous solution of sodium acetate and potassium hydroxide at low temperature.

See: Wild, p. 53; F. A. Menalda, *Rec. Trav. chim.*, **49**, 967 (1930); H. Henstock, *J. Chem. Soc.*, 216 (1933).

*3,5-Dinitrobenzoate.**



3,5-Dinitrobenzoate

Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

EXPLANATIONS AND REFERENCES TO TABLE VI (Continued)

From the alcohol in excess with 3,5-dinitrobenzoyl chloride.

For directions and examples see: Cheronis, pp. 467–470; Shriner, pp. 212–213; Vogel, p. 262; G. B. Malone and E. E. Reid, *J. Amer. Chem. Soc.*, **51**, 3424 (1929).

From an aqueous solution of the alcohol with 3,5-dinitrobenzoyl chloride in a ligroin-benzene mixture.

See: Cheronis, pp. 468–469, 472.

From the alcohol with 3,5-dinitrobenzoyl chloride and pyridine in benzene.

See: Linstead, p. 34; Wild, p. 53; T. Reichstein, *Helv. chim. Acta*, **9**, 799 (1926); W. M. D. Bryant, *J. Amer. Chem. Soc.*, **54**, 3758 (1932).

From the alcohol with 3,5-dinitrobenzoyl chloride and a catalytic amount of pyridine in isopropyl or *n*-butyl ether.

See: Cheronis, pp. 469, 471.

From the alcohol with 3,5-dinitrobenzoyl chloride in pyridine.

See: Cheronis, p. 469; Shriner, pp. 212–213; Vogel, pp. 262–263.

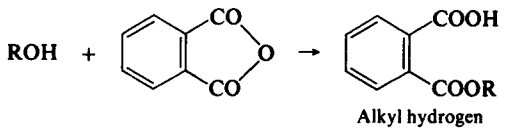
From the alcohol with 3,5-dinitrobenzoyl chloride in aqueous potassium hydroxide.

See: Linstead, p. 34.

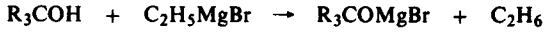
From the alcohol in aqueous sodium hydroxide and potassium acetate with 3,5-dinitrobenzoyl chloride in a benzene-ligroin mixture.

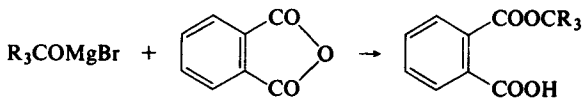
See: Wild, pp. 53–54; W. N. Lipscomb and R. H. Baker, *J. Amer. Chem. Soc.*, **64**, 179 (1942).

*Hydrogen phthalate.**



Alkyl hydrogen phthalate





tert-Alkyl hydrogen phthalate

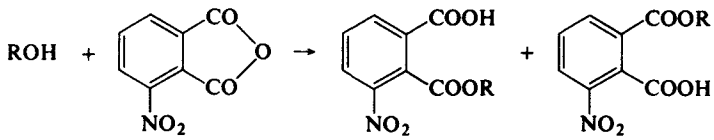
From the alcohol with phthalic anhydride.

For directions and examples see: E. E. Reid, *J. Amer. Chem. Soc.*, **39**, 1250 (1917); J. F. Goggans and J. E. Copenhaver, *J. Amer. Chem. Soc.*, **61**, 2909 (1939).

From the alkoxymagnesium halide derived from a tertiary alcohol (prepared from the alcohol with ethylmagnesium bromide) with phthalic anhydride in ether or an ether-dioxan mixture.

See: W. A. Fessler and R. L. Shriner, *J. Amer. Chem. Soc.*, **58**, 1384 (1936).

*Hydrogen 3-nitrophthalate.**



Main product Trace

Hydrogen 3-nitrophthalates
(3-Nitrophthalic acid monoalkyl esters)

From the alcohol with 3-nitrophthalic anhydride.

For directions and examples see: Cheronis, pp. 473–474; Linstead, p. 35; Shriner, p. 213; Vogel, p. 265; Wild, p. 59; G. M. Dickinson, L. H. Crosson and J. E. Copenhaver, *J. Amer. Chem. Soc.*, **59**, 1094 (1937); B. H. Nicolet and J. Sacks, *J. Amer. Chem. Soc.*, **47**, 2348 (1925); A. J. Veraguth and H. Diehl, *J. Amer. Chem. Soc.*, **62**, 233 (1940).

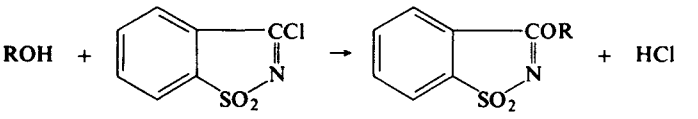
From a high boiling alcohol with 3-nitrophthalic anhydride in toluene.

See: Linstead, p. 35; Shriner, p. 213; Vogel, p. 265; Wild, p. 59; G. M. Dickinson, L. H. Crosson and J. E. Copenhaver, *J. Amer. Chem. Soc.*, **59**, 1094 (1937).

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

Pseudosaccharin ether (Pseudosaccharin derivative).



Pseudosaccharin chloride — Pseudosaccharin ether

From the alcohol with pseudosaccharin chloride without solvent.

For directions and examples see: Vogel, p. 266; Wild, pp. 60–61; J. R. Meadoe and E. E. Reid, *J. Amer. Chem. Soc.*, **65**, 457 (1943).

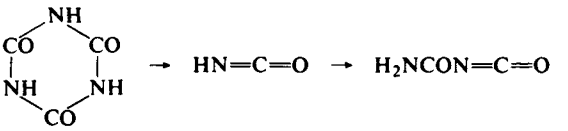
From the alcohol with pseudosaccharin chloride in chloroform.

See: H. Böhme and H. Opper, *Z. Anal. Chem.*, **139**, 255 (1953).

From the alcohol with pseudosaccharin chloride and a catalytic amount of pyridine in chloroform.

See: Cheronis, p. 482; H. Böhme and H. Opper, *Z. Anal. Chem.*, **139**, 255 (1953).

Allophanate



Cyanuric acid — Cyanic acid — Cyanic acid dimer

$$ROH + H_2NCON{=}C{=}O \rightarrow H_2NCONHCOOR$$

Allophanate

From the alcohol with cyanic acid (prepared from the depolymerization of cyanuric acid).

For directions and examples see: Linstead, p. 36; A. Behál, *Compt. rend.*, **168**, 945 (1919); M. A. Spielman, J. D. Barnes and W. J. Close, *J. Amer. Chem. Soc.*, **72**, 2520 (1950); H. W. Blohm and E. I. Becker, *J. Amer. Chem. Soc.*, **72**, 5342 (1950); *Chem. Revs.*, **51**, 471 (1952).

From the alcohol with sodium cyanate and dry hydrochloric acid in dioxane.

See: E. S. Lane, *J. Chem. Soc.*, 2764 (1951).

*Benzoate.**

$$ROH + C_6H_5COCl \rightarrow C_6H_5COOR + HCl$$

Benzoate

Especially for polyhydric alcohols.

From the alcohol with benzoyl chloride.

For directions and examples see: Shriner, p. 212.

From the alcohol with benzoyl chloride in anhydrous pyridine.

See: Cheronis, pp. 481–482; Shriner, p. 212; Vogel, pp. 243, 447.

From the alcohol with benzoyl chloride in aqueous sodium hydroxide.

See: Vogel, p. 447.

Acetate.

$$ROH + (CH_3CO)_2O \rightarrow CH_3COOR + CH_3COOH$$

$$R_3COH + CH_3COCl \rightarrow CH_3COOCR_3 + HCl$$

Acetate

Especially for polyhydric alcohols.

From the alcohol with acetic anhydride and sodium acetate.

For directions and examples see: Linstead, pp. 35, 39; Shriner, p. 212.

From the alcohol with acetic anhydride in pyridine.

See: Shriner, p. 212.

From the alcohol (especially a tertiary alcohol) with acetyl chloride in the presence of magnesium.

See: A. Spassow, *Chem. Ber.*, **70B**, 1926 (1937).

NOTE: For additional information regarding directions and examples for the preparation of derivatives of polyhydric alcohols see explanations and references to Table XIX, p. 326.

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

TABLE VI. ORGANIC DERIVATIVES OF ALCOHOLS

a) Liquids (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Phenylurethane	1 Naphthylurethane	4 Nitrobenzoate	3,5-Dinitrobenzoate	Hydrogen 3-nitrophthalate	Hydrogen phthalate	Miscellaneous
1	**Methanol** (Methyl alcohol)	64 65	f p −97	1 3306[15]	0 7915	47, al	124, lgr	96, dil al	108 (cor), al	153 (cor)	82 5 (cor)	Pseudosaccharin ether, 182 (cor)
2	**Ethanol** (Ethyl alcohol)	78 32	f p −117 3	1 3610	0 7894	52	79, lgr	57, al	93, al	158 (cor), w	48	Pseudosaccharin ether, 219 (cor)
3	**2-Propanol** (Isopropyl alcohol)	82 4	−89 5	1 37927	0 78507	75-6, lt pet	106	110 5, lt pet 108	123, pet eth	154 (cor), w		Pseudosaccharin ether, 137 (cor)
4	***d,l*-3-Buten-2-ol** (Methyl vinyl carbinol)	94-6								43-4		Allophanate, 152, Constant boil mixt with 21 76% w , b p 80
5	**2-Propen-1-ol** (Allyl alcohol)	97 1		1 41345	0 8540	70	108	28	49-50	124		
6	**1-Propanol** (*n*-Propyl alcohol)	97 1		1 38499	0 80359	57, pet	80, 76	35, pet	74, pet eth	145 5 (cor), w	54 1-4 (cor), pet eth - bz (9 1)	Pseudosaccharin ether, 124 5 (cor)
7	**2-Butanol** (*d,l-sec*-Butyl alcohol, Ethyl methyl carbinol)	99 5		1 39495[25]	0 80692	64 5, pet	97	25-6, dil al	76	131 (cor)	59-60	Pseudosaccharin ether, 65 5 (cor)
8	**2-Methyl-2-butanol** (*tert*-Amyl alcohol)	102 3	−8 55	1 4052	0 80889	42, pet eth	72	85	116, 117-8			
9	**2-Fluoroethanol**	105		1 3633[25]			128					
10	**2-Methyl-1-propanol** (Isobutyl alcohol)	108 1		1 3939[25]	0 80196	86, lgr	104	69	87	180 5 (cor)	65, pet eth	Pseudosaccharin ether, 100 (cor)
11	**3-Buten-1-ol**	122 5-3 5[755]				23 4-4 5						
12	***d,l*-3-Methyl-2-butanol** (*sec*-Isoamyl alcohol, *d,l*-Isopropyl methyl carbinol)	114, *d* 110-2		1 3973	0 8180	68	109			127	39, *d* 34, *l* 34	*d* $[\alpha]_D^{20}$ +5 34, in al
13	**3-Pentanol** (*sym-sec*-Amyl alcohol, Diethyl carbinol)	116 1		1 4103	0 82037	48-9	95, lgr	17	101, 99, 97	121		
14	**1-Butanol** (*n*-Butyl alcohol)	117 6, 116	−90 2	1 3974[25]	0 80960	61	71	70, 64 35-6	64, 62 5	147 (cor)	73 1-5 (cor)	Pseudosaccharin ether, 96 (cor)
15	***d,l*-2-Pentanol** (*sec*-Amyl alcohol)	119 85		1 4060	0 80919		74 5, 76, *d* 88-91	17	62	102-3	60-1, *d* 34, *l* 34	Pseudosaccharin ether, 38 (cor)
16	**3,3-Dimethyl-2-butanol** (*d,l*-Pinacolyl alcohol, *tert*-Butyl methyl carbinol)	120 4	5 3	1 4148	0 8185	77-8, pet eth			107, yel - wh , pet eth		85-6, lt pet	
17	**2,3-Dimethyl-2-butanol** (Dimethyl isopropyl carbinol)	120 5	−14	1 4140	0 8208	65-6, pet eth	101		111, yel , bz - pet eth			
18	**3-Methyl-3-pentanol**	123	−22	1 4166[25]	$0\ 82334_4^{25}$	43 5	83 5		96 5, yel , pet eth , 62 5			Allophanate, 152 (cor)

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VI. ORGANIC DERIVATIVES OF ALCOHOLS
a) Liquids (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	D_4^{20}	Phenyl urethane	1-Naphthyl urethane	4 Nitro benzoate	3,5-Dinitrobenzoate	Hydrogen 3-nitrophthalate	Hydrogen phthalate	Miscellaneous
19	**2-Methyl-2-pentanol** (Dimethyl *n*-propyl carbinol)	123, 121	−103, −108	1 4113	0 81341				72			Benzoate, 182 3, al , Allophanate, 128
20	**2-Methoxyethanol** (Methyl cellosolve, Ethylene glycol monomethyl ether)	124 5		1 40238	0 9647		112 5 3 0	50 5, dil al		129, dil al		Diphenyl urethane, 51
21	**2-Methyl-3-pentanol** (Ethyl isopropyl carbinol)	127 5		1 4168	0 82487	50			85, yel , pet eth	150 7	70 69 71, racemic	
22	**1-Chloro-2-propanol**	127							77			
23	**2-Methyl-1-butanol** (Active amyl alcohol, *d-sec*-Butyl carbinol)	128 9		1 4107	0 8193	31	82, lgr		70	157 8, w		$[\alpha]_D^{20}$ −5 756
24	**2-Chloroethanol** (Ethylene chlorohydrin)	131				51	101			98		
25	***d,l*-4-Methyl-2-pentanol** (Isobutyl methyl carbinol)	132		1 4011	0 80713	143, et ac	88	26	65, yel , pet eth			
26	**3-Methyl-1-butanol** (*prim*-Isoamyl alcohol)	132	−117	$1\ 40851^{15}$	0 80918	56–7, lgr	68	21	61	166 3 (cor), 30% al 165–6, w		Pseudosaccharin ether, 64 (cor)
27	***d,l*-2-Chloro-1-propanol**	133 4		1 436	1 103				76			Alkali + heat → propylene oxide b p 35
28	**3-Methyl-2-pentanol** (*sec*-Butyl methyl carbinol)	$134\ 2^{749}$					72		43 5, yel , pet eth , 41			
29	**2-Ethoxyethanol** (Ethylene glycol monoethyl ether)	135		1 40797	0 9297		67 3- 5		75, al	118 8 6 (*anh*), 94 2 4 (monohyd) *w* -al		Diphenyl urethane, 43
30	**3-Hexanol** (Ethyl *n*-propyl carbinol)	136		1 4159	0 81851				97, yel - wh , pet eth		76–7, pet eth	
31	**2,2-Dimethyl-1-butanol** (*tert*-Amyl carbinol)	136 7		1 4208	0 82834	65–6	80–1, lgr			51, yel , pet eth		Pseudosaccharin ether, 68–9 lt pet
32	**1-Pentanol** (*n*-Amyl alcohol)	138 (cor)	−78 5	1 40994	0 81479	46	68	11	46 4	136 (cor)	75 5	Pseudosaccharin ether, 62 (cor)
33	***d,l*-2-Hexanol** (*n*-Butyl methyl carbinol)	$138\ 9^{745}$		$1\ 4126^{25}$	$0\ 80977_4^{25}$		60 5	40	38 5		*d* 29	3,5-Dinitrophenyl urethane, 40
34	**2,4-Dimethyl-3-pentanol**	140		1 42259	0 8288	95, eth - pet eth , 96–9	95, 99	155		150–1		Camphor-like odor
35	**Cyclopentanol**	140 85		1 4530	0 94688	132 5, al	118					
36	**2-Isopropoxyethanol** (Ethylene glycol monoisopropyl ether)	$141\ 5^{736}$		1 40954	0 9030							Triphenylmethyl ether, 71 0- 5, me al

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VI. ORGANIC DERIVATIVES OF ALCOHOLS.
a) Liquids (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Phenylurethane	1 Naphthylurethane	4 Nitrobenzoate	3 5-Dinitrobenzoate	Hydrogen 3-nitrophthalate	Hydrogen phthalate	Miscellaneous
37	**3-Ethyl-3-pentanol** (Triethyl carbinol)	142		1 4305	0 83889							Camphor-like odor, Allophanate, 152 (cor)
38	**2,3-Dimethyl-1-butanol**	145		1 4195	$0\ 8297_4^{20\cdot5}$	28 9			51 5, pa yel , pet eth			
39	**3-Hydroxy-2-butanone** (*d,l*-Acetoin, Acetyl methyl carbinol)	145	−72	1 4178	$0\ 9861_4^{30}$							Semicarbazone, 185, al , 202, 2,4-Dinitrophenylhydrazone, 318, or , $PhNO_2$-tol
40	**1-Hydroxy-2-propanone** (Acetol Acetyl carbinol)	146	−17	1 4295	$1\ 0824_{20}^{20}$							Semicarbazone, 196, al , 2,4-Dinitrophenylhydrazone, 128 5 (cor), or , al
41	**2-Methyl-1-pentanol** (2-Methyl-*n*-amyl alcohol)	148 0		1 4190	0 8208		75 6		50 5, yel , pet eth	145, 141, bz		
42	**2-Ethylbutanol**	148 9		1 4224	0 83345				51 5, pet eth			
43	**2-Bromoethanol** (Ethylene bromohydrin)	149d					86					
44	**2-*n*-Propoxyethanol** (Ethylene glycol mono-*n*-propyl ether)	$150\ 0^{736}$		1 41328	0 9112							
45	**Trichloroethanol**	151	19			87	120	71, al	142 3			Urethane 64 5
46	**3-Methyl-1-pentanol**	151-2 153 7 4 1		1 4188	0 8242		58 *d,l* 40-1, *d* 38-40 *l* 37 8		38, yel pet eth			
47	**4-Methyl-1-pentanol** (Isoamyl carbinol Isohexyl alcohol)	152 3		1 4153	0 8131	48 (cor)			72, pet eth 69 8 (cor)	138 5 40, bz - pet eth		
48	***d,l*-4-Heptanol** (Di-*n* propyl carbinol)	156	−41 5	1 4205	0 8183		78 80	35	64		60	
49	**1-Hexanol** (*n*-Hexyl alcohol)	157 5	−51 6 −46 1	1 41778	0 81893	42	59 62	5	58 4 (cor), 60 1	124 (cor), 123	25	Pseudosaccharin ether 60 (cor)
50	***d l*-2-Heptanol** (*n*-Amyl methyl carbinol, *sec*-Heptyl alcohol)	158 7		1 4210	0 8167		54		49 4		57 5 *d,l* 76 5	
51	**2-Isobutoxyethanol** (Ethylene glycol mono-isobutyl ether)	$159\ 3^{746}$		1 41428	0 8900							
52	**2-*sec*-Butoxyethanol** (Ethylene glycol mono-*sec*-butyl ether)	$159\ 3^{746}$		1 41606	0 8966							
53	**2,4-Dimethyl-1-pentanol**	159 8		1 427	0 793					154-5, bz -pet eth		*p*-Xenylurethane, 74-5, pet

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VI. ORGANIC DERIVATIVES OF ALCOHOLS
a) Liquids (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Phenylurethane	1-Naphthylurethane	4-Nitrobenzoate	3,5 Dinitrobenzoate	Hydrogen 3-nitrophthalate	Hydrogen phthalate	Miscellaneous
54	**3-Chloro-1-propanol** (3-Chloropropyl alcohol)	161 2				38	76		77			
55	**2-Methyl-1-hexanol**	164 5		1 4250	0 8270					131 2, wh , pet		*p*-Xenylurethane, 88 0- 5, pet
56	**2-Ethyl-1-pentanol** (2-Ethyl-*n*-amyl alcohol)	164 6								127 8, bz - pet		*p*-Xenylurethane, 77-77 5, pet
57	***d,l*-4-Methyl-1-hexanol**	165 173		1 4219	0 8239		50			149		Odor of Amyl alcohol
58	***d,l-cis*-2-Methylcyclohexanol** (*cis*-Hexahydro-*o*-cresol)	165 3	−9 3	1 4640	0 9340	90 1 93 4		51 2 55 6	98 9		103 4 104 5	
59	**4-Hydroxy-4-methyl-2-pentanone** (Diacetone alcohol)	166			$0\ 9306^{25}$			48	55			Oxime, 57 5-8 5 lgr -eth
60	***d,l-trans*-2-Methylcyclohexanol** (*trans*-Hexahydro-*o*-cresol)	167 4	21	1 4611	0 9235	105 mixt *cis* + *trans* 90 105		65 mixt *cis* + *trans* 35-6	114 5 mixt *cis* + *trans* 85 90		124 5 mixt *cis* + *trans* 95 6	
61	**2-*n*-Butoxyethanol** (Ethylene glycol mono-*n*-butyl ether)	$170\text{-}6^{743}$		$1\ 4177^{26}$	0 9188	62				120 0 6		4-Nitrophenylurethane, 58 7 9 1, CCl,
62	**2-Aminoethyl alcohol** (Ethanolamine)	171										N-1-Naphthylurea, 186 (cor) Picrate, 160
63	**2,6-Dimethyl-4-heptanol** (Di-isobutyl carbinol)	171 4 3 4		1 4242	$0\ 8129_{20}^{20}$	61 2, lgr -al					118	*p* Xenylurethane, 118 Allophanate, 156
64	**Furfuryl alcohol** (2-Furyl carbinol)	172, 170		1 4863	$1\ 1351_{20}^{20}$	45	129 30, lgr , 133	76	80 1		85	Urethane, 50, Pseudosaccharin ether 55
65	***d,l-cis*-3-Methylcyclohexanol** (*cis*-Hexahydro-*m*-cresol)	173 4		1 4572	0 919	87 8	128 9	65	91 2		82-3	
66	***d,l-cis*-4-Methylcyclohexanol** (*cis*-Hexahydro-*p*-cresol)	$173\ 4^{750}$		1 4549	0 914	118 9		94	134		72 3	
67	***d,l-trans*-4-Methylcyclohexanol** (*trans*-Hexahydro-*p*-cresol)	$173\ 4\ 5^{74}$		1 4534	0 913	124 5, mixt *cis* + *trans* 112 5		67	139 40, mixt *cis* + *trans* 125 30		119-25, ac a	
68	***d,l-trans*-3-Methylcyclohexanol** (*trans*-Hexahydro-*m*-cresol)	174 5		1 4550	0 9145	93 4 mixt *cis* + *trans* 75 85	122	58	97 8, mixt *cis* + *trans* 80 5		93 4	
69	**2,6-Dimethylcyclohexanol**	$174\text{-}5^{748}$		1 4619	0 9115, 0 9235	158						
70	***cis*-2,5-Dimethylcyclohexanol**	175		$1\ 4522^{1}$	$0\ 9096^{1}$							Allophanate, 157 8
71	***trans*-2,4-Dimethylcyclohexanol**	175		1 4560	0 900	96						Acetate, b p 198^{71}
72	**1,3-Dichloro-2-propanol**	176				73	115					

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VI. ORGANIC DERIVATIVES OF ALCOHOLS
a) Liquids (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Phenyl urethane	1 Naphthyl urethane	4 Nitro benzoate	3,5 Dinitro benzoate	Hydrogen 3 nitro phthalate	Hydrogen phthalate	Miscellaneous
73	**3-Bromo-1-propanol** (Triethylene bromohydrin)	176d					73					
74	*cis*-**2,4-Dimethylcyclohexanol**	176		1 4582	0 907							
75	**1-Heptanol** (*n*-Heptyl alcohol)	176 8	−34 6 −33 8	1 4245	0 82242	60 65	62	10	46 47	127 (cor)	16 5-17 5	Pseudosaccharin ether, 55 (cor)
76	*trans*-**2,5-Dimethylcyclohexanol**	177		$1\ 4545^{17}$	$0\ 9079_{17}^{17}$							Allophanate, 125
77	**2,2-Dimethylcyclohexanol**	177	8	1 4648	0 9225	85						
78	**Tetrahydrofurfuryl alcohol**	177-8[743]		1 45167	1 0544	61, pet eth		46-8	83-4			Diphenylurethane, 81, me al
79	**2-Methyl-1,2-propanediol** (Isobutylene glycol)	178		$1\ 4358^{17}$	$0\ 999_4^{14}$	*bis* 140 5						
80	*d,l*-**2-Octanol**	179		1 4265	0 8205	oil	63-4, 62 5	28	32		55, *d,l* 75	
81	**2,2-Dibromoethanol**	179-81										Urethane 90-1
82	**1,3,5-Trimethylcyclohexanol**	181		$1\ 454^{16\ 3}$	$0\ 8876_4^{16\ 8}$							
83	**2,3Butanediol** (2,3-Butylene glycol)	*meso* 181 7[42], *d,l* 176 7[42]	*meso* 34 4, *d,l* 7 6	*meso* 1 43637	*meso* 1 0433	*meso* *bis* 201						Dibenzoate *d,l* 53 4, *meso* 75 5-6 2
84	**Cyclohexyl carbinol** (Hexahydrobenzyl alcohol)	182		1 4649	0 9280							Acetate, b p 199-201[740]
85	**2,3-Dichloropropanol**	182				73	93	37-8				2-Naphthylurethane, 99
86	**4-Methyl-1-heptanol**	182 7								133		Pseudosaccharin ether, 34 (cor)
87	**2-Ethyl-1-hexanol**	184 6		1 4328	0 8328	33-4	60 1			108		*p*-Xenylurethane, 80, pet , Pseudosaccharin ether, 53 5 (cor)
88	**3,3-Dimethylcyclohexanol**	185^{754}	11 2	$1\ 4606^{15}$	$0\ 9128_4^{14}$			83				Acetate, b p 194-5[750], *o*-Nitrobenzoate, 62
89	*cis*-**3,5-Dimethylcyclohexanol**	187		$1\ 454^{21}$	$0\ 9109_4^{21}$							Acetate, b p 201-2
90	*trans*-**3,5-Dimethylcyclohexanol**	*d,l* 187		1 4579	*d* 0 9146, *l* 0 9166							Acetate, *d,l*, b p , 196 *d*, $[\alpha]_D^{26}$ +4 55, *l*, $[\alpha]_D^{17}$ −7 74
91	*d,l*-**1,2-Propanediol** (α-Propylene glycol)	187 4		$1\ 43162^{25}$	$1\ 0354_4^{23}$	*bis* 153, 143-4						Monostearate, 59 5, Distearate, 72 3
92	**3,4-Dimethylcyclohexanol**	189		$1\ 458^{16}$	$0\ 9073_4^{16}$	119						
93	**2,4,5-Trimethylcyclohexanol**	*cis* 191-3, *trans* 196				*cis* 83 5, al , *trans* 95, al					81-3 5, eth - lgr	
94	**1,3,3-Trimethylcyclohexen-6-ol**	193 (cor)			$0\ 9310_4^{13}$							Acetate, b p 206 7
95	**2,3,6-Trimethylcyclohexanol**	193-5[747]			$0\ 9119_4^{17}$							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VI. ORGANIC DERIVATIVES OF ALCOHOLS
a) Liquids (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point, °C	n_D^{20}	D_4^{20}	Phenylurethane	1 Naphthyl urethane	4 Nitro benzoate	3 5-Dinitro benzoate	Hydrogen 3-nitro phthalate	Hydrogen phthalate	Miscellaneous
96	**2-(2-Methoxyethoxy)-ethanol** (Diethylene glycol monomethyl ether)	194		1 4244	$1\ 035_{20}^{20}$			92		91 4 2 2 (anh), 87 90 (monohyd) w -al		4-Nitrophenylurethane, 73 5 76
97	**5-Nonanol**	194^{743}		$1\ 4289^{18}$							45	Allophanate, 158
98	**1-Octanol** (*n*-Octyl alcohol)	195	−16, −16 7	$1\ 4274^{25}$	0 8249	74 72	67	12	61 2	128 (cor)	22	Pseudosaccharin ether 46 (cor)
99	**2-Methyl-2,4-pentanediol**	196 198		$1\ 42976^{16\ 7}$	$0\ 9240_4^{17}$							Odor of pinacol, Heating with 2% HBr → diene, b p 75 5-76 0
100	**2-(2-Ethoxyethoxy)-ethanol** (Diethylene glycol monoethyl ether)	196^{763}		1 4298	$1\ 023_{20}^{20}$			oil	oil	oil		4 Nitrophenylurethane, 65 8 6 3
101	**Glycol** (1,2-Ethanediol)	197 85	−12 6	1 43192	1 11361	*di* 157	*di* 176	140, 141	*di* 169			*bis*-4-Nitrophenylurethane, 135 5
102	***d l*-2-Nonanol**	198 2		$1\ 4290^{25}$	$0\ 81910_4^{25}$		55 5, lt pet		42 8 (cor)		42 4, *d,l* 58-9	
103	***l*-Linalool** (*l*-Linalyl alcohol)	199		1 46238	0 8622	65 6	53	70				$[\alpha]_D$ −3 to −17
104	**Benzyl alcohol**	205 5	−15 3	1 53955	1 04540	77 75 5 76, pet eth	134	85	113	176	106, 104	Pseudosaccharin ether, 130 (cor)
105	***d,l*-1,3-Butanediol** (*d l*-1,3-Butylene glycol	207 5, 204		$1\ 44252^{19\ 5}$	1 0053	122-3 *d* 115-6	184					Diphenylurethane *l* 127 8
106	***d l*-2-Decanol** (Methyl *n*-octyl carbinol)	211		*d* 1 4344	*d* 0 8250		69, lt pet				48 9, *d* 38 9	
107	**1-Nonanol** (*n*-Nonyl alcohol)	213 5		1 43105	0 8271	60, 69, 62-4	65 5	60, 66	52 2	125 (cor)	42 5	Pseudosaccharin ether, 49 (cor)
108	**1,3-Propanediol** (Trimethylene glycol)	214 7, 210-2	−30	1 43983	1 0538	*di* 137	*di* 164	*di* 119	*di* 178			Dibenzoate, 57, 59
109	**3-Methylbenzyl alcohol** (3-Tolyl carbinol)	217			$0\ 9157^{17}$		116					
110	α 4-**Dimethylbenzyl alcohol** (α-Methyl-4-tolyl carbinol)	219			$0\ 9668_4^{20\ 5}$	96, pet eth						
111	**1-Phenyl-*n*-propyl alcohol** (*d l*-Phenylethyl carbinol)	219		1 5257	$1\ 0056_{20}^{20}$		102	59-60, 56 5 7 8				
112	**2,3-Dibromo-1-propanol**	219d				84		59-60				3,5-Dinitrophenylurethane, 71
113	**2-Phenethyl alcohol** (2-Phenylethanol)	219 8	−25 8	1 5240	$1\ 0235_4^{25}$	78, 79-80, al	119	61 5-2 (cor), 62-3, al	108	123	188-9	
114	***d,l*-α-Terpineol**	221	35, *d,l* 37-8	1 4834	0 9337	112 3, me al , *d,l* 110	152, 147	139, me al	78-9, lgr		117-8, ac a	Commercial liquid, lilac-like odor

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VI. ORGANIC DERIVATIVES OF ALCOHOLS

a) Liquids (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{t}	Phenyl urethane	1 Naphthyl urethane	4 Nitro benzoate	3 5 Dinitro benzoate	Hydrogen 3 nitro phthalate	Hydrogen phthalate	Miscellaneous
115	**Citronellol**	222 118^{17}										Oxid → Adipic acid, 89, Rose-like odor
116	**α-Isopropylbenzyl alcohol** (*d,l*-Isopropyl phenyl carbinol)	222 4		1 51932[18]	0 9790$_{20}^{20}$		116 7					Oxid → Isopropylphenyl ketone, b p 222
117	***d l*-2-Undecanol** (*d l*-2-Hendecanol Methyl *n*-nonyl carbinol)	228-9			0 8263[18]						49 50	
118	**2-(2-*n*-Butoxyethoxy)-ethanol** (Diethylene glycol mono-*n*-butyl ether)	228-30		1 4341	0 957$_{20}^{20}$							4-Nitrophenyl-urethane 54 5-5 3
119	**1,4-Butanediol** (Tetramethylene glycol)	230, 235	19 0 5	1 4467	1 0171	*di* 183 3 5 chl 180	*di* 199, xyl	*di* 175 ac a				Dibenzoate, 81 2, eth
120	**Geraniol**	230		1 4766	0 8894		47 8	35	62 3	117	47, lgr	
121	**1-Decanol** (*n*-Decyl alcohol)	231	5 99, 6 4	1 43682	0 8292	59 6, bz , then al	73	30 2, al	57 7	122 8 (cor)	38 (cor)	Pseudosaccharin ether, 47 5 (cor)
122	**2-Phenoxyethanol** (Ethylene glycol monophenyl ether)	237, 245		1 534	1 102[22]					112 3		Benzoate 64 4-Toluenesulfonate 80, al
123	**3-Phenylpropanol** (Hydrocinnamyl alcohol)	237 4, 235		1 53565	1 0079	45 47-8, al		45 6, 47	92	117		4 Nitrophenyl urethane 104 pet eth
124	**1,5-Pentanediol** (Pentamethylene glycol)	238-9		1 4499	0 9939$_{20}^{20}$	*di* 174-5 (cor) abs al	*di* 147	*di* 104-5, bz -al				
125	**1-Undecanol** (1-Hendecanol *n*-Undecyl alcohol)	243	15 85, 14 3			62, al , 52		99 5, al	55	123 3 (cor)	43 8 4 1	Allophanate 156 Pseudosaccharin ether 58 5 (cor)
126	**Diethylene glycol** (β,β'-Dihydroxydiethyl ether)	244 5	f p −10 45	1 4475	1 1212$_{15}^{15}$		149	151 (cor), 149, ac a				
127	**2-Methoxybenzyl alcohol** (Saligenin-2-methyl ether)	247		1 549[17]	1 0495$_{15}^{15}$		135-6					Allophanate, 180, Benzoate, 59, lgr
128	**2-Benzyloxyethanol** (Ethylene glycol monobenzyl ether)	265 0		1 5225	1 0700$_{20}^{20}$							Triphenylmethyl ether, 76 7, eth
129	***n*-Hexyl phenyl carbinol**	275		1 501	0 946	75						
130	**Triethylene glycol** (Ethylene glycol di-(β-hydroxyethyl)ether)	285, 165[14]	−9 4	1 4578[15]	1 1274$_{4}^{15}$							*bis*-Triphenylmethyl ether, 142 2 5, acet
131	**Glycerol** (1,2,3-Trihydroxypropane)	290d	17 9	1 4729	1 26134	*tri* 180	*tri* 191-2, al	*tri* 188				4-Nitrophenyl urethane, 216 Tribenzoate, 71 2, 75 6
132	**3,4-Dimethoxybenzyl alcohol** (Veratryl alcohol)	296-7[732]		1 555[17]	1 179$_{17}^{17}$	118						Acetate, b p 170[14], n_D^{17} 1 5245, Benzoate, 36 7

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VI. ORGANIC DERIVATIVES OF ALCOHOLS
a) Liquids (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Phenyl urethane	1 Naphthyl urethane	4 Nitro benzoate	3 5 Dinitro benzoate	Hydrogen 3 nitro phthalate	Hydrogen phthalate	Miscellaneous
133	**4-Methoxyphenyl methyl carbinol** (4 Anisyl methyl carbinol)	310d (cor)		1 557	$1\ 086_4^{16}$	82 3						Odor of anise Oxid → 4 Methoxy acetophenone 38
134	***cis*-Octa-9-decen-1-ol** (Oleyl alcohol *cis*-Octadecenyl alcohol)	333 5		1 4607	0 8489	oil	β 44 5 al					Allphanate 135 chl 129 chl 4 Nitrophenyl urethane 85 91

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VI. ORGANIC DERIVATIVES OF ALCOHOLS

b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point °C	Boiling point, °C	Phenyl urethane	1 Naphthyl urethane	4 Nitro benzoate	3,5 Dinitro benzoate	Hydrogen 3 nitro phthalate	Hydrogen phthalate	Pseudo saccharine ether	Miscellaneous
1	**1-Phenylethyl alcohol** (*d l* Methyl phenyl carbinol)	20, 20 1	202	92, 91-2, lgr	106	43 (cor), al	95 93		108 ac a		n_D^{20} 1 5275, D_4^0 1 0129
2	*trans*-**2-Methylcyclohexanol**	21	167 4	*d l* 105	*d l* 155		*d l* 115				Oxalate *d l* 61
3	**1-Dodecanol** (*n*-Dodecyl alcohol, Lauryl alcohol)	24, 26	259	74	80	45, 42	60	124 (cor)	50 3 (cor)	54 (cor)	
4	**1,1-Dimethyl-2-phenylethanol** (Benzyl dimethyl carbinol)	24	216								n_D^{16} 1 5174
5	**4-Methoxybenzyl alcohol** (4 Anisyl carbinol)	24-5	259	92 (cor)							Benzoate, 38, Me eth , b p 225-6, n_D^{25} 1 5422, D_{15}^{15} 1 1129
6	**Cyclohexanol**	25 1	161 1	82	129	50	112 3, al	160	99		$n_D^{\frac{1}{2}}$ 1 46477 D_4^{30} 0 94155
7	*tert*-**Butyl alcohol** (Trimethyl carbinol)	25 5	82 5	136, eth	101	116, al	142, pet eth				n_D^{20} 1 38779, D_4^{20} 0 78670
8	**3-Nitrobenzyl alcohol**	27	175-80[3]								Benzoate, 71 2 Ox → 3-nitro benzoic acid 140
9	**2,3,3-Trimethylcyclohexanol**	28	197								
10	**Diethanolamine** (β,β'-Dihydroxy-diethylamine)	28	270, 217-8[150]								Picrate, 109-10
11	**2,4-Hexadien-1-ol**	30 5-1 5	76[12]	78-9			85				
12	**1-Tridecanol**	α 30 6, β 28 3	155 6[15]			37 4 (cor)		124 (cor)	52 5	66 (cor)	D_4^{31} 0 8223
13	**Cinnamyl alcohol**	33	257	90 0-1 5	114	78, 76 5	121				
14	**2-Methylbenzyl alcohol** (2 Tolyl carbinol)	36, 35	219	79 (cor)							
15	*trans*-**Octa-9-decen-1-ol** (Elaidyl alcohol)	36 7, 35, 34	333, 216[18]	56-7	71						
16	*d,l*-**Fenchyl alcohol**	38-9, *d* α 45, *l* α 47, *l* β 3-4	201 5, *d* α 201-2	104, *d* α 82, *l* α 82	149	109, α 108 9 β 94-5, *l* α 109, *l* β 83	104	95	169, *d* α 145, *l* α 146, *l* β 153		
17	**1-Tetradecanol** (Myristyl alcohol)	39, 37 7	170-3[20]	74, 71	82	51 2 (cor)	67	123 5 (cor)	60 (cor)	62 (cor)	
18	**1,2,2-Trimethylcyclohexanol**	41 ($+\frac{1}{2}$ H_2O)	81 4-8[20]								$n_D^{18.4}$ 1 469, $D_4^{18.4}$ 0 9274
19	**Pinacol** (Tetramethylethylene glycol)	43, 45-6	172								Diacetate, 65, Hydrate, 46
20	*l*-**Menthol**	44, 42 5, 35, 33, 31, *d* 38-40 *d,l* 34	216	111-2, al , *d l* 103-4	119, 126	61-2	153		112, 129-31, ac a		Allophanate, 215
21	**1-Pentadecanol**	α 44, β 38 9		72, bz	72	45 8 (cor)		122 5 (cor)	60 4	72 (cor)	
22	**1,3,5-Trimethyl-1-cyclohexen-3-ol**	46	87-90[17]								$n_D^{19.3}$ 1 4735, $D_4^{20.2}$ 0 9132
23	*d,l*-α-**Propylbenzyl alcohol**	*d* 49, *l* 49	168-70[100]		99	58			91, 53-4		
24	**1,1,1-Trichloroisopropanol**	50-1	161 8[773]								Camphor-like odor
25	**1-Hexadecanol** (Cetyl alcohol)	50, 49 27	190[18]	73	82	58 4 (cor), 52	66	122 (cor)	66 8	69 5 (cor)	
26	**2,2,6-Trimethylcyclohexanol**	51, al	186-7[753]								n_D^{20} 1 4600, D_4^{20} 0 9128

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VI. ORGANIC DERIVATIVES OF ALCOHOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point °C	Phenyl urethane	1 Naphthyl urethane	4 Nitro benzoate	3 5 Di nitro benzoate	Hydrogen 3 nitro phthalate	Hydrogen-phthalate	Pseudo sac charine ether	Miscellaneous
27	**3,3,5-Trimethylcyclohexanol**	*trans* 52, 37	*cis* 201–3^{750}, *trans* 196 5^{770}								Acetate, *cis* b p 209–10, *trans* b p 209–10
28	**2,2-Dimethyl-1-propanol** (*tert*-Butyl carbinol, Neopentyl alcohol)	52–3	113	144, lgr	100				71		
29	**4-Methylbenzhydrol** (Phenyl 4-tolyl carbinol)	53, 58, 42									Ox → Phenyl 4-tolyl ketone, 60
30	**1-Heptadecanol**	α 54	310		88 5	53 8 (cor)	121 5 (cor)	121 0–8	66 6–7 (cor)	76 (cor)	
31	**Piperonyl alcohol**	58		102 5							Benzoate, 66, Allophanate, 176 5
32	**4-Methylbenzyl alcohol** (4-Tolyl carbinol)	59–60	217	79			117 8				
33	**1-Octadecanol** (Stearyl alcohol)	59 5	210 5^{15}	79–80		64 3 (cor)	66	119 (cor)	72 5 (cor)	74 5 (cor)	
34	**1-Nonadecanol**	62				58 9			71	80 5	
35	**Eicosanol**	65	220^{3}			69 4			77		Acetate, 40
36	**1-(1-Naphthyl) ethanol** (*d,l*-Methyl 1-naphthyl carbinol)	66							131–2, bz		
37	**1,2-Diphenylethanol** (*d l*-Benzyl phenyl carbinol)	67	167^{10}						131 (cor), eth -lt pet		
38	**4,4′-Dimethylbenzhydrol** (Di-4-tolyl carbinol)	68, al									Carbinyl bromide 48 5–9 lgr
39	**Benzhydrol** (Diphenyl carbinol)	68, lgr	288, 180^{20}	139 40, bz	135 6, 139	131–2	141		164 5		Acetate 41 2 Benzoate 88–9, al
40	**1-Glyceryl phenyl ether**	69, eth									Conc H_2SO_4 → pa red
41	**Erythritol** (*d,l*-1,2,3,4 Tetrahydroxybutane)	72									Tetraacetate, 53
42	**Dihydroxyacetone** (1,3-Dihydroxy-2-propanone)	72									Diacetate, 48, Dibenzoate, 120 5, 2,4-Dinitrophenylhydrazone, 277–8
43	**2-Nitrobenzyl alcohol**	74	270· 165^{20}								Benzoate, 101–2
44	**1,10-Decanediol** (Decamethylene glycol)	75 5, 72									1 10-Dibromide, 27 4 b p 162 5 5^{10}
45	**2,2,2-Tribromoethanol**	80	92–3^{10}								Urethane, 86–7
46	**10-Nonadecanol** (Myricyl alcohol)	85		96	54						
47	**Phenacyl alcohol** (α-Hydroxyacetophenone, Benzoyl carbinol)	86	118–20^{11}			128 6					Benzoate, 118 5, 3-Nitrobenzoate, 104 5
48	***n*-Triacontanol** (1-Hydroxytriacontane)	86 5, bz									Acetate, 69, pet eth
49	**2-Hydroxybenzyl alcohol** (Saligenin)	86–7									2-Benzoate, 66
50	***d*-Sorbitol**	89–93, 112 (anh)									Hexaacetate, 99, Hexabenzoate, 216–7, et ac
51	**3-Nitrophenacyl alcohol** (3-Nitrobenzoyl carbinol)	92 5–3 0, pa yel									Acetate, 53, eth -lgr , Semicarbazone, 214, al

*Derivative data given in order m p , crystal color, solvent from which crystallized

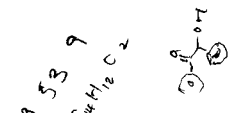


TABLE VI. ORGANIC DERIVATIVES OF ALCOHOLS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Phenylurethane	1 Naphthyl urethane	4-Nitro benzoate	3,5-Dinitrobenzoate	Hydrogen 3-nitrophthalate	Hydrogenphthalate	Pseudosaccharine ether	Miscellaneous
52	**4-Nitrobenzyl alcohol**	93	185[12]								Acetate, 78, Benzoate, 94 5
53	**4,4',4''-Trimethyltriphenyl carbinol** (Tris-*p*-tolyl carbinol)	96									Et eth 111 pet eth H_2SO_4 → gr-red
54	***meso*-Erythritol**	121, 120 (cor)	330								Tetraacetate 85 89 Dibenzylidene, 201-2
55	**4-Nitrophenacyl alcohol** (4-Nitrobenzoyl carbinol)	121									Acetate, 124, et ac-lgr, Phenylhydrazone, 178, bz
56	***d l*-Benzoin** (Benzoyl phenyl carbinol)	137, 133	344	165	140	123					4 Nitrophenylurethane 183 Acetate, 83
57	**Cinchol** (β-Sitosterol)	137					202 4				Acetate, 134, Benzoate, 145
58	**Furoin** (Furoyl furyl carbinol)	138 9 (cor), 135									Acetate, 76-7 Benzoate, 92-3
59	**Cholesterol** (anh) (*l*-Cholesterol)	148 5	360d	168	176	185 190 3			161		4-Nitrophenylurethane, 205 Benzoate, 151-2
60	**Triphenylmethanol** (Triphenyl carbinol)	161 2, bz	380								Acetate, 87 8
61	**Ergosterol**	165		185	202		202, chl				Acetate, 176, 180, eth, Benzoate, 168
62	***d*-Mannitol**	166, *l* 163-4, *d l*-α 168		303							Hexaacetate, 126, eth, Benzoate, 149-50, 147-8, al
63	**1,1,1-Tribromo-*tert*-butyl alcohol** (Brometone)	167-76, w-al									Acetate, 43 4, al, Benzoate, 27, al
64	**Dulcitol** (1,2,3,4,5,6-Hexanehexol)	188 5									Hexaacetate, 171, 168 9, abs al, Hexabenzoate, 189-91, eth-chl
65	**4,4',4''-Triaminotriphenyl carbinol** (Pararosaniline base)	205									4 4 ,4'' Triacetyl, 192 acet-eth Me eth 105, eth, 135, bz
66	***d*-Borneol** ("Borneo camphor")	208, 205, *d l* 210 5	212	138-9	132, *iso* 130, 127	153, *d l* 134, 137	154 5		161 4, aca, 165 (cor)		
67	***meso*-Inositol** (1,2,3,4,5,6-Hexahydroxycyclohexane)	225 (cor), 218					86, al				Hexaacetate, 212, subl, tol, Hexabenzoate, 258, al
68	***d*-Quercitol** (Pentahydrocyclohexane)	232, 234									Pentabenzoate, 155
69	**Pentaerythritol** (2,2-Bishydroxymethyl-1,3-propanediol)	262 253									Tetraacetate, 84, wh, al, Tetrabenzoate, 99-101, al

*Derivative data given in order m p, crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLE VII

Phenylurethane

$$ArOH + C_6H_5N{=}C{=}O \rightarrow C_6H_5NHCOOAr$$

Phenylurethane
(Phenylcarbamate)

From the phenol with phenylisocyanate without solvent

For directions and examples see Linstead, pp 34–35, J B McKinley, J E Nickels and S S Sidue, *Ind Eng Chem, Anal Ed*, **16**, 304 (1944)

From the phenol with phenylisocyanate in kerosene

See Cheronis, p 489

From the phenol with phenylisocyanate and a catalytic amount of pyridine

See Shriner, p 265

From the phenol with phenylisocyanate in toluene

See O L Brady and J Harris, *J Chem Soc*, **127**, 2175 (1925)

1-Naphthylurethane (α-Naphthylcarbamate) *

$$ArOH + 1\text{-}C_{10}H_7N{=}C{=}O \rightarrow 1\text{-}C_{10}H_7NHCOOAr$$

1-Naphthylurethane
(α-Naphthylcarbamate)

From the phenol with 1-naphthylisocyanate without solvent

For directions and examples see Cheronis, p 488, Linstead, pp 34–35, Vogel, p 683, Wild, p 68

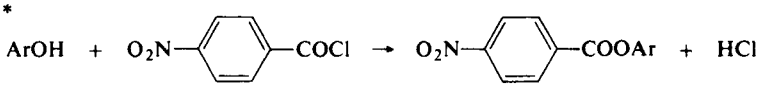
From the phenol with 1-naphthylisocyanate and a catalytic amount of pyridine, triethylamine or trimethylamine in ether

See Shriner, p 211, Vogel, p 683, Wild, p 68, H E French and A F Wirtel, *J Amer Chem Soc*, **48**, 1736 (1926)

From the phenol with 1-naphthylisocyanate and a catalytic amount of a tertiary aliphatic amine in petrol ether

See Cheronis, p 488, Vogel, p 684

p-Nitrobenzoate *



p-Nitrobenzoate

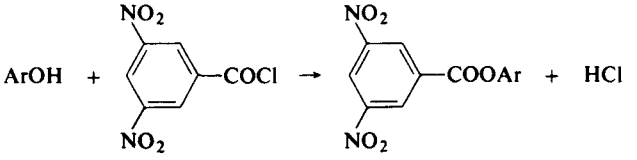
From the phenol with *p*-nitrobenzoyl chloride in pyridine

For directions and examples see Vogel, p 682, Wild, p 52

From the phenol with *p*-nitrobenzoyl chloride without solvent

See Wild, p 52

3,5-Dinitrobenzoate *



3,5-Dinitrobenzoate

From the phenol with 3,5-dinitrobenzoyl chloride in pyridine

For directions and examples see Cheronis, p 486, Vogel, p 682, Wild, p 65, R C Brown and R E. Kremers, *J Amer Pharm Ass*, **11**, 607 (1922), M Phillips and G L Keenan, *J Amer Chem Soc*, **53**, 1924 (1931)

From the phenol with 3,5-dinitrobenzoyl chloride without solvent

See Shriner, pp 212–213

Benzoate

$$ArOH + C_6H_5COCl \rightarrow C_6H_5COOAr + HCl$$

Benzoate

From the phenol with benzoyl chloride in aqueous sodium hydroxide

For directions and examples see Cheronis, pp 481–482, 487, Linstead, p 20, Wild, p 65

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

EXPLANATIONS AND REFERENCES TO TABLE VII (Continued)

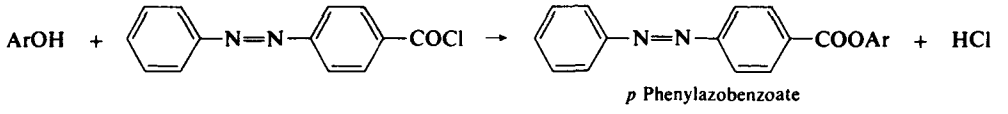
From the phenol with benzoyl chloride in pyridine
See Linstead, p 19

Acetate

$$ArOH + (CH_3CO)_2O \rightarrow \underset{\text{Acetate}}{CH_3COOAr} + CH_3COOH$$

From the phenol with acetic anhydride in aqueous sodium hydroxide
For directions and examples see Linstead, p 21, Vogel, p 682, Wild, p 64, F D Chattaway, *J Chem Soc*, 2495 (1931)
From the phenol with acetic anhydride and sodium acetate
See Linstead, p 21, Wild, p 64
From the phenol with acetic anhydride and a catalytic amount of sulfuric acid
See Cheronis, p 487

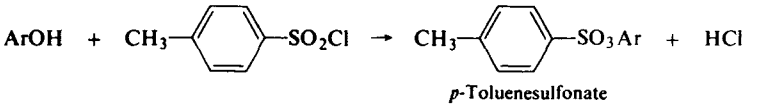
p-Phenylazobenzoate



p Phenylazobenzoate

From the phenol with *p*-phenylazobenzoyl chloride in pyridine
For directions and examples see Cheronis, p 486, E O Woolfolk and J M Taylor, *J Org Chem*, **22**, 827 (1957)

p-Toluenesulfonate



p-Toluenesulfonate

From the phenol with *p*-toluenesulfonyl chloride in pyridine
For directions and examples see Linstead, p 20, Vogel, p 684, Wild, p 66
From the phenol with *p*-toluenesulfonyl chloride in aqueous sodium hydroxide
See Linstead, p 20
From the phenol with *p*-toluenesulfonyl chloride and sodium hydroxide in aqueous acetone
See Wild, p 66

Bromo derivative *

$$ArOH + Br_2 \rightarrow \underset{\substack{\text{Mono}\\\text{bromophenol}}}{Ar(OH)Br} + HBr$$

$$ArOH + nBr_2 \rightarrow \underset{\substack{\text{Poly}\\\text{bromophenol}}}{Ar(OH)Br_n} + nHBr$$

From the phenol in aqueous methanol, in ethanol, in acetone or in dioxane with bromine in aqueous potassium bromide
For directions and examples see Cheronis, p 490, Shriner, p 264
From the phenol in aqueous hydrochloric acid with bromine in water
See Linstead, p 19
From the phenol in glacial acetic acid and bromine
See Wild, p 73
From the phenol with bromine in carbon disulfide
See Vogel, p 679
For a discussion on the effect of solvents in the bromination of phenols
See N D Cheronis, *Micro and Semimicro Methods (Technique of Organic Chemistry)*, Vol 6, Interscience, New York, 1954, pp 286–287

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

EXPLANATIONS AND REFERENCES TO TABLE VII (Continued)

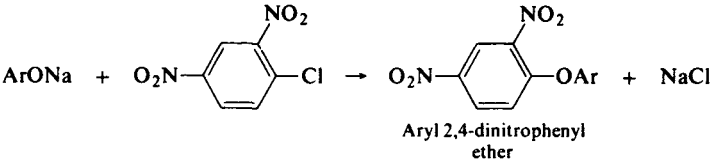
*Aryloxyacetic acid.**

$$ArONa + ClCH_2COOH \rightarrow \underset{\text{Aryloxyacetic acid}}{ArOCH_2COOH} + NaCl$$

From the phenol in aqueous sodium hydroxide with aqueous chloroacetic acid.

For directions and examples see: Cheronis, pp. 489–490; Linstead, p. 20; Shriner, p. 264; Vogel, p. 683; Wild, p. 72; C. F. Koelsch, *J. Amer. Chem. Soc.*, **53**, 304 (1931); N. V. Hayes and G. E. K. Branch, *J. Amer. Chem. Soc.*, **65**, 1555 (1943).

Aryl 2,4-dinitrophenyl ether.



Aryl 2,4-dinitrophenyl ether

From the phenol in aqueous sodium hydroxide with 2,4-dinitrochlorobenzene in alcohol.

For directions and examples see: Cheronis, pp. 490–491; Vogel, p. 684; Wild, p. 71; R. W. Bost and F. Nicholson, *J. Amer. Chem. Soc.*, **57**, 2368 (1935).

From the phenol with 2,4-dinitrochlorobenzene and aqueous potassium hydroxide.

See: Linstead, pp. 20–21.

NOTE: For additional information regarding directions and examples for the preparation of derivatives of phenols which are similar to those of alcohols (e.g., 1-naphthylurethanes, 3,5-dinitrobenzoates, etc.) see explanations and references to Table VI, p. 77, 78, 79.

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS

a) Liquids. (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point °C	Melting point, °C	n_D^{20}	D_4^{20}	Phenyl-urethane	α-Naphthyl-urethane	*p*-Nitro-benzoate	3,5-Di-nitro-benzoate	Bromo derivative	*p*-Toluene sulfonate	Miscellaneous
1	**2-Chlorophenol**	175.6	7	1.5473[40]	1.2410$^{18}_{15}$	121	120	115	143	*mono* 48.9, *di* 76	74	Aryloxyacetic acid, 145, 2,4-Dinitrophenyl ether, 99, 4,6-Bis(dimethylaminomethyl) deriv., 62.3, *p*-Phenylazobenzoate, 120-1
2	**2-Bromophenol**	195	5		1.4924		129			95	78	*p*-Phenylazobenzoate, 126-7
3	**2-Chloro-4-methylphenol** (2-Chloro-*p*-cresol)	195.6		1.5200[2]	1.1785[27]							Benzoate, 71.2, Aryloxyacetic acid, 108, Acetate, b.p. 238
4	**2-Hydroxybenzaldehyde** (Salicylaldehyde)	197 (cor.)	1.6	1.574	1.1690$^{20}_{20}$	133		128			63.4	Aryloxyacetic acid, 132, Acetate, 39
5	**3-Methylphenol** (*m*-Cresol)	203	12	1.540	1.03401	125, 121.2, al.-lgr	127.8	90	165.4 (cor.), al.	*tri* 84	51	Aryloxyacetic acid, 103, 2,4-Dinitrophenyl ether, 74, Benzoate, 55
6	**2-Ethylphenol**	207			1.0371[0]	143.4, 141		56.7	108			Aryloxyacetic acid, 141, Benzoate, 38-9, al.
7	**2-Isopropylphenol**	212	16	1.5315	1.012							Aryloxyacetic acid, 132.3, Methyl urethane, 96.7, 4,6-Dinitro deriv., 53
8	**2-Bromo-4-ethylphenol**	213.4									121	
9	**3-Ethylphenol**	217	−4		1.0250[0]	137, 138.8		68				Aryloxyacetic acid, 77, Benzoate, 52, 95% al.
10	**2-Allylphenol**	220	−6	1.5181	1.0255$^{15}_{15}$	116, 106.0 6.5				6-*mono* 50		Aryloxyacetic acid, 148.5-50
11	**2-Chloro-4,6-dimethylphenol**	221.3				129.30		94-5				
12	**Methyl salicylate** (Methyl 2-hydroxybenzoate)	224	−8	1.5369	1.184	117, bz		128				Acetate, 52, Benzoate, 92, al.
13	**2-Propylphenol**	224.6-6.6, 220.0-0.5		1.5280	1.000$^{15}_{15}$	111, formic a.			96			Aryloxyacetic acid, 99-100
14	**2-*sec*-Butylphenol**	227-8, 116[21]	12-3	1.5288	0.9876	86, lgr						Aryloxyacetic acid, 109.5-110
15	**4-Allylphenol**	230-1[750]	16	1.5441[18]	1.033[18]				103.0-3.5			Urethane, 122.3, Acetate, b.p. 238-9
16	**Ethyl salicylate** (Ethyl 2-hydroxybenzoate)	234	1.3	1.5226	1.131	98 100		107-8, yel., bz				Benzoate, 79-80, 87, al., 3,5-Dinitro deriv., 92-3
17	**2-*n*-Butylphenol**	234-7 113.5[14]		1.5180[25.5]	0.975				97			Aryloxyacetic acid, 104-5, Acetate, 105.5
18	**4-Isobutylphenol**	236, 235-9		1.5319[25]	0.9796$^{20}_{20}$							Aryloxyacetic acid, 124-5
19	**Carvacrol** (5-Isopropyl-2-methylphenol)	237.8	1	1.524	0.9760	134.5, 138	116, lgr	51	83, 76-7	46		Aryloxyacetic acid, 151, *p*-Xenylurethane, 116, al.
20	**Isopropyl salicylate** (Isopropyl 2-hydroxybenzoate)	240-2		1.50650	1.0729							3,5-Dinitro deriv., 101.2, al.

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS

a) Liquids. (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Phenylurethane	α-Naphthylurethane	*p*-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p*-Toluene sulfonate	Miscellaneous
21	**3-Methoxyphenol** (Resorcinol monomethyl ether)	243 244	−17 5				128 9			*tri* 104		Aryloxyacetic acid, 118, 111-3, w , 2,4-Dinitrophenyl ether, 87-8
22	**2-Allyl-6-methoxyphenol**	250-1 115[9]		1 5393				96 7				
23	**4-Allyl-2-methoxyphenol** (Eugenol)	254 8, 127[15]	−9 1, 16 9	1 5410	1 0664	95 5	122, lgr	81	130 8 (cor), al	*tetra* 118	85	Acetate, 29, al , Benzoate, 70, al , Aryloxyacetic acid, 81 100, 2,4-Dinitrophenyl ether, 115, N,N-Diphenylurethane, 108
24	**Isobutyl salicylate** (Isobutyl 2-hydroxybenzoate)	260 2		1 50872	1 0639							3,5-Dinitro deriv , 72 3, al
25	***d,l*-1,2,3,4-Tetrahydro-2-naphthol**	264[716]		1 5523[17]	1 0715[17]	99						Acetate, b p 169[34], Benzoate, b p 254 5[40]
26	**2-Methoxy-4-propenylphenol** (Isoeugenol)	267 5		*cis* 1 5700, *trans* 1 5782	*cis* 1 0851, *trans* 1 0852	*cis* 118, *trans* 152	149 50, lgr	109	154 8 (cor), *n*-BuOH			Acetate, 79-80, bz - lgr , Benzoate, *cis*, 68, *trans*, 103 4, al Aryloxyacetic acid, 116 (94), 2,4-Dinitrophenyl ether, 128
27	***n*-Butyl salicylate** (*n*-Butyl 2-hydroxybenzoate)	270-2, 259-60	−5 9	1 51148	1 0728							3,5-Dinitro deriv , 60 1, al , *p*-Nitrobenzyl ether, 92
28	**Isoamyl salicylate** (Isopentyl salicylate)	276 8		1 50799	1 0535							3,5-Dinitro deriv , 61-2, al
29	**3-Acetoxyphenol** (Resorcinol monoacetate)	283		1 5328								Saponification → resorcinol, 110 + ac a , Diacetate, b p 130 1[7]

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point °C	Phenyl urethane	α-Naphthyl urethane	*p*-Nitro benzoate	3,5-Dinitrobenzoate	Bromo derivative	*p*-Toluene sulfonate	Acetate	Benzoate	Miscellaneous
1	**2-Benzylphenol** (2-Hydroxydiphenylmethane) (Labile form)	21, stable 52, 54	312	117–8								Me eth, 30, Urethane, 110–1
2	**4-*n*-Propylphenol**	22	232	129			123			b p 245 6^{745}	38	n_D^2 1 5220
3	**4-*n*-Butylphenol**	22	248, 138–9[18]	115, al		67–8, yel al	92			b p 138–41[15]	27	$n_D^{25.5}$ 1 5165, D_4^{20} 0 978, Aryloxyacetic acid, 81
4	**4-*n*-Amylphenol** (4-*n*-Pentylphenol)	23	248–53								51 0 0 5, al	n_D^{2} 1 5272, D_{20}^{20} 0 9621, Aryloxyacetic acid, 90
5	**3-*n*-Propylphenol**	26	228				75 (117–8)					n_D^{20} 1 5223, D_4^{20} 0 9887, Aryloxyacetic acid, 96–7, lgr
6	**2-Chloro-3,4-dimethylphenol**	27, pet eth									87, aq al	
7	**2,4-Dichloro-3-methylphenol** (2,4-Dichloro-*m*-cresol)	27	240 5–2 5						92 0 2 5, al		90 5	Benzenesulfonate, 70, al
8	**2,4-Dimethylphenol** (*m*-4-Xylenol)	27 8	211 5 (cor)	103, 112, CCl_4	135	102, 105	164 6 (cor), 95% al				37 8, ac a	n_D^{14} 1 5420, D_4^{14} 1 0276, *p*-Xenylurethane, 184, Aryloxyacetic acid, 141, *p*-Phenylazobenzoate, 110–3 2 4-Dinitrophenyl ether, 102–3
9	**2-Ethoxyphenol**	28	217								31	Allophanate, 212
10	**2-Acetylphenol** (2-Hydroxyacetophenone)	28	215							89, al	87 8, al	n_D^{20} 1 5590, D_4^{20} 1 131, Semicarbazone, 210, Oxime, 118, Phenylhydrazone, 110
11	**2-Methylphenol** (*o*-Cresol)	31	191–2	141, 143	141 2, lgr	94	138 4 (cor), al	*di* 56	54 5, pyr			Aryloxyacetic acid, 152, *p*-Phenylazobenzoate, 110–11 5, 2,4-Dinitrophenyl ether, 90, N,N-Diphenylurethane, 73
12	**2-Methoxyphenol** (Guaiacol)	32, 28 2	205	136, al	118	93	141 2 (cor), al	4,5,6-*tri* 116, al	85, lgr		57 8	n_D^{20} 1 5441, $D_{(vac)}^{20.4}$ 1 1287, Aryloxyacetic acid, 116, 2,4-Dinitrophenyl ether, 97
13	**5-Fluoro-2-nitrophenol**	32, lgr									110 11	Me eth, 52, lgr
14	**3-Bromophenol**	33	236		108				52 4	b p 149[40]	86	Aryloxyacetic acid, 108, *p*-Phenylazobenzoate, 125–6
15	**3-Chlorophenol**	33	214		158	99	156				71	Aryloxyacetic acid, 110, 2,4-Dinitrophenyl ether, 75, *p*-Phenylazobenzoate, 127–8
16	**2-Bromo-4-chlorophenol**	33–4	123[10]								99–100	Aryloxyacetic acid, 139–40

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Phenyl urethane	α-Naphthyl urethane	*p*-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p*-Toluenesulfonate	Acetate	Benzoate	Miscellaneous
17	**4-Methylphenol** (*p*-Cresol)	36	202	115	146	98	188 6 (cor), al	*di* 49, *tetra* 198-9, al	69-70, al		70	*p*-Phenylazobenzoate, 134 5-6 5, N,N-Diphenylurethane, 94, *p*-Xenylurethane, 198
18	**2,4-Dibromophenol**	36, 40	238-9			183 5		6-*mono* 95-6	120	36	97 5	Aryloxyacetic acid, 153, 2,4-Dinitrophenyl ether, 135, Me eth , 61 3, b p 272, Et eth , 53 5
19	**4-Methyl-2-nitrophenol** (2-Nitro-*p*-cresol)	36 5, yel , w -al	125[22]				192				100-1	Me eth , 8 5, pa yel , b p 274, Et eth , b p 275 85 d
20	**4-Chlorophenol**	37, 43	217	148 5	166	171	186	2-*mono* 33 4, 2,6-*di* 90	71	7 8	88	Aryloxyacetic acid, 156, 2,4-Dinitrophenyl ether, 126, *p*-Phenylazobenzoate, 153-4, N, N-Diphenylurethane, 97
21	**2,4-Diethylphenol**	37-8	219	170 1								Aryloxyacetic acid, 67-8
22	**3-Fluoro-2-nitrophenol**	39, lgr									114	Me eth , 43 5, lgr
23	**2,6-Dichloro-4-methylphenol** (2,6-Dichloro-*p*-cresol)	39, 42	120-5[14]							48	9	NH_4 salt, 125, Me eth , b p 234
24	**3-Ethoxyphenol** (Resorcinol monoethyl ether)	40	246-7, pa yel , 254-8			183 5					97 5	2,4-Dinitrophenyl ether, 114-5, Picrate, 105-6, red, chl
25	**3-Iodophenol**	40		138		133	183		60-1	38, pet eth	72-3, pet eth	Aryloxyacetic acid, 115
26	**2-Benzoylphenol** (2-Hydroxybenzophenone)	41				124						*p*-Nitrobenzyl ether, 124 5, acet , Phenylhydrazone, 155, Semicarbazone, 250-1, Oxime, 141 3
27	**3-Methyl-2-nitrophenol** (2-Nitro-*m*-cresol)	41, yel , pet eth								59, al	79, al	Me eth , 54, yel , al
28	**Phenol**	41 8, 42	182, 183	126, bz	132 3, lgr	127, bz	145 8 (cor), al	*tri* 95	95 6, al		69	Aryloxybenzoic acid, 99, *p*-Phenylazobenzoate, 148-50, *p*-Xenylurethane, 173, N,N-Diphenylurethane, 105
29	**3-Fluoro-4-nitrophenol**	42, w or lgr	173[12]								118	Me eth , 56 5
30	**Phenyl salicylate** (Salol, Phenyl 2-hydroxybenzoate)	42, 38 8, 28 5 (three forms)		111-2, bz , 242		111				99 5	81	N,N-Diphenylurethane, 144

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Phenyl urethane	α-Naphthyl-urethane	*p*-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p*-Toluene sulfonate	Acetate	Benzoate	Miscellaneous
31	**2-Iodophenol**	43	186-7[160]	122						98 101	34, pet eth	D^{80} 1 8757 Aryloxyacetic acid, 135 *p*-Phenylazobenzoate 126 8 2,4 Dinitrophenyl ether, 95
32	**5-Bromo-2-nitrophenol**	44 yel								74 5		Me eth , 85 5 Et eth , 79 5 80 5, al
33	**2,4-Dichlorophenol**	45	210				142-3	68	125		97	Aryloxyacetic acid, 141, 135, β-Naphthylurethane, 166, 2,4-Dinitrophenyl ether, 119
34	**2-Nitrophenol**	45, yel , al	216		113	141	155	*di* 117	83	40 1, lgr	59	D_4^{40} 1 2942, Aryloxyacetic acid, 158, 2,4-Dinitrophenyl ether, 142, N,N-Diphenylurethane, 114, *p*-Phenylazobenzoate, 136 5 7 0
35	**5-Chloro-2-hydroxybiphenyl**	46									88	
36	**2-Chloro-5-methylphenol** (6-Chloro-*m*-cresol)	46	196						96	b p 122-3[11]	31 40	Benzenesulfonate, 99
37	**4-Bromo-5-isopropyl-2-methylphenol**	46, lgr				53 4						Me eth , b p 147 50[15]
38	**2-*tert*-Butyl-5-methylphenol** (6-*tert*-Butyl-*m*-cresol)	46-7	127[11]							b p 139[17]		Me eth , 22, b p 225 7
39	**3-Chlorocatechol** (3-Chloro-1,2-dihydroxybenzene)	46-8, 48 50	110 11[11]								110-11	2-Me eth , 31 5 3 0
40	**4-Ethylphenol** (4-Hydroxyethylbenzene)	47	219	120	128	80 1	132-3				59 60, al	n_D^{25} 1 5239, D_{20}^{20} 1 0123 Aryloxyacetic acid, 97, *p*-Phenylazobenzoate, 117-8
41	**3-Methyl-2,4,6-trichlorophenol** (2,4,6-Trichloro-*m*-cresol)	47, w	265						92 3	35, 32, eth	53	
42	**4-Chloro-2-methylphenol** (4-Chloro-*o*-cresol)	48	222-5								71	Aryloxyacetic acid, 115 7, Me eth , b p 213 5
43	**2,6-Dibromo-4-methylphenol** (2,6-Dibromo-*p*-cresol)	49, 54				141 2				67	94 5	
44	**Thymol** (2-Isopropyl-5-methylphenol)	49 7, 51 5, acet	233 5	107, aq al	160, lgr	70	103 2, al	55	71	b p 242 3	33	Aryloxyacetic acid, 149, 2,4-Dinitrophenyl ether, 67, *p*-Xenylurethane, 194, *p*-Phenylazobenzoate, 85 6

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Phenyl urethane	α-Naphthyl urethane	p-Nitrobenzoate	3,5-Dinitro benzoate	Bromo derivative	p-Toluene sulfonate	Acetate	Benzoate	Miscellaneous
45	**2-Hydroxy-4-methoxyacetophenone** (Peonol)	52.3, al								46.5		$n_D^{81.2}$ 1.54322, $D^{81.2}$ 1.310, *m*-Nitro benzoate, 109, *p*-Nitrophenylhydrazone, 238.9, ac a
46	**2-Benzylphenol** (2-Hydroxydiphenylmethane) (stable form)	52.54, labile 21-2	312	117.5-8.0, lgr								Benzyl eth., 38, me al
47	**2-Chloro-3-methylphenol** (2-Chloro-*m*-cresol)	55.6, 49.50	194						96		55.6	Benzenesulfonate, 58
48	**4-Methoxyphenol** (Hydroquinone monomethyl ether)	56.55	243.4							32	87, al	Aryloxyacetic acid, 110-2
49	**3-Methyl-6-nitrophenol** (6-Nitro-*m*-cresol)	56, yel., bz								48, al	77	Me eth., 62, Et eth., 55, pet eth., 50-1
50	**3-Bromo-4-methylphenol** (3-Bromo-*p*-cresol)	56	245								75	Me eth., b.p. 103-5[10]
51	**2-Phenylphenol** (2-Hydroxybiphenyl)	56, 67.5 (cor.)	275						64.6, dil al	62.5.3 pet eth	75-6	*p*-Phenylazobenzoate, 141.4, 2,4-Dinitrophenyl ether, 113-4
52	**2,6-Dibromophenol**	56-7	162[21]					93.3		46	68	Me eth., 13, b.p. 143-5[34], Et eth., 40.6
53	**4-*n*-Caproylresorcinol**	56.7, tol.-pet eth	343.5 d			89.91 pa yel., al						
54	**2-Bromo-4-methylphenol** (2-Bromo-*p*-cresol)	56.7	213-4, 102.4[20]						121	b.p. 120[4]		$D_{4}^{24.5}$ 1.547
55	**5-Bromo-3-methylphenol** (5-Bromo-*m*-cresol)	56-7, 54								83		Me eth., b.p. 139 40[20], Picrate, 130
56	**2-Cyclohexylphenol**	56.7										4,6-Dinitro deriv., 106, al., 2,4-Dinitrophenyl ether 76.7
57	**2,3-Dichlorophenol**	56.7	206					*di* 90				Me eth., 31
58	**4,6-Dibromo-2-methylphenol** (4,6-Dibromo-*o*-cresol)	57				136.7					62	
59	**3-Hydroxy-6-nitrobiphenyl**	57.8, bz				135	171					2,4-Dinitrophenyl ether, 131 4-Nitro deriv., 176-8
60	**2,3,6-Trichlorophenol**	58, pet eth									90, al	
61	**2,6-Dichloro-3-methylphenol** (2,6-Dichloro-*m*-cresol)	58	234						100-1, al		78.0 8.5, al	
62	**2,5-Dichlorophenol**	58-9, pet eth	212								69	
63	**4-Propylcatechol** (1,2-Dihydroxy-4-propylbenzene)	60, bz	175-80[30]									3-Me eth., b.p. 240-2, Di-me eth., b.p. 247
64	**1,2-Dihydroxynaphthalene** (1,2-Naphthalenediol)	60 (hyd.), 103-4 (anh.)									*di* 106	
65	**4-Isopropylphenol**	61	223-5								71-2	

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Phenyl urethane	α-Naphthyl urethane	*p*-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p*-Toluene sulfonate	Acetate	Benzoate	Miscellaneous
66	**5,6,7,8-Tetrahydro-2-naphthol**	61 5–2 5	275[705]			113, 106 5				b p 158[14]	96	N,N-Diphenylurethane, 114, Cinnamate, 77 5
67	**2,3,5-Trichlorophenol**	62 (hyg)									103, lgr	Me eth , 84, al
68	**2-Methyl-3,5,6-trichlorophenol** (3,5,6-Trichloro-*o*-cresol)	62, ac a									110, al	
69	**3,4-Dimethylphenol** (*o*-4-Xylenol)	62 5, w	225[757]	120, dil al	141 2, lgr		181 6 (cor), al	*tri* 171		22	58 5	Aryloxyacetic acid, 162 5 2 4-Dinitrophenyl ether 105–6 *p*-Xenylurethane, 183, al Picrate, 83 8, yel Me eth , 204 5, *p*-Phenylazobenzoate, 104–7
70	**2,6-Dinitrophenol**	63–4							135			Picrate, 122, Me eth , 118
71	**4-Bromo-3-methylphenol** (4-Bromo-*m*-cresol)	63 5, pet eth	118–23[7]						84 5		83 5	Benzenesulfonate, 79–80, Me eth , b p 108 5[12]
72	**4-Bromo-2-methylphenol** (4-Bromo-*o*-cresol)	64	235 (subl)							b p 132[12]	67 8	Et eth , b p 238–40
73	**1-Acetyl-2-naphthol**	64, lgr									85 6, pyr	
74	**4-Bromophenol**	64, 66 4	238	140	169	180	191	*tri* 171		22	58 5	Aryloxyacetic acid, 157, 2,4-Dinitrophenyl ether, 141, N,N-Diphenylurethane, 99, *p*-Phenylazobenzoate, 167 5–8 5
75	**2-Methyl-1-naphthol**	64–5								81 2	94–5	Picrate, 133–4
76	**4-Methylcatechol** (3,4-Dihydroxytoluene)	65, bz	252	*di* 166						*di* b p 260–4	*di* 58	Diaryloxyacetic acid, 58, Di-*p*-xenylurethane, 193
77	**3-Bromo-2-nitrophenol**	65–7, pet eth (anh), 35 (hyd), w							136 5–7 5, al		133	Me eth , 73
78	**4-Chloro-3-methylphenol** (4-Chloro-*m*-cresol)	66, 55	235		153–4				98		86	2,4-Dinitrophenyl ether, 112, Benzenesulfonate, 66
79	**4-Hydroxy-3-nitrobiphenyl**	66								85–6, lgr	111	Me eth , 91–2
80	**4-Methyl-2,3,5-trichlorophenol** (2,3,5-Trichloro-*p*-cresol)	66–7, ac a								37–8, w -ac a	89, w -al	
81	**2,6-Dichlorophenol**	67	219–20, 80–5[4]								74 0–4 5	Me eth , b p 105–6[20]
82	**3,5-Dimethylphenol** (*m*-5-Xylenol)	68	219 5 (subl)	148, 151		109	195 4 (cor), al	*tri* 166	83, ac a	b p 130[26]	24	Aryloxyacetic acid, 111, 81, 2,4-Dinitrophenyl ether, 100, *p*-Phenylazobenzoate, 104 5–6 5, *p*-Xenylurethane, 150
83	**2-Bromo-6-nitrophenol**	68, yel								39 5–40		Me eth , 67

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Phenyl urethane	α Naphthyl urethane	*p*-Nitrobenzoate	3,5 Dinitrobenzoate	Bromo derivative	*p*-Toluenesulfonate	Acetate	Benzoate	Miscellaneous
84	**3-Methylcatechol** (2,3-Dihydroxytoluene)	68, bz										2-Me eth, 39, b p 204, Di-Me eth, b p 202-3
85	**3,5-Dichlorophenol**	68	233					*tri* 189	116	38	55	
86	**2,6-Di-iodophenol**	68								107, aca		Me eth, 35, ac a, Et eth, 41-2, ac a
87	**2,4,5-Trichlorophenol**	68, pet eth									92 3, al	Aryloxyacetic acid, 157, Me eth, 77-5, al
88	**5,6,7,8-Tetrahydro-1-naphthol**	68 5-9 0, 74-5	264 5-5 0							73 5	46	Me eth, b p 124[10], Et eth, b p 259[705]
89	**2-Bromo-4,6-dichlorophenol**	68 9	268 d						82-3			2,4-Dinitrophenyl ether, 140-1
90	**2-Bromo-4-methyl-6-nitrophenol** (2-Bromo-6-nitro-*p*-cresol)	69, yel							128	110-11		
91	**2,4,6-Trichlorophenol**	69 5, ac a, 68	245			105 6				b p 261-2	75 5, al	Aryloxyacetic acid, 182 6, 2,4-Dinitrophenyl ether, 136, N,N-Diphenylurethane, 143, Me eth, 61-2, al, Et eth, 43-4
92	**2,4,6-Trimethylphenol**	70, 69	220	141-2 lgr				*di* 158			62, pet eth	Aryloxyacetic acid, 142
93	**2,3,4,6-Tetrachlorophenol**	70	150[15]							65 6	108	Me eth, 64-5, Et eth, 55, Benzenesulfonate, 127
94	**1-Chloro-2-naphthol**	70, lgr, 72								42 3	99 100	Me eth, 70-1, Et eth, 58
95	**Methyl 3-hydroxybenzoate**	70	280	115-6, bz								
96	**2-Methyl-6-nitrophenol** (6-Nitro-*o*-cresol)	70, w -al							66, al		42, al	Me eth, 30, pet eth, Et eth, b p 249 50, yel
97	**3-Propylcatechol** (1,2-Dihydroxy-3-propylbenzene)	70-2, pet eth										3-Me eth, b p 144-6[25], Di-Me eth, b p 134-7[22] Aryloxyacetic acid, 132, *p*-Xenylurethane, 196
98	**2,4,5-Trimethylphenol** (Pseudocumenol)	71	232	110				35		34 0-4 5, pet eth	63, al	Aryloxyacetic acid, 132, *p*-Xenylurethane, 196
99	**4,6-Dichloro-3-methylphenol** (4,6-Dichloro-*m*-cresol)	72	235-6, 110[18]						104-5, al		57 5, al	n_D^{20} 1 5722, Benzenesulfonate, 86, al
100	**2,4-Di-iodophenol**	72, w							165-7 (cor)	70-1, w -al	98	Me eth, 68, w -al, Et eth, 46, me al, 51
101	**2-Chloro-4,5-dimethylphenol**	72									43	
102	**3,5-Dimethylcatechol** (4,5-Dihydroxy-*m*-xylene)	73-4, w								*di* 161, ac a		4-Me eth, b p 227-8

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Phenyl urethane	α-Naphthyl-urethane	*p*-Nitrobenzoate	3,5 Dinitrobenzoate	Bromo derivative	*p*-Toluene sulfonate	Acetate	Benzoate	Miscellaneous
103	**5-Chloro-2-methylphenol** (5-Chloro-*o*-cresol)	73 4	225					*tri* 190	110		53 4	Me eth , b p 206-8, Et eth , b p 210 20
104	**2,5-Dibromophenol**	73 4							110			
105	**3-Iodo-2-nitrophenol**	73 5, w								102 5		Me eth , 83-4
106	**Ethyl 3-hydroxybenzoate**	73 8, bz	295 282							35	58, al	
107	**1,3-Dibromo-2-naphthol**	75								102		
108	**2,5-Dimethylphenol** (*p*-2-Xylenol)	75, al -eth	212	160 1, bz , 162, 166	172 3 lgr	87	137 2 (cor)	*tri* 178			61	Aryloxyacetic acid, 118 *p*-Xenylurethane, 162, *p*-Phenylazobenzoate, 95 5-7 5, Picrate, 81-2, or , al
109	**2,3-Dimethylphenol** (*o*-3-Xylenol)	75, w -al		193 5								Aryloxyacetic acid, 187, *p*-Phenylazobenzoate, 134 6, Me eth , 29, b p 199, Et eth , 10, b p 212 5
110	**8-Hydroxyquinoline** (Oxine)	75 6, dil al	266 6[752]			174 5			115	b p 280	118 20, al	Picrate, 203 4, Methiodide, 143 d (hyd)
111	**4-(Dimethylamino) phenol**	76							130	78		
112	**3-Chloro-4-hydroxybiphenyl**	76 7, 80									110 11, 95 7	2,4-Dinitrophenyl ether, 109-11
113	**3-Bromo-2,6-dichlorophenol**	76 5, lgr	264-70[751]								102	Me eth , b p 260 5[50]
114	**2-Methyl-4,5,6-trichlorophenol** (4,5,6 Trichloro-*o*-cresol)	77, pet eth								45, w -me al		Me eth 51 5, al
115	**2-Bromo-4-methyl-3-nitrophenol** (2-Bromo-3-nitro-*p*-cresol)	77, yel , w								81		Me eth , 74
116	**3-(Diethylamino) phenol**	78	276 80								22 3	Methylurethane, 85 6, Methiodide, 140 3
117	**3-Phenylphenol** (3-Hydroxybiphenyl)	78, 75	>300						52 5		60 1, al	Et eth , 34
118	**4-Bromo-2,6-dinitrophenol**	78 yel							136, al	110 5, bz	154, al	Me eth , 88, Et eth , 66
119	**4-Chloro-2-iodophenol**	78		128						57	88, 84	
120	**2,4-Diaminophenol** (4 Hydroxy-*m*-phenylenediamine)	78 80 unstable										Me eth , 68, Et eth , 67 8, 4,N-Acetyl, 249, N,N'-Diacetyl, 220-2, O,N,N'-Triacetyl, 180 2, N,N'-Dibenzoyl, 253-4, Picrate, 120 d , yel
121	**4-Methyl-3-nitrophenol** (3-Nitro-*p*-cresol)	79, yel , eth							91			Me eth , 17, b p 266 7
122	**2,3,4,6-Tetramethylphenol** (Isodurenol)	79 81	230 50	178 9, wh , w -al							71-2, wh , w -al	
123	**2-Bromo-4,5-dimethylphenol**	80, pet eth									51	Me eth , b p 86[3], *o*-Nitrobenzoate, 151-2

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point °C	Phenyl urethane	α Naphthyl urethane	*p*-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p* Toluenesulfonate	Acetate	Benzoate	Miscellaneous
124	**5-Bromo-2-methylphenol** (5-Bromo-*o*-cresol)	80									41	
125	**4-Iodo-2-nitrophenol**	80 1									102 3	Me eth , 98, Et eth , 80
126	**4-Hydroxy-3-methoxybenzaldehyde** (Vanillin)	81	285	116 7					115	102	78	Aryloxyacetic acid, 187 2,4-Dinitrophenyl ether, 131, 2,4-Dinitrophenylhydrazone, 271 d
127	**3,5-Dibromophenol**	81								53	77	Me eth , 140
128	**4-Chloro-2,6-dinitrophenol**	81								110 11		Me eth , 66 Et eth , 54 5
129	**4-Methyl-2-naphthol**	81 2								117 8		
130	**5-Chloro-2,3-dimethylphenol**	81 2									88, al	
131	**3-Methyl-2,4,6-tribromophenol** (2,4,6-Tribromo-*m*-cresol)	81 5-2 0, al							113 4, al	68, al	84 5 al	*p*-Phenylazobenzoate, 130-2
132	**2-Hydroxy-1-naphthaldehyde**	82	192[2]							87, al *tri* 124, al		Me eth , 84 Et eth , 115, Oxime 157, Picrate, 120
133	**3,4-Di-iodophenol**	83									123	
134	**2-Hydroxyazobenzene** (2-Benzeneazophenol)	83								−20	93 pet eth	Me eth , 41, Et eth , 44 Cu deriv , 225 6, al
135	**5-Propylresorcinol** (1,3-Dihydroxy-5-propylbenzene, Divarinol)	83 4, bz , (anh), 51, w								*di* 12-5		Di-Me eth , b p 147[29]
136	**2,3,4-Trichlorophenol**	83 5, lgr									141, al	Me eth , 69 5, al
137	**4-Benzylphenol** (4-Hydroxydiphenylmethane)	84	321, 308								*mono* 87, pet	2,4-Dinitrophenyl ether, 75 6, Benzyl eth , 49 5, al
138	**4-Chloro-2,3-dimethylphenol**	84									102	
139	**2,4-Dimethyl-1-naphthol**	84 5	169 70[10]	174 5								Me eth , b p 150-1[12], Picrate 143 4, dk red
140	**4-Methyl-1-naphthol**	84 5									81	
141	**1-Bromo-2-naphthol**	85								56		Me eth , 85
142	**3-Bromo-2-naphthol**	85								94		Me eth , 77-8
143	**2-Nitroresorcinol** (1,3-Dihydroxy-2-nitrobenzene)	85, or -red, w -al								*di* 63		Di-Me eth , 131, yel , al Di-Et eth , 106 7
144	**3-(Dimethylamino)phenol** (3-Hydroxydimethylaniline)	85	265-8, 138[10]							36 5, b p 160[5]	94	Picrate, 162, Methylurethane, 87, Ethylurethane, 150, 99 100, Me eth , b p 237, Et eth , b p 247
145	**3-Hydroxy-2-nitrobiphenyl**	85-6, bz , 81 2, yel , al								61 5 2 5	131 0 2 5	Benzenesulfonate, 130-1, 4-Nitro deriv , 126 7, 6-Nitro deriv , 214, 4,6-Dinitro deriv , 168 70
146	**2-Hydroxybenzyl alcohol** (Saligenin)	86 7, w									*di* 51, 70% al	Aryloxyacetic acid, 120, w

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Phenylurethane	α-Naphthylurethane	*p*-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p* Toluenesulfonate	Acetate	Benzoate	Miscellaneous
147	**4,6-Dinitro-2-methylphenol** (4,6-Dinitro-*o*-cresol)	86 5								95-6	135, 132	
148	**3-Nitrocatechol** (1,2-Dihydroxy-3-nitrobenzene)	86 5, yel, pet eth								*di* b p 103-4[1]	2-*mono* 66	1-Me eth, 62, yel, 2-Me eth, 102-3, Di-Me eth, 64-5, al
149	**4-Chloro-2-nitrophenol**	86-7								47 8		Me eth, 98 Et eth, 61-2
150	**2,4,5-Tribromophenol**	87, CH_2Cl_2-pet eth									99	Me eth, 105, *o*-Br-*p*-toluenesulfonate, 107 8, al
151	**4-Bromocatechol** (4-Bromo-1,2-dihydroxybenzene)	87									*di* 111	1-Me eth, 65
152	**4-(Methylamino) phenol**	87, bz							135, bz - lgr	43, pet eth	173-4, 50% al	Aryloxyacetic acid, 213 4, Me eth, 37
153	**2-Methyl-3,4,5-tribromophenol** (3,4,5-Tribromo-*o*-cresol)	89, pet										
154	**2-Amino-6-methylphenol** (6-Amino-*o*-cresol)	89, w							89, 90	78-9		N-Acetyl, 100 1
155	**N-Benzylidene-2-aminophenol**	89								93-6		Et eth, b p 215-6[20]
156	**3-Nitro-2,4,6-tribromophenol**	89-90, lgr							146-7, al			Me eth, 82, al, Et eth, 79, eth
157	**2-Amino-6-chloro-4-methylphenol** (2-Amino-6-chloro-*p*-cresol)	89-90										N,O-Diacetyl, 162 3
158	**1,3-Dimethyl-2-naphthol**	89-90		197					85 o			Picrate, 132-3
159	**2-Propylhydroquinone** (1,4-Dihydroxy-2-propylbenzene)	90, bz										Di-Me eth, b p 240-6
160	**4-Chlorocatechol** (4-Chloro-1,2-dihydroxybenzene)	90-1	136[8.5]							*di* b p 145-7[7]	*di* 96-7, eth	Di-Me eth, b p 242 4
161	**3-Chloro-4,6-dimethylphenol**	90-1										
162	**2-Methyl-3,4,6-tribromophenol** (3,4,6-Tribromo-*o*-cresol)	91, pet								76-7, ac a	85, 133, bz	Me eth, 71, al
163	**5-Chloro-2,4-dinitrophenol**	92								69		Me eth, 105, Et eth, 112, 6-Nitro deriv, 113 5
164	**4-Chloro-2,6-dibromophenol**	92							107-8			2,4-Dinitrophenyl ether, 145-6 Me eth, 74
165	**4-Bromo-2-nitrophenol**	92, 89								75		Me eth, 88 Et eth, 47, Benzenesulfonate, 83-4
166	**4-*tert*-Amylphenol**	92-3	260-5	108					55		61	
167	**4-Hydroxyphenylethyl alcohol** (Tyrosol)	93, chl	310, 156[15]							*β-mono* 59, eth - lgr *di* b p 187[18]	*di* 111, al	4-Et eth, 40

*Derivative data given in order: m.p, crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Phenyl urethane	α-Naphthyl urethane	*p* Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p* Toluene sulfonate	Acetate	Benzoate	Miscellaneous
168	**4-Iodophenol**	93 4, w		148, bz					99, me al	32	119	Aryloxyacetic acid 156, N,N-Diphenylurethane 127, 2,4-Dinitrophenyl ether, 156
169	**1-Naphthol** (α-Naphthol)	94	278-80	177-8, al	152, lgr	143, 140	217 4 (cor), yel , al	2,4-*di* 105	89	48-9, al	56, al	Aryloxyacetic acid, 193 5, *p*-Xenylurethane, 190 2,4-Dinitrophenyl ether, 128, *p*-Phenylazobenzoate, 118-9
170	**2-Iodo-4-nitrophenol**	94, 86-7								68		Me eth , 97, Et eth , 96
171	**2,4,6-Tribromophenol** (Bromol)	95, HCOOH 94, ac a (+1 ac a)			153	153	174	*tetra* 120	113, al	82, 87 ac a	81, al	Aryloxyacetic acid, 200, N,N-Diphenylurethane, 153, 2,4-Dinitrophenyl ether, 137 8 *p*-Phenylazobenzoate, 116-9
172	**2,2'-Stilbenediol** (2,2'-Dihydroxystilbene)	α 95, al , β 197, al									α *di* 107-8	β Di-Me eth 136
173	**6-Chloro-1-naphthol**	95								47		Picrate, 165
174	**3-Bromo-4-hydroxybiphenyl**	95								74 5	93 4	Benzenesulfonate 102 3
175	**1,3,6-Trihydroxynaphthalene** (1,3,6-Naphthalenetriol)	95								*tri* 112-3		Me eth , 103-4
176	**2,3,4-Tribromophenol**	95, w -HCOOH										Me eth , 106
177	**2,3,5-Trimethylphenol**	95 6	233	174, pet eth						241	50, pet eth	
178	**2-Naphthyl salicylate** (Betol)	95 5, stable, 93 5, labile		268, yel , ac a						136, al		
179	**3-Amino-2,4,6-trichlorophenol**	95 5-6 0, lgr										N-Acetyl, 185 0 6 5, tol
180	**3-Acetylphenol** (3-Hydroxyacetophenone)	96	296, 153[5]							44 0-4 5	52-3	D^{109} 1 099, n_{α}^{109} 1 5348 Me eth b p 240, Semicarbazone, 194-6
181	**5-Iodo-2-nitrophenol**	96, yel , pet eth								95	122	Me eth , 92, Et eth , 86-7
182	**2-Methoxy-5-propenylphenol**	96, 92	147[19]							101		Et eth , 49 50
183	**2-Methyl-4-nitrophenol** (4-Nitro-*o*-cresol)	96, yel , bz , 30-40 (+1 H_2O), w	186 90						107, al		128	Me eth , 64, al , Et eth , 71, w -al
184	**2-(Methylamino)phenol**	96-7, 86 7, pet eth									157 9	N-Benzoyl, 160 1, Me eth , 33 0-3 5
185	**3-Nitrophenol**	97	194[70]	129	167	174	159	*di* 91	112 3	55-6	95	D^{100} 1 2797, Aryloxybenzoic acid, 156, 2,4-Dinitrophenyl ether 136, *p*-Phenylazobenzoate, 160 5-2 5

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point °C	Phenyl urethane	α-Naphthylurethane	p-Nitrobenzoate	3,5 Dinitrobenzoate	Bromo derivative	l Toluene sulfonate	Acetate	Benzoate	Miscellaneous
186	**2,3-Dibromo-5,6-dimethylphenol**	97, aq al								78, pet eth	153, al	
187	**5-Methyl-1-naphthol**	97-8									77 8	
188	**3-Acetylcatechol** (2,3-Dihydroxyacetophenone)	97-8, yel, w								*di* 109, bz		1-Me eth, 152 3 Di-Me eth, 48, Oxime 96 7 Semicarbazone, 166 7
189	**2-Cyanophenol**	98									106, pet eth	$D_4^{99.6}$ 1 1052 $n_\alpha^{99.6}$ 1 53716
190	**3-Chloro-4,5-dimethylphenol**	98									42, al	
191	**2,5-Di-iodophenol**	99, pet eth								70, ac a		
192	**4-*tert*-Butylphenol**	100	237	148 5	110			50 *di* 64 7	109 10		81-2	Aryloxyacetic acid, 86 5, 2,4-Dinitrophenyl ether 108 10 Benzenesulfonate 70 1
193	**3,4,5-Trichlorophenol**	101, lgr, 91	271 7^{746}								120, al	Me eth, 130, b p 256 61, *m*-Nitrobenzenesulfonate, 176
194	**3,5-Dibromo-2-methylphenol** (3,5-Dibromo-*o*-cresol)	101 98 101									91-3	
195	**4,6-Dinitro-3-methylphenol** (4,6-Dinitro-*m*-cresol)	101 73 4							110 11		95	Me eth, 115 Et eth, 97
196	**2-Acetyl-1-naphthol**	102, pa grn, al, 98, br-yel, bz	325, sl d							107 5, al	128, al	
197	**2-Methyl-3,4,5-trinitrophenol** (3 4,5-Trinitro-*o*-cresol)	102, or yel, acet										Me eth, 111 2, w-al
198	**4-Methyl-2,3,6-tribromophenol** (2,3,6 Tribromo-*p*-cresol)	102, pet								77, lgr		
199	**1-Nitro-2-naphthol**	103, yel, al								61, pet eth		*m*-Nitrobenzenesulfonate, 176, ac a, Et eth, 104-5, yel, al
200	**3,3'-Dihydroxydiphenylmethane**	103, yel, al								*di* 57 5 8 5, lgr		
201	**4-Chloro-2-naphthol**	104								56		
202	**3,5-Di-iodophenol**	104, w								79, me al	93	Me eth, 85, pet eth, Et eth, 30, me al
203	**2-Bromo-4-methyl-5-nitrophenol** (2-Bromo-5-nitro-*p*-cresol)	104, yel								121		Me eth, 94, yel, eth
204	**3-Hydroxybenzaldehyde** (3-Formylphenol)	104, 108 (cor)	240	158-60						b p 203	38, 48 5-9 0	Aryloxyacetic acid, 148, 2,4-Dinitrophenylhydrazone, 257d, Semicarbazone, 198
205	**5-Methyl-2-naphthol**	104 5									107 8	Picrate, 156 7

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Phenyl urethane	α-Naphthyl urethane	*p*-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p*-Toluenesulfonate	Acetate	Benzoate	Miscellaneous
206	**3-Hydroxy-4-nitrobiphenyl**	104 5, al				157	199					
207	**Catechol** (Pyrocatechol, 1,2-Dihydroxybenzene)	105	245 6	*di* 169	175	*mono* 159 *di* 169, al	*di* 152	*tetra* 192 3, wh - vlt		*mono* 57 8, *di* 65	*mono* 181, 131 *di* 84, al - eth	Aryloxyacetic acid 136 8 Monobenzenesulfonate *monoacetate*, 86 me al Dibenzenesulfonate, 155-6, acet
208	**2,4-Dibromo-1-naphthol**	105, 111								92-3		Me eth , 54-5, al *sym* -TNB add comp , 97, Picrate, 97, yel
209	**2,4-Dichloro-5-nitrophenol**	105 6									111 2	*m*-Nitrobenzoate, 154, *o*-Nitro-*p*-toluenesulfonate, 143
210	**Chlorohydroquinone**	106								*mono* 62, *di* 72, 99		
211	**4,6-Dinitro-2-iodophenol**	106 7, w							149	113		
212	**1,6-Dibromo-2-naphthol**	106-7 (+1 ac a , 84)								125		Me eth , 102, Et eth , 94
213	**2-Amino-5-chloro-4-methylphenol** (2-Amino-5-chloro-*p*-cresol)	106-7										N-Acetyl, 115, aq al , Me eth , 106, lgr
214	**4-Chlororesorcinol** (4-Chloro-1,3-dihydroxybenzene)	106-7 89	259, 147[18]						*di* 46 7	*di* 66		3-Me eth , 79-80 Di-Me eth , b p 135 7[17]
215	**2-Hydroxypyridine** (α-Pyridone)	106 7, bz	280 1			120			158-9, 53	b p 150-60[0 09]	42	Picrate, 176 7, Benzyl eth , 42
216	**2-Phenoxyphenol** (2-Hydroxydiphenyl ether)	106 7	151 5[11]							b p 358-60	48 5	Me eth , 79, lgr
217	**5-Methylresorcinol** (Orcinol, 3,5-Dihydroxytoluene)	106 5 8, 56 8 (+1 H_2O)	287-90	154	160, lgr	214	190	*tri* 104		*di* 25	*di* 88, al	Aryloxyacetic acid 217 *p*-Xenylurethane, 196 2,4-Dinitrophenyl ether, 153 4
218	**6-Amino-4-chloro-2-methylphenol** (6-Amino-4-chloro-*o*-cresol)	107								2,3-*di* 196		
219	**2,4-Dichloro-1-naphthol**	107-8								74-6		Me eth , 58
220	**1,2-Dihydroxynaphthalene** (1,2-Naphthalenediol, β-Naphthohydroquinone)	108, 105 5								*di* 104-6, 109, ac a	*di* 106	Diaryloxyacetic acid, 104 6, 1-Me eth , 90 5, Di-Me eth , 31
221	**1,2,3,4-Tetrahydroanthranol**	108, lgr								109, al	142	Me eth , b p 197[14]
222	**4-Methyl-5,6,7,8-tetrahydro-2-naphthol**	108				114 6					89	
223	**4-Acetylphenol** (4-Hydroxyacetophenone)	109								54		Semicarbazone, 199, 2,4-Dinitrophenylhydrazone 261 5 (cor), br , al
224	**3-Methyl-2,4,6-trinitrophenol** (2,4,6-Trinitro-*m*-cresol)	109 10, yel , al								135, pa yel , bz	140	Di-Me eth , 155, al , Di-Et eth , 36 7, w -al

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Phenyl urethane	α-Naphthyl urethane	*p*-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p*-Toluene sulfonate	Acetate	Benzoate	Miscellaneous
225	**2-Iodo-6-nitrophenol**	109 10								96-7		Me eth , 96-7
226	**Resorcinol** (1,3-Dihydroxybenzene)	110 (stable), 108 8 5 (labile)	280 8 (cor), 275 9	*di* 164, chl		*di* 182 175	*di* 201	*tri* 112	*di* 80-1, acet - dil al	57-8, dil al	*mono* 135-6, *di* 117, dil al	Aryloxyacetic acid, 175, 195, 2,4-Dinitrophenyl ether, 194, N,N-Diphenylurethane, 194, Me eth , 43-4, me al
227	**2,2 -Biphenol** (2 2 Dihydroxybiphenyl)	110 109, tol	326	*di* 145, dil al				*di* 188	190	*di* 95, xyl	*di* 101, al	Di-Me eth , 155, al , Di-Et eth , 36-7, w -al
228	**Bromohydroquinone**	110						*di* 186		*di* 72		
229	**4-Hydroxy-2'-nitrobiphenyl**	110 1, 116								122	156-7	Aryloxyacetic acid, 160-1, Benzenesulfonate, 106, yel , al , Me eth , 60 0-0 5, Et eth , 51 5-nitro deriv , 151-2
230	**7-Methyl-1-naphthol**	110-11								39-41		Picrate, 164-5
231	**1-Methyl-2-naphthol**	111								66	116 7	Picrate, 163 4
232	**2-Chloro-4-nitrophenol**	111, w								63		Me eth , 98, Et eth , 82, 142
233	**2-Amino-6-nitrophenol**	111-2 aq al								2-*mono* 102-3 (hyd), 122 (anh)		Me eth , 198
234	**2,4,6-Tribromoresorcinol** (1,3-Dihydroxy-2,4 6-tribromobenzene)	112, w								*mono* 114, CS_2, *di* 108	*mono* 120, chl - pet - eth	Me eth , 104, Di-Me eth , 68-9, w - al
235	**4',5-Dimethyl-2-hydroxyazobenzene** (2-*p*-Toluene-azo-*p*-cresol)	112 3, tol								91, yel , ac a	95, yel , al	Et eth , 43, ac a , Propionate, 62, lgr
236	**4-Hydroxyphenanthrene** (4-Phenanthrol)	112-3 5, pet eth								58-9, al		Me eth , 68, me al
237	**2,2'-Dihydroxy-3,3'-dimethylbiphenyl**	113, pet eth									*di* 147, me al	
238	**2,6-Dinitro-4-iodophenol**	113, w							138		175	
239	**2-Chloro-4,6-dinitrophenol**	113, 110							155			
240	**4,4'-Dihydroxy-2,2'-dimethylbiphenyl**	114								*di* 75	*di* 127	
241	**2-Bromo-4-nitrophenol**	114								62, 86	131-2	Me eth , 106, Et eth , 98, yel
242	**4-Nitrophenol**	114		156	150-1	159	186, 188 (+1 ac a)	2,6-*di* 142	97	81-2, w -al	142 5	Aryloxyacetic acid, 187, 2,4-Dinitrophenyl ether, 120, N,N-Diphenylurethane, 112, *p*-Phenylazobenzoate, 203-6
243	**2,4-Dinitrophenol**	114				139		6-*mono* 118	121	72	132	2,4-Dinitrophenyl ether, 248
244	**2,3,5-Tri-iodophenol**	114, bz - lgr								123		Et eth , 121

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Phenyl urethane	α-Naphthyl urethane	*p*-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p*-Toluene sulfonate	Acetate	Benzoate	Miscellaneous
245	**4-Hydroxy-3-methoxybenzyl alcohol**	115								4-*mono* 51, *di* 48, bz-lgr	4-*mono* 90, et ac-al, *di* 121	4-Et eth, 56 7
246	**1-Hydroxyfluorenone**	115, yel								130–1, aq al	128–9	Me eth, 141 5 2 5 Oxime, 169–70, Phenylhydrazone, 173–4
247	**Ethyl 4-hydroxybenzoate**	115, 116	297–8								94, eth	
248	**4-Chloro-3,5-dimethylphenol**	115–6								47 8		
249	**3,5-Dimethyl-2,4-dinitrophenol**	115–6, 106							171	148	156	
250	**4-Bromo-1,5-dihydroxynaphthalene** (4-Bromo-1,5-naphthalenediol)	116								*di* 138		Di-Me eth, 115
251	**3-Benzoylphenol** (3-Hy	116 al										Oxime *anti* 76 bz *syn* 126 (on heating *anti*)
252	**4-Hydroxybenzaldehyde**	116–7									90	Aryloxyacetic acid 198, 2,4-Dinitrophenylhydrazone 270 1
253	**3-Bromo-1,2-dihydroxynaphthalene** (3-Bromo-1,2-naphthalenediol)	117								*di* 160		Naphthalene add comp, 100
255	**Phloroglucinol** (1,3,5-Trihydroxybenzene)	117 (+2H$_2$O), 217–9 (anh)				283		*tri* 151		*tri* 104	*tri* 185	Picrate, 101–3
256	**2,4'-Dihydroxydiphenylmethane**	117–8, w-al								*di* 70, ac a	*di* 108	Di-Me eth, 26 Di-Et eth, 60, w-al
257	**2,3,5,6-Tetramethylphenol** (Durenol)	118, wh, pet	249					4-*mono* 118, or, dil al				
258	**4-Amino-2-methyl-6-nitrophenol** (4-Amino-6-nitro-*o*-cresol)	118, al								4-*mono* 217, yel, al		
259	**2,4-Dibromo-6-nitrophenol**	118, ac a							140	89		Me eth, 76–7, yel, Et eth, 46
260	**2-Methyl-5-nitrophenol** (5-Nitro-*o*-cresol)	118, yel, lgr							123–4, al	74		Me eth, 74, al, Et eth, 61, al
261	**2-Bromo-4,6-dinitrophenol**	118–9, yel							157	104 5	94, aq al	Me eth, 48, yel
262	**2-Bromo-5-nitrophenol**	118 5–21, pet eth							131 5–2 5, al			Me eth, 104, al
263	**2-Amino-4-methyl-6-nitrophenol** (2-Amino-6-nitro-*p*-cresol)	119, 110, br, al										N-Acetyl, 143, yel al
264	**3-Amino-2,4,6-tribromophenol**	119, pet eth							146–7, al			O,N,N-Triacetyl, 136

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Phenyl urethane	α-Naphthyl urethane	*p*-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p*-Toluene sulfonate	Acetate	Benzoate	Miscellaneous
265	**2-Methylresorcinol** (1,3-Dihydroxy-2-methylbenzene, 2,6-Dihydroxytoluene)	119 20, bz	271 (cor)								*di* 105–6, me al	Di-Me eth , 39
266	**4-Acetylcatechol** (3,4-Dihydroxyacetophenone)	119 2 7 116							*di* 144–5, et ac	4-*mono* 58, *di* 91, 88	*di* 118, al	Oxime, 184 d , et ac , 1-Me eth , 91, 2-Me eth , 115, Di-Me eth , 51
267	**2-Chloro-5-nitrophenol**	119 5, w								82	127–8	Me eth , 83, Et eth , 64 5, al
268	**5-Methyl-1,2,3-trihydroxybenzene** (3,4,5-Trihydroxytoluene, 5-Methylpyrogallol)	120 (subl), bz								*tri* 99		3,5-Di-Me eth , 36, al
269	**9-Hydroxyanthracene** (9-Anthrol, Anthranol)	120, yel								126 31	286 8	
270	**6-Bromo-2-methyl-4-nitrophenol** (6-Bromo-4-nitro-*o*-cresol)	120 d , yel , lgr								137		
271	**2,2′-Dihydroxy-4,4′-dimethylbiphenyl**	120									*di* 148, al - acet	
272	**4-Nitro-2-naphthol**	120, yel , pet eth							122, pa yel , al			*m*-Nitrobenzenesulfonate, 149, ac a , Me eth , 100–3, br , bz -al
273	**4-Chloro-1-naphthol**	120 1, 116 7, al or chl								44		Picrate, 171, Carbonate, 228
274	**2-Chloro-3-nitrophenol**	120 5, w								51 5	94	Me eth , 94, Et eth , 51, me al
275	**4-Chloro-3,5-dibromophenol**	121									132	Me eth , 82 5
276	**3,4-Dimethyl-1-naphthol**	121 5 3 0, lgr	205 10^{15}				222 4			89 5 91		Turns red in air, Picrate, 168
277	**3-Aminophenol** (3-Hydroxyaniline)	122				143	179					N-Acetyl, 148, N-*p*-Toluenesulfonyl, 157, N-Phenylthiourea, 156
278	**2-Amino-3-chlorophenol**	122										N-Acetyl, 123, N-Benzoyl, 123, HNO_3 salt, 137
279	**4-Bromo-2-naphthol**	122								61		Me eth , 64
280	**4-Nitroresorcinol** (1,3-Dihydroxy-4-nitrobenzene)	122, yel , CCl_4	178–9[11]							*di* 90–1, al	1-*mono* 124, ac a , 3-*mono* 189, ac a , *di* 110	Di-Et eth , 85
281	**2,4,6-Trinitrophenol** (Picric acid)	122 (subl on slow htng , exp on rapid htng)								76		Naphthalene add comp , 149-51

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Phenyl urethane	α-Naphthyl urethane	p-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	p-Toluenesulfonate	Acetate	Benzoate	Miscellaneous
282	**3-Hydroxyphenanthrene** (3-Phenanthrol)	122-3, al								114-5, aq al		Me eth, 63, me al, Et eth, 46, me al, Picrate, 124-5, red, al
283	**2,4-Dichloro-6-nitrophenol**	122-3								77		3-Nitrobenzoate, 149-50
284	**2-Naphthol** (β-Naphthol)	123	286	155-6, al	156-7, lgr	169	210-2 (cor.), al	84	125, al	71-2 70	106-7	Aryloxyacetic acid, 95, 2,4-Dinitrophenyl ether, 95, N,N-Diphenylurethane, 141, p-Phenylazobenzoate, 190-3
285	**2,3,4,5-Tetrabromophenol**	123, aq al						225-6		110-5, aq ac a	133, al	
286	**2,4-Dimethyl-2-methoxyphenol**	123							137-8	114		Et eth, 91
287	**2-Nitro-4,5,6-tribromophenol**	123, yel, bz										Me eth, 109, al, Et eth, 74
288	**1,4-Dichloro-2-naphthol**	123-4								90-1		
289	**4-Butyl-2-methylphenol** (4-Butyl-*o*-cresol)	124	127 9^{15}							268-70		
290	**3,3'-Biphenol** (3,3'-Dihydroxybiphenyl)	124, w								*di* 82-5, dil al	*di* 92	Di-Me eth, 36, w-al, b.p. 328
291	**1,3-Dihydroxynaphthalene** (1,3-Naphthalenediol)	124, w								*di* 56, w-ac a		*sym*-Trinitrobenzene add. comp., 174-5, red
292	**3-Iodo-4-nitrophenol**	124, yel, pet eth								73-7	119	Me eth, 69-70
293	**2-Methylhydroquinone** (2,5-Dihydroxytoluene)	124-5, bz						84	125	*mono* 92, pet eth, *di* 49, 45, w	*di* 119-20	Aryloxyacetic acid, 153, Di-Et eth, 24-5, b.p. 247-9
294	**4-Hydroxybenzyl alcohol** (α,4-Dihydroxytoluene)	124-5-5-5								*α-mono* 84, *di* 75	*α-mono* 88-9	
295	**4,6-Dimethylresorcinol** (4,6-Dihydroxy-*m*-xylene)	124-5-5.0, w (+1 w)	276-9							*di* 45, al, b.p. 285-7		Di-Me eth, 76, Di-Et eth, 75, al
296	**4-Benzyl-1-naphthol**	125-6								87-8	103	
297	**Pentamethylphenol**	126	267	215						273	127	Me eth, 163-4
298	**3,5-Dinitrophenol**	126, 122								126-7		Me eth, 105-6, Et eth, 97
299	**7-Chloro-2-naphthol**	126-5								104-5		
300	**4-Chloro-3-nitrophenol**	126-5 w								83-5	96-7	Me eth, 98, al, Et eth, 47-5, al
301	**2-Nitro-3,4,6-tribromophenol**	127, pa yel, w-HCOOH								118		Me eth, 72, w-HCOOH
302	**2-Nitro-1-naphthol**	127-8, yel, al								118		Me eth, 80, Et eth, 84, yel, lgr
303	**1,3-Dibromo-2,4-dihydroxynaphthalene** (1,3-Dibromo-2,4-naphthalenediol)	128-9, ac a						186, CS_2		4-*mono* 148, *di* 125, al		

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Phenyl urethane	α Naphthyl urethane	*p* Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p*-Toluenesulfonate	Acetate	Benzoate	Miscellaneous
304	**4-Iodo-2-naphthol**	128.5								59		Me eth., 67
305	**4-Bromo-1-naphthol**	129								51		
306	**3-Methyl-4-nitrophenol** (4-Nitro-*m*-cresol)	129, w								34, al	74	Me eth., 55, lgr., Et eth., 45, al
307	**3-Hydroxypyridine** (β-Pyridone)	129								b.p. 210, 92°	50.0–0.5	Hydrochloride, 105–7, Picrate, 200–1
308	**4-Hydroxy-3-nitroazobenzene**	129, lgr								120.5, ac a	132, bz	Me eth., 107
309	**3-Amino-2-methylphenol** (3-Amino-*o*-cresol)	129, w								108		Turns br. in air
310	**6-Bromo-2-naphthol**	129.30								103		Me eth., 108
311	**8-Nitro-1-naphthol**	130										*m*-Nitrobenzenesulfonate, 166, ac a
312	**4-Amino-2-nitrophenol**	131, dk red										Me eth., 243, Et eth., 170, N-Acetyl, 157–8, yel
313	**Methyl 4-hydroxybenzoate**	131		134–5, bz						85	135	
314	**5-Methyl-1,2,4-trihydroxybenzene** (2,4,5-Trihydroxytoluene)	131.2, bz								*tri* 114.5, al		4-Me eth., 124, w., 4-Et eth., 131 (subl.), bz., Trime eth., 55, w.-me al
315	**5-Chloro-1-naphthol**	131.2, w or CS_2								53		Picrate, 160
316	**4-Cyclohexylphenol**	132		145.5		137, al	168 (cor.)			35	118.5, me al	
317	**Pyrogallol** (1,2,3-Trihydroxybenzene)	133	309	*tri* 173		*tri* 230	*tri* 205	*di* 158		*di* 110–11, *tri* 165, 173	*mono* 140, *di* 108, *tri* 90, al	Tris-N,N-Diphenylurethane, 212
318	**2-Amino-4,6-dimethylphenol**	134–5, al										N-Acetyl, 96, aq al., O,N-Dibenzoyl, 153.5 Me eth., b.p. 239–40
319	**4-Amino-5-isopropyl-2-methyl-6-nitrophenol** (4-Amino-5-isopropyl-6-nitro-*o*-cresol)	134.5 yel., al									1-*mono* 280–3, *di* 222.5, bz	
320	**4,6-Dibromo-2-naphthol**	134–5								128	128.9	Me eth., 103, Et eth., 98
321	**2,3-Dichloro-1,4-dihydroxynaphthalene**	135, 155–6, aq al								*di* 239–40	*di* 252	Di-Me eth., 107–8, Dipropionate, 166–7, Dibutyrate, 128
322	**4-Benzoylphenol** (4-Hydroxybenzophenone)	135								81, me al	115, 94–5	2,4-Dinitrophenylhydrazone, 242.4 (cor.), Semicarbazone, 194

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Phenyl urethane	α Naphthyl urethane	*p*-Nitrobenzoate	3,5 Dinitrobenzoate	Bromo derivative	*p* Toluenesulfonate	Acetate	Benzoate	Miscellaneous
323	**2-Amino-4-methylphenol** (2-Amino *p*-cresol)	135, w										N-Benzoyl, 191, al, O,N-Dibenzoyl, 190–1, al, O,N-Diacetyl, 128–9, Me eth, 93–4, pet eth
324	**3-Amino-4,6-dichlorophenol**	135–6 w							113–4			N-Acetyl, 233–6, Me eth, 51
325	**2,6-Dinitrohydroquinone**	135 6 (anh)								4-*mono* 95–6, *di* 135–6	4-*mono* 150 1	4-Me eth, 102, Di-Me eth, 95–6 112
326	**1,4-Dimethyl-2-naphthol**	135 6								77–8	124–5	
327	**Trichlorohydroquinone**	136, w								*di* 153 (subl)		Di-Et eth, 68 5, al
328	**5-Iodo-3-nitrophenol**	136, w								110	100 5	Me eth, 84
329	**Trichlorophloroglucinol**	136, al								*tri* 167 8, ac a		Di-Me eth, 93–5 Tri-Me eth, 130–1, al
330	**1,6-Dihydroxynaphthalene** (1,6-Naphthalenediol)	137–8, bz								*di* 73, al	*di* 103–4	Di-Me eth, 60–1 pet eth, Di-Et eth, 83, lgr, 2-Naphthylamine add comp, 110 5
331	**2,4-Dinitro-1-naphthol**	138									174	Me eth, 97, Et eth, 92
332	**4-Amino-2,6-dimethylphenol**	138 d, bz										N-Acetyl, 136–7, aq al, O,N-Diacetyl, 160, Me eth, 66, w
333	**2-Amino-3-bromophenol**	138							120–1, al			Me eth, 65, Hydrochloride, 225
334	**2-Amino-4-chlorophenol**	138 (unstable)							115	73–4		N-Acetyl, 185, O,N-Dibenzoyl, 157–8, Me eth, 82–3
335	**1,4,6-Trihydroxynaphthalene** (1,4,6-Naphthalenetriol)	138–40								94 5		
336	**2,6-Dibromo-3,4,5-trihydroxybenzoic acid** (Dibromogallic acid)	139 d (+1H_2O)								*tri* 168	*tri* 95–6	Triacetate of Me eth, 150–2
337	**2-Hydroxy-2′-nitrobiphenyl**	139–40				116	180	3,5-*di* 149	100		116	3-Nitrobenzenesulfonate, 161, 4-Nitrobenzenesulfonate, 147, 2,4-Dinitrophenyl ether, 118, Me eth, 82, 3,5-Dinitro deriv, 123
338	**4-Phenyl-1-naphthol**	140									73–4	
339	**1,3-Dihydroxy-2-methylnaphthalene** (2-Methyl-1,3-naphthalenediol)	140								118		
340	**1,2,4-Trihydroxybenzene**	140–5, eth								*tri* 96–7, wh, abs al	*tri* 120, al	Tri-Et eth, 34, al, Picrate, 96
341	**2-Amino-5-iodophenol**	141										N-*p*-Toluenesulfonyl, 175–6

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Phenyl urethane	α-Naphthyl urethane	*p* Nitrobenzoate	3 5-Dinitrobenzoate	Bromo derivative	*p* Toluene sulfonate	Acetate	Benzoate	Miscellaneous
342	**4-Hydroxy-2-nitrobiphenyl**	141-3								169	105 6	Me eth , 72
343	**1,8-Dihydroxynaphthalene** (1,8-Naphthalenediol)	142, ac a , 140, w								*di* 155 ac anh	*di* 174 5	Di-Me eth , 50, pet eth Picrate, 135 7 2-Naphthylamine add comp , 124
344	**2-Amino-4-nitrophenol**	142 3 (anh), 80-90 (hyd)				122			122, yel , al			N-Acetyl, 279, N-Benzoyl, *ca* 200 d , Me eth 124 5 Et eth , 97 8
345	**3,4-Dihydroxyphenanthrene** (Morphol)	143, pet eth								*di* 159, eth		Me eth , 62 3, Di-Me eth , 45, me al
346	**3-Chloro-1-naphthol**	143, 134 5, lgr								69, lgr	118 9	Me eth , b p 162-4[18]
347	**2-Isopropyl-5-methylhydroquinone** (Thymoquinol)	143, 139 5	290	232 3, al	147 8, al					*di* 73 5	141 2, al	
348	**2,6-Dibromo-4-nitrophenol**	144							128 9	181		
349	**3,4,5-Tribromocatechol**	144 (+1H_2O)								*di* 120		Di-Me eth , 86-7
350	**3-Amino-4-methylphenol** (3-Amino-*p*-cresol)	144										N-Acetyl, 178 O,N-Diacetyl, 128 9 N-Benzenesulfonyl, 183, Me eth , 47, w
351	**8-Nitro-2-naphthol**	144-5, yel								101-2, w -al		*m*-Nitrobenzenesulfonate, 144-6, ac a , Me eth , 69, Et eth , 72-3, yel , pet eth
352	**4-Benzoylresorcinol** (2,4-Dihydroxybenzophenone)	144 6								*di* 78		
353	**1-Hydroxyacenaphthene** (1-Acenaphthenol)	144 5-5 5 (cor), 148		137						b p 166-8[5]		
354	**4-Amino-2,3,6-trinitrophenol**	145 d , ac a										N-Acetyl, 178-9, N-Benzoyl, 205, ac a , Me eth , 138-9, al
355	**4-Benzoylcatechol** (3,4-Dihydroxybenzophenone)	145, 134									*di* 95	Me eth , 131-2, Di-Me eth , 103 4
356	**3-Bromo-5-nitrophenol**	145								99		Me eth , 88
357	**3,4-Dihydroxybiphenyl** (4-Phenylcatechol)	145								*di* 77 5 8 0		
358	**2,4,6-Tri-iodoresorcinol**	145, CS_2								*di* 170		
359	**2,4'-Dihydroxychalcone**	145								*di* 94 5	*di* 120	4'-Me eth , 148 d , al
360	**2,6-Diamino-4-methylphenol** (4-Hydroxy-3,5-toluenediamine)	146										N,N'-Diacetyl, 225-7, dil al , 1,2,6-Triacetyl, 228, al
361	**5-Aminoresorcinol** (3,5-Dihydroxyaniline)	146-52										N-Benzoyl, 139, Di-Me eth , 46, Picrate, 167-70 d , yel , aq al

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Phenyl urethane	α-Naphthyl urethane	p-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	p Toluene sulfonate	Acetate	Benzoate	Miscellaneous
362	**4-Acetylresorcinol** (Resacetophenone, 2,4-Dihydroxyacetophenone)	147								3-*mono* 119 20, 4-*mono* 74, *di* 38	3-*mono* 67, 4-*mono* 106 7	Semicarbazone, 216, 2,4-Dinitrophenylhydrazone, 218, Oxime, 199, Phenylhydrazone, 159
363	**3-Chloro-5-nitrophenol**	147								84	78	Me eth , 101, Et eth , 47, al
364	**5-Nitro-2-naphthol**	147, yel , w										*m*-Nitrobenzenesulfonate, 106, ac a , Et eth , 115, yel , al
365	**2-Methyl-3-nitrophenol** (3-Nitro-*o*-cresol)	147, yel , w							94, al			Me eth , 52 3, w - me al
366	**2-Chloro-4-hydroxybenzaldehyde**	147 8								52	97	Semicarbazone, 214, Oxime, 194, *p*-Nitrophenylhydrazone, 288 d
367	**1,5-Dibromo-4,8-dihydroxynaphthalene**	147 5								*di* 131		
368	**5-Acetylresorcinol** (3,5-Dihydroxyacetophenone)	148								*di* 91 2		Semicarbazone, 205 6 *p*-Nitrophenylhydrazone, 236 7
369	**2,4-Dinitroresorcinol**	148							*mono* 126–7	*di* 119 20	*di* 182 4	Aryloxyacetic acid, 155, Me eth , 108, Di-Et eth , 57
370	**4-Propionylphenol** (4-Hydroxypropiophenone)	148								62, lgr	107 5	2,4-Dinitrophenylhydrazone, 229
371	**9,10-Dihydroxyphenanthrene** (9,10-Phenanthrenediol)	148								*mono* 168 70, *di* 202	*di* 216 7	
372	**3,4,5-Trihydroxyphenanthrene** (3,4,5-Phenanthrenetriol)	148, w								*tri* 138, bz - pet eth		Tri-me eth , 90, me al
373	**4-Hydroxypyridine** (γ-Pyridone)	148 5 (anh), 65 (+1 H_2O)	>350							140 50	81	Picrate, 240, Methiodide, 108 9
374	**3-Nitrosalicylic acid**	148 5–9 0										Amide, 155, 145
375	**3-Acetamidophenol** (3-Hydroxyacetanilide)	148 9, w								99 5 100 5		
376	**2-Amino-3,6-dimethylphenol**	149 50, bz										N-Benzoyl, 210–11, O,N-Dibenzoyl, 178–9
377	**2,6-Dimethylhydroquinone**	149–51, xyl										4-Me eth , 77, pet eth
378	**2,4'-Dihydroxybenzophenone**	150								84 5		
379	**5-Amino-2-bromophenol**	150 d							135 6			
380	**2-Amino-5-bromophenol**	150										O,N-Dibenzoyl, 133 4, H_2SO_4 salt, 239 40
381	**1-Hydroxyanthracene** (1-Anthrol)	150–3, br , al								128–30		Me eth , 70, Et eth , 69
382	**2-Amino-4-chloro-6-nitrophenol**	152										N-Acetyl, 150 60, yel

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Phenyl urethane	α Naphthyl-urethane	*p*-Nitrobenzoate	3,5-Di-nitro-benzoate	Bromo derivative	*p* Toluene sulfonate	Acetate	Benzoate	Miscellaneous
383	**4-Hydroxyazobenzene** (4-Benzeneazophenol)	152, al								89, 84 5, yel, al	136–8, yel, al	Hydrochloride, 169 HNO_3 → 2,4-Dinitrophenol, 113 Propionate, 75, red
384	**Tribromophloroglucinol**	152 3 (anh), w								*mono* 169, bz - pet eth, *tri* 181 3, al		Me eth , 123, bz Tri-Me eth 145, al Di-Et eth , 63 5, w -ac a , Tri-Et eth , 102 4, ac a
385	**4-Amino-2-chlorophenol**	153							116–7, aq al			N-Acetyl, 144 O,N-Diacetyl, 124 Me eth , 62
386	**2,2'-Dihydroxy-5,5'-dimethylbiphenyl**	153–4, w								*di* 88		Diformate, 61, 70% al
387	**2-Amino-5-chlorophenol**	154, aq al										O,N-Dibenzoyl, 140, al Me eth , 46, Hydrochloride 226 d
388	**1,2,4-Trihydroxynaphthalene** (1,2,4-Naphthalenetriol)	154								*tri* 134 5		
389	**6-Hydroxybiphenyl-2-carboxylic acid**	154 (anh)							177, ac a	88–9, al	121, 150	Benzenesulfonate, 104–5 Butyrate, 59–60
390	**4-Amino-3-nitrophenol**	154, dk red							134, al	185		N-Acetyl, 218, yel , w O N-Diacetyl, 146, O-*m*-nitrobenzenesulfonate, 184
391	**2-Azoxyphenol** (2,2'-Dihydroxyazoxybenzene)	154 5								*di* 150, bz	*di* 108 al	Di-Me eth 81 Di-Et eth , 102
392	**3,5-Stilbenediol** (3,5-Dihydroxystilbene, Pinosylvyn)	155 5–6 0, ac a								*di* 100–i me al	*di* 150 1 ac a me al	Me eth , 122–3, ac a Di-Me eth , 56 7 me al
393	**1-Hydroxyphenanthrene** (1-Phenanthrol)	156, eth								135–6, al		Me eth , 105, me al , Picrate 182, or -red, me al
394	**4-Iodo-3-nitrophenol**	156, yel , al								107 5		Me eth , 62, Et eth , 63 5
395	**1,4,5-Trichloro-2-naphthol**	157–8, ac a								129		
396	**9-Hydroxyphenanthrene** (9-Phenanthrol)	158, bz, 153								77–8, al	99–100	Me eth , 95–6, me al , Picrate, 185, red, Propionate, 95, ac a
397	**5-Nitroresorcinol**	158, w								*di* 105		Me eth , 141–2, yel , Di-Me eth , 89, eth -et ac , Et eth , 80, w
398	**4,4'-Dihydroxydiphenylmethane**	158, w								*di* 69–70, al	*di* 156, al	Di-Me eth , 52, Di-Et eth , 38–9
399	**2,4,6-Tri-iodophenol**	158–9, w - al					181			156, bz	137	Me eth , 98–9, bz Et eth , 83, eth

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Phenyl urethane	α-Naphthyl urethane	*p*-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p* Toluene sulfonate	Acetate	Benzoate	Miscellaneous
400	**Salicylic acid** (2-Hydroxybenzoic acid)	158 3	211[20]			205, me al				135, wh	132	Aryloxyacetic acid, 191, Amide, 142, Anilide, 136, *p*-Toluidide, 156
401	**4-Amino-2,3,6-trichlorophenol**	159, al								153, yel		N-2,4-Dinitrophenyl, 211, or-red
402	**4-Amino-3-chlorophenol**	160										N-Acetyl, 121
403	**6-Amino-2,4-dinitro-3-methylphenol** (6-Amino-2,4-dinitro-*m*-cresol)	160, al										N-Acetyl, 225, yel
404	**2,2'-Dihydroxychalcone**	160–1								*di* 85 5 6 0	*di* 114	2-Me eth , 112, al 2-Et eth , 61, al
405	**4-Amino-6-nitroresorcinol**	160–1 d , eth -lgr										N-Acetyl, 261, yel , ac a , Di-Me eth 136 7, red aq al
406	**4,4'-Dihydroxy-3,3'-dimethylbiphenyl**	160–1								*di* 131, al , 135 5	185, ac a	
407	**2,3-Dihydroxynaphthalene** (2,3-Naphthalenediol)	160 1, w									*di* 235	Me eth , 108, Di-Me eth , 116 5, lgr , Et eth , 109–10, Di-Et eth , 96–7, 2-Naphthylamine add comp 168
408	**1,2-Dihydroxyanthracene** (1,2-Anthracenediol)	160–2								*di* 157 0–7 5, al -ac a		
409	**6-Retenol** (6-Hydroxyretene)	161, xyl							110 5 11	134–5		Picrate, 152–2 5, red, al
410	**5-Amino-2-methylphenol** (5-Amino-*o*-cresol)	161, w							111–2, aq al			N-Acetyl, 225, N,N-Diacetyl, 132–3, O,N-Di-benzoyl, 162, Me eth , 58
411	**4,4'-Dihydroxytriphenylmethane**	161, w -al								*di* 109 10		Di-Me eth , 100 1, chl -me al
412	**3-Hydroxyphthalic acid**	161 d								114–6	148	
413	**1,2,3,4-Tetrahydroxybenzene** (Apionol, Phenetrol)	161, pink, et ac								*tetra* 142	*tetra* 191 2	1,4-Di-Me eth , 106, Tetra-Me eth , 89
414	**5-Amino-2-nitrophenol**	162, or-yel , w										N-Acetyl, 221, yel , ac a , O,N-Di-acetyl, 149, w
415	**1,3,4-Trichloro-2-naphthol**	162								133 5–4 0, ac a		
416	**2-Amino-5-methylphenol** (6-Amino-*m*-cresol)	162 d										N-Benzoyl, 169, acet -pet eth , O,N-Dibenzoyl, 162 3, me al , Me eth , 171, 50% al
417	**1-Amino-2,4-dihydroxynaphthalene**	162 (at 130 → vlt)										O,O,N-Triacetyl, 155–6, bz

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Phenyl urethane	α-Naphthylurethane	p-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	p Toluenesulfonate	Acetate	Benzoate	Miscellaneous
418	**2,4'-Biphenol** (2,4'-Dihydroxybiphenyl)	162 3	342							*di* 94, al		Di-Me eth , 70
419	**2,5-Dimethylresorcinol** (2,6-Dihydroxy-*p*-xylene)	163, bz	277 80							*di* 69, al		Me eth , 118–21, bz
420	**2-Amino-3,5-dimethylphenol**	163, bz								186 7		O,N-Diacetyl, 87–8, N-Benzoyl, 211 2, al O,N-Dibenzoyl, 148–9, me al , Hydrochloride, 270 80, dil HCl
421	**4-Nitro-1-naphthol**	164, w										*m*-Nitrobenzenesulfonate, 135, Me eth , 81, yel , bz 85–6, Et eth , 120, al , 116 7
422	**3,5-Dinitrocatechol** (1,2-Dihydroxy-3,5-dinitrobenzene)	164								120, *di* 112 4, 124, al		1-Me eth , 123, 2-Me eth , 80 Di-Me eth , 102, al , 1-Et eth , 155, al , Di-Et eth , 78 94 5
423	**2,2'-Dihydroxy-6,6'-dimethylbiphenyl**	164								*di* 87, al	*di* 136, al	
424	**2-Amino-3,4-dihydroxynaphthalene**	164								*di* >200 d		N-Acetyl, 170 d , 3-O,N-Diacetyl, 195 d , acet
425	**2,6-Dibromohydroquinone**	164								*di* 117		
426	**2-Benzoylphloroglucinol** (2,4,6-Trihydroxybenzophenone)	165									*tri* 125–6	2,4-Di-Me eth , 83, 2,6-Di-Me eth , 178–9
427	**5-Amino-3-nitrophenol**	165, yel										N-Acetyl, 260–70, et ac
428	**2-Methoxy-4-nitrophenol**	165 d , yel , chl								156–8	188, yel , al	Me eth , 105 6
429	**3-Amino-4,5-dimethylphenol**	165, eth , br , (173–5, subl)										N-Acetyl, 191 (sinters, 184), O,N-Diacetyl, 157, al , O,N,N-Triacetyl, 100–1, al , N-Benzoyl, 195–6
430	**1,2,3,5-Tetrahydroxybenzene**	165								*tri* 74		1,3-Di -Me eth , 159, 83, 1,2,3-Tri-Et eth , 105
431	**4-Phenylphenol** (4-Hydroxybiphenyl)	165	305 8	167 5					177, ac a , 179, al - acet	88–9, 87–8, al	150–1, al	*p*-Phenylazobenzoate, 213 5–4 0, 2,4-Dinitrophenyl ether, 118
432	**4-Amino-2-bromophenol**	165, 155										N-Benzoyl, 145, O,N-Dibenzoyl, 192
433	**Benzeneazocatechol** (3,4-Dihydroxyazobenzene)	165 d , dk red, al										3-Me eth , 70–1, red, lgr , Di-Me eth , 53–4, red, lgr , 44–5
434	**4-Amino-2-chloro-3-nitrophenol**	165 5 d , bz										N-Acetyl, 184–5, Et eth , 74, or

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Phenyl urethane	α-Naphthyl urethane	p-Nitro benzoate	3 5-Di nitro-benzoate	Bromo derivative	p-Toluene sulfonate	Acetate	Benzoate	Miscellaneous
435	**4-Amino-2,5-dinitrophenol**	166–7, al										N-Acetyl, 144–5, Me eth , 153, bz - lgr , red, Et eth , 139
436	**4-Amino-2,6-dinitro-3-methylphenol** (4-Amino-2,6-dinitro-*m*-cresol)	167, red, 50% al										N-Acetyl, 231 d , ac a , Et eth , 96 7, Hydrochloride, 200 d , dil, HCl
437	**2-Benzamidophenol** (2-Hydroxybenzanilide	167 d							109–10, al	134 40, al		Me eth , 60
439	**2,3,4-Trichloro-1-naphthol**	168, lgr								123–4		
440	**2-Hydroxyphenanthrene** (2-Phenanthrol)	168, al								142–3	139–40, al	Et eth , 112, al , Picrate, 156, red
441	**1,5-Di-(2-hydroxyphenyl)-1,4-pentadiene-3-one**	168								*di* 128, al	135, al	Di-Me eth , 125, al , Di-Et eth , 89, al
442	**3,5-Diaminophenol**	168–70										3,5-Diacetyl, 195
443	**4-Acetamidophenol** (4 - Hydroxyacetanilide)	169								150–1		
444	**2-Amino-4,6-dinitrophenol** (Picramic acid)	169, dk red, al										N-Acetyl, 201, N-Benzoyl, 230, 220, N-*p*-Toluenesulfonyl, 191
445	**4-Amino-2-chloro-5-nitrophenol**	169 5 d										N-Acetyl, 166, yel , Et eth , 128 5, or
446	**3,3'-Dihydroxybenzophenone**	170								89–90	101–2	
447	**1,4-Dihydroxy-2-methylnaphthalene** (2-Methyl-1,4-naphthohydroquinone)	α 170, β 60, ac a								*di* 113, al	181	
448	**4-Amino-2,6-dinitrophenol** (Isopicramic acid)	170, br , w										N-Acetyl, 182, N-Benzoyl, 263, 250, Me eth , 212, Et eth , 172
449	**Benzeneazoresorcinol** (2,4-Dihydroxyazobenzene)	170, dk red								*di* 104, or - red, al		Di-Me eth , 92, red, al , Di-Et eth , 70 yel -red, al
450	**3,4-Diaminophenol**	170 2, 167 8, unstable										N,N'-Diacetyl, 205–7, 3,4-Dibenzoyl, 203 5, 1,3,4-Tribenzoyl, 225, Et eth , 71 2 b p 294–6
451	**5-Nitro-1-naphthol**	171, dk yel -red, w								114, w - al	109, me al	Me eth , 96–7, yel pet eth
452	***Hydroquinone*** (1,4-Dihydroxybenzene)	171, 172	286	*di* 224, 205 7		*di* 258, al	*di* 317	*di* 186	*mono* 98–9, bz , *di* 159, 25% al	*di* 123, w	*di* 199, 204 (cor), tol	Aryloxyacetic acid, 250, 2,4-Dinitrophenyl ether, 243–6, N,N-Diphenylurethane, 250

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Phenyl urethane	α Naphthyl urethane	*p*-Nitrobenzoate	3 5-Di nitro benzoate	Bromo derivative	*p*-Toluene sulfonate	Acetate	Benzoate	Miscellaneous
453	**2-Azophenol** (2,2'-Dihydroxyazobenzene)	172, yel, bz								*di* 150, or -red		Di-Me eth, 153, or, Di-Et eth, 131, red
454	**2,3,4-Trihydroxyacetophenone** (Gallacetophenone)	173 192 0-2 5								2,4-*di* 107-8, 3,4-*di* 78-81, *tri* 85		Semicarbazone, 225 d, Oxime, 162-3, Picrate, 133
455	**3,5-Dinitrosalicylic acid**	173-4 (anh)									163	Amide, 181, Anilide, 180 (subl), 194
456	**2-Aminophenol** (2-Hydroxyaniline)	174									175	N-Acetyl, 209, 201, N-Benzenesulfonyl, 141, N-*p*-Toluenesulfonyl, 146
457	**3-Benzamidophenol** (3-Hydroxybenzanilide)	174, tol									153	Et eth, 103
458	**4-Amino-2-methylphenol** (4-Amino *o*-cresol)	175, bz							109-10, bz-lgr			N-Acetyl, 179, O,N-Dibenzoyl, 194, ac a, Me eth, 59 0-9 5, 92-3, aq al
459	**1,6,7-Trihydroxynaphthalene** (1,6,7-Naphthalenetriol)	175								*tri* 143 4		
460	**4-Nitrocatechol**	176, yel, w								*di* 98	*di* 156, al	Di-Me eth, 96, w-al, Di-Et eth, 73 5, pa yel
461	**1,4-Dihydroxynaphthalene** (1,4-Naphthalenediol, 1,4-Naphthohydroquinone)	176, 192								*di* 128 30, al	*di* 169, ac a	Me eth, 131, Di-Me eth, 85, CS_2
462	**1,7-Dihydroxynaphthalene** (1,7-Naphthalenediol)	178, bz		203 4		182-3				*di* 108, bz	*di* 101 5, 113-5	Di-Et eth, 67
463	**1,2-Dihydroxyphenanthrene** (1,2-Phenanthrenediol)	178, w-al								*di* 147, me al		Di-Me eth, 100 2, lgr
464	**4-Amino-6-isopropyl-3-methylphenol** (4-Amino-6-isopropyl-*m*-cresol)	178-9, bz										N-Benzoyl, 178-9, O,N-Dibenzoyl, 166-7, aq al, Hydrochloride, 255
465	**1,8,9-Trihydroxyanthracene** (1,8,9-Anthracenetriol, Anthralin)	178 80, 176 7								*tri* 209 10		
466	**4-Amino-3-methylphenol** (4-Amino-*m*-cresol)	179, 50% al									92, pet eth	N-Acetyl, 138, Hydrochloride, 215, Me eth, 29-30
467	**2,5-Dihydroxyphenanthrene** (2,5-Phenanthrenediol)	180, xyl								*di* 144, w-ac a		Di-Me eth, 117, ac a
468	**9,10-Dihydroxyanthracene** (9,10-Anthradiol)	180, yel								*di* 260, ac a	*di* 292, yel xyl-chl	Di-Me eth, 202, bz, Di-Et eth, 148, bl fluor, al

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Phenyl urethane	α-Naphthyl urethane	*p*-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p* Toluene sulfonate	Acetate	Benzoate	Miscellaneous
469	**1,2,5,8-Tetrahydroxynaphthalene** (1,2,5,8-Naphthalenetetrol)	180 d								*tetra* 202		
470	**4-Hydroxy-3-iodo-5-methoxybenzaldehyde** (5-Iodovanillin)	180								105-6	135 5-6 5	Oxime, 178 9 Semicarbazone, 187 8 d
471	**6-Nitro-1-naphthol**	181 2								121		
472	**4-Amino-3,5-dimethylphenol**	181 2, chl										N-Acetyl, 178 80 N-Benzyl, 104 5, Me eth , 43, pet eth
473	**2-Amino-4-nitroresorcinol**	182, br , aq al										N-Acetyl, 213, yel
474	**3-Azoxyphenol** (3,3'-Dihydroxyazoxybenzene)	183								*di* 102, 50% al	*di* 75, ac a	Di-Me eth , 49 50, 47 6
475	**N-Benzylidene-4-aminophenol**	183								92	144	Me eth , 62, Et eth , 76 (71), Hydrochloride, 167-77
476	**4-Aminophenol** (4-Hydroxyaniline)	184 (subl)					178 5 (cor)			168		O,N-Diacetyl, 150, 2,4-Dinitrobenzoyl, 204 5 (cor), N-*p*-Toluenesulfonyl, 253
477	**1,9-Dihydroxyphenanthrene** (1,9-Phenanthrenediol)	184 5, bz								*di* 154-5, w -al		9-Me eth , 131 2, bz -pet eth Di-Me eth , 113 4, me al
478	**4,6-Diacetylresorcinol** (Resodiacetophenone)	185, al								*di* 120	*mono* 214-5, *di* 118	Di-Me eth , 171 5, Dioxime, 242, Phenylhydrazone, 233
479	**4-Amino-2-naphthol**	185							137			O,N-Dibenzoyl, 309
480	**7-Hydroxy-4-methylcoumarin** (4-Methylumbelliferone)	185 6, al		155-6		143				150, al	159-60, al	Me eth , 159, *m*-Nitrobenzoate, 210-11, Picrate, 108
481	**3-Amino-4-nitrophenol**	185-6, or , w										N-Benzoyl, 166, Me eth , 131, Et eth , 105-6
482	**1,2,6-Trihydroxynaphthalene** (1,2,6-Naphthalenetriol)	188								*tri* 262		
483	**α,2,4-Trihydroxyacetophenone** (ω-Hydroxyresacetophenone)	189								*tri* 129	*α-mono* 200	α-Me eth , 136, *p*-Nitrophenylhydrazone, 205 d , Oxime, 105-7
484	**2,7-Dihydroxynaphthalene** (2,7-Naphthalenediol)	190, 185-6, w							150, chl	*mono* 171-2, me al , *di* 136, w	*mono* 199, me al , *di* 139, al	Aryloxyacetic acid, 149, N,N-Diphenylurethane, 176, Me eth , 117 Di-Me eth , 139, Di-Et eth , 104, al
485	**1,4,5,8-Tetrahydroxynaphthalene** (1,4,5,8-Naphthalenetetrol)	190								*tetra* 277 9		

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Phenyl urethane	α Naphthyl urethane	*p*-Nitrobenzoate	3,5 Dinitrobenzoate	Bromo derivative	*p* Toluenesulfonate	Acetate	Benzoate	Miscellaneous
486	**1,5-Diacetyl-2,3,4-trihydroxybenzene** (4,6-Diacetylpyrogallol Gallodiacetophenone)	190 1, w								*mono* 207 9	*tri* 189	Tri-Me eth , 73-4
487	**3,9-Dihydroxyacridine**	190 2 lt br → dk in air al										9-Me -3-Et eth , 144, yel , w In al → grn fluor
488	**Pentachlorophenol**	190 2							145	149-50	164-5, 159	Aryloxyacetic acid, 196
489	**5-Amino-2-naphthol**	191										O,N-Diacetyl, 187, O,N-Dibenzoyl, 223
490	**1,4-Dihydroxynaphthalene** (1,4-Naphthalenediol)	192								*di* 128-30	*di* 169	
491	**5-Amino-1-naphthol**	192										O,N-Dibenzoyl, 276
492	**Tetrabromocatechol**	192-3								*di* 215-6	*di* 197-8, bz-lgr	Me eth , 162-3, Di-Me eth , 151-2, 118-20
493	**6-Hydroxyquinoline**	193, al							98	36 8	230-1, ac a	Methiodide, 236 d , Picrate, 235 6
494	**3-Methyl-2,4,5,6-tetrabromophenol** (2,4,5,6-Tetrabromo-*m*-cresol)	194, ac a								165 6	153-4	Me eth , 145 6, al , Et eth , 108, eth
495	**1,5-Dichloro-4,8-dihydroxynaphthalene**	194, ac a								4-*mono* 148-60, ac a *di* 154, 143, acet	4-*mono* 157-8, ac a , *di* 179, acet	
496	**1,6-Dinitro-2-naphthol**	195 d							181			Me eth , 204, 198, Et eth , 144, yel , Alc NH_3 at 160° → 1,6-dinitro-2-naphthylamine, 248, Oxid → 4-nitrophthalic acid, 165
497	**5,6-Dihydroxyacenaphthene** (5,6-Acenaphthenediol)	196-9, bz								*di* 194-5		
498	**1,2,7-Trihydroxynaphthalene** (1,2,7-Naphthalenetriol)	197								181-2		
499	**4-Methyl-2,3,5,6-tetrabromophenol** (2,3,5,6-Tetrabromo-*p*-cresol)	199								156		
500	**2-Hydroxyquinoline**	199										2-Ph eth , 69
501	**2-Amino-4-methyl-5-nitrophenol** (2-Amino-5-nitro-*p*-cresol)	199-200 d										N-Acetyl, 242, ac a , Me eth , 132, yel
502	**6-Amino-1-naphthol**	199 5										O,N-Diacetyl, 130, N-Benzoyl, 203, O,N-Dibenzoyl, 230
503	**Hexahydroxybenzene**	200 d								*hexa* 203	*hexa* 313	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Phenyl urethane	α-Naphthyl urethane	p-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	p Toluene sulfonate	Acetate	Benzoate	Miscellaneous
504	**Methylenedi-2-naphthol** (2,2'-Dihydroxy-1,1'-dinaphthylmethane)	200, ac a								*di* 214, al		Di-Me eth, 144–7, al, Picrate, 178 9, red-br
505	**3-Hydroxybenzoic acid**	200								131		Aryloxyacetic acid, 206, Amide, 170, *p*-Bromophenacyl ester, 176
506	**Methyl gallate** (Methyl 3,4,5-trihydroxybenzoate)	200–1								*tri* 120, 120 2, al	*tri* 139, al	
507	**3-Hydroxyquinoline**	200–1, bz							90			Picrate, 240 5
508	**7-Amino-2-naphthol**	201, 208									177	N-Acetyl, 232, O,N-Diacetyl, 156, N-Benzoyl, 243–6, O,N-Dibenzoyl, 181
509	**4-Amino-3-methyl-2-nitrophenol** (4-Amino-2-nitro-*m*-cresol)	201, al										O,N-Diacetyl, 127 8
511	**2-Acetamidophenol** (2-Hydroxyacetanilide)	201 3, 209, aq al								122	140	O,N-Diacetyl, 77
512	**2-Acetylhydroquinone** (2,5-Dihydroxyacetophenone)	202								*di* 68	*di* 113	*p*-Nitrophenylhydrazone, 215–6, Oxime, 149–50
513	**2,8-Dihydroxyphenanthrene** (2,8-Phenanthrenediol)	202, w -al								*di* 125, al		
514	**4-Hydroxy-4'-nitrobiphenyl**	203, 200–1							159, bz	138 9, lgr	208–10, ac a	Me eth, 111, yel., al, 3,5-Dinitro deriv, 197–8
515	**3,5-Dimethoxy-4-hydroxybenzoic acid**	205								191	229–32	
516	**4-Hydroxycoumarin** (Benzotetronic acid)	206, 232 3								103		Me eth, 124, w
517	**2,3,5-Trihydroxyacetophenone**	206–7, yel, ac a								*tri* 106–7, lgr	*tri* 106–7	*p*-Nitrophenylhydrazone, 241–2 d, w -al
518	**2,4,5-Trihydroxyacetophenone**	206–7, red								2,4-*di* 165–6, bz		
519	**6-Chloro-3-hydroxy-4-methylbenzoic acid**	206–8									146	Amide, 239–40, Anilide, 222
520	**8-Amino-2-naphthol**	207 d										O,N-Diacetyl, 178, O,N-Dibenzoyl, 208
521	**3-Azophenol** (3,3'-Dihydroxyazobenzene)	207, yel								*di* 144, yel, al	*di* 188, w -al	Di-Me eth, 73–4, Di-Et eth, 91, yel
522	**2-Amino-5-nitrophenol**	207–8, or, 201–2, w							188, yel, al			N-Acetyl, 271–2, O,N-Diacetyl, 187, Me eth, 139
523	**2-Methyl-3,4,5,6-tetrabromophenol** (3,4,5,6-Tetrabromo-*o*-cresol)	208								154		
524	**2,6-Dichloro-3,4,5-tribromophenol**	209									202	Me eth, 143–4

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Phenyl urethane	α Naphthyl urethane	*p* Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	*p*-Toluenesulfonate	Acetate	Benzoate	Miscellaneous
525	**4-Hydroxy-3-methoxybenzoic acid** (Vanillic acid)	210 (subl)				140 1 d				110, w	178, aq al	Hydrazide, 207, Phenylhydrazide, 150 2 5
526	**4,4'-Dihydroxybenzophenone**	210									156, 152	Me eth, 151-2, Di-Me eth, 146, 2,4-Dinitrophenylhydrazone, 190-2
527	***cis*-1,2-Dihydroxyacenaphthene** (*cis*-Acenaphthylene glycol)	212 3, w								*mono* 122-3, al, *di* 130, me al		
528	**4-Hydroxy-4'-nitroazobenzene**	212 3 219 0-9 5								147, or	195, or	Me eth, 157 5 8 0
529	**6-Amino-2-naphthol**	213 d										O,N-Diacetyl, 220
530	**2,4-Dihydroxybenzoic acid**	213, 216 d										Amide, 222, Anilide, 126-7, *p*-Nitrophenyl ester, 189
531	**Methylphloroglucinol** (2,4,6-Trihydroxytoluene)	214-6, et ac								*tri* 76, lgr		2-Me eth, 91 (+1H_2O), 117 9 (anh), 4-Me eth, 124, Tri-Me eth, 10 13, b p 140-2[18]
532	**4-Hydroxybenzoic acid**	215, 210								187	221-3	Aryloxyacetic acid, 278, Anilide, 198, *p*-Toluidide, 204
533	**4,6-Dinitroresorcinol**	215, yel				*di* 178			*mono* 135	*di* 139	*di* 343-4	Me eth, 113, Di-Me eth 157, Et eth, 77, Di-Et eth, 133
534	**4-Chloro-2,3,5,6-tetrabromophenol**	215									203	Me eth, 161
535	**2,6-Dihydroxynaphthalene** (2,6-Naphthalenediol)	215, 218								*di* 175	*di* 215	Di-Me eth, 50, bz, Di-Et eth, 162, al
536	**1,2,4,5-Tetrahydroxybenzene**	215-20								*tetra* 226-7		2-Me eth, triacetyl, 142, Tetra-Me eth, 103
537	**4-Azophenol** (4,4'-Dihydroxyazobenzene)	α 216, grn (anh), β 216, dk red (anh)								*di* 198-9, yel, ac a	*di* 210 5 1 5, 249-51, red-yel, bz	Di-Me eth, 160 5 2 5, me al, Di-Et eth, 157-9, yel, al, 160
538	**2-Amino-3-nitrophenol**	216 7, red							136			N-Acetyl, 172, Me eth, 75-6
539	**4-Benzamidophenol** (4-Hydroxybenzanilide)	216 7, 227								171	235	Me eth, 153-4, al, Et eth, 173, aq al, Benzyl eth, 226-7
540	**2,5-Dimethylhydroquinone** (Hydrophlorone)	217								*mono* 117, *di* 135	*mono* 162-3, pet eth, *di* 159, me al	Me eth, 90, lgr

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Phenyl urethane	α-Naphthyl urethane	*p*-Nitro benzoate	3,5-Dinitro benzoate	Bromo derivative	*p*-Toluene sulfonate	Acetate	Benzoate	Miscellaneous
541	**Phloroglucinol** (1,3,5 Trihydroxybenzene)	217 9, rapid htng , 200 9, slow htng		*tri* 190 1		283	*tri* 162	*tri* 151		*tri* 104 6, al	*tri* 173 4, al	Monobenzenesulfonate, 163 4 (anh) Monobenzenesulfonate, di acetate, 95 6, bz Dibenzenesulfonate, 120-1, bz , Dibenzenesulfonate monoacetate, 81 me al
542	**2-Amino-3,5-dinitrophenol**	218, yel , al							186			O,N-Di *p*-Toluene sulfonyl, 188 N Acetyl, 171 Me eth , 181
543	**2,2′-Dihydroxy-1,1′-binaphthyl**	218								*di* 109, al	*mono* 204, *di* 160	Dipicrate, 175 6, Di-Me eth , 190, Di-Et eth , 90
544	**7-Hydroxybenzo [a]pyrene**	218 9, yel								194 5, yel	191 2, yel	Me eth , 183 4, pyr *p*-Nitrobenzyl eth , 252-3
545	**Acetylphloroglucinol** (2,4, 6-Trihydroxyaceto phenone, Phloracetophenone)	219, w , 222								*tri* 103	2-*mono* 168, 4 *mono* 210-11, *tri* 117 8	2-Me eth 205 7 4-Me eth , 139 40, Tri-Me eth , 103 Tri-Et eth , 75, aq al
546	**1,1′-Dihydroxy-2,2′-binaphthyl**	220								*di* 169		Di-Me eth , 122, lgr
547	**3,5-Dihydroxypyrene**	220 d , ac a								*di* 155		Di-Me eth , 177-8
548	**3,6-Dihydroxyphenanthrene** (3,6-Phenanthrenediol)	221, w -al								*di* 124 5, al		3-Me eth , 135 6 w -me al Di-Me eth , 104-5, w -me al
549	**2,3-Dimethylhydroquinone** (3,6-Dihydroxy-*o*-xylene)	221, sl d , w								*mono* 174 5, acet - pet eth , *di* 182, acet - pet eth		Di-Et eth , 68 9
550	**3-Hydroxy-2-naphthoic acid**	222								184-6		Amide, 218, Anilide, 244 *p*-Toluidide, 222
551	**4-Amino-6-chloro-3-methylphenol** (4-Amino-6-chloro-*m*-cresol)	223-5 d										O,N-Diacetyl, 162 O,N-Dibenzoyl, 220
552	**4-Azoxyphenol** (4,4′-Dihydroxyazoxybenzene)	224 d								*di* 163, or , al	*mono* 200, al , 212, bz , *di* 187-90	Di-Me eth , 118-9 yel , Di-Et eth , 137-8

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Phenyl urethane	α-Naphthylurethane	p-Nitrobenzoate	3,5-Dinitrobenzoate	Bromo derivative	p Toluene sulfonate	Acetate	Benzoate	Miscellaneous
553	**5-Hydroxyquinoline**	224							85			Hydrochloride, 240, Methiodide, 224, Picrate, 187
554	**2-Amino-4-chloro-5-nitrophenol**	225 d, yel										N-Acetyl 193 Me eth, 132
555	**1,2,3,4-Tetrahydroxynaphthalene** (1,2,3,4-Naphthalenetetrol)	225								*tetra* 220		
556	**1,8-Dihydroxyanthracene** (1,8-Anthracenediol, Chrysazol)	225, yel, al -w								*di* 184, et ac		Di-Me eth, 198, al, Di-Et eth, 139, al
557	**4-Amino-6-nitrocatechol**	228, yel										O,O,N-Triacetyl, 207, ac a
558	**5-Hydroxycoumarin**	229								88 9, 84		Me eth, 85 7
559	**2-Hydroxy-5-nitro-benzoic acid**	229 30										Amide, 225, Anilide, 224
560	**Pentabromophenol**	229 5, 225 6								197, 171		Me eth, 173 4, Et eth, 136
561	**2,6-Dihydroxyphenanthrene** (2,6-Phenanthrenediol)	234, w -al								*di* 122-3, al	*di* 252 3	Di-Me eth, 87, me al
562	**3-Amino-2-naphthol**	235										O,N-Diacetyl, 188, O,N-Dibenzoyl, 184
563	**5-Hydroxy-1-naphthoic acid**	235								202	241	
564	**2,3-Dihydroxyacridine** (2,3-Acridinediol)	235 d										Di-Me eth, 107, yel -wh, al
565	**Tetrachlorohydroquinone**	236 7								*di* 245	*di* 233	
566	**7-Hydroxyquinoline**	238-40, al, (br at 200)							116		88-9, al	Methiodide, 251 d, al, Picrate, 244-5
567	**1,7-Dihydroxyanthrone** (Euxanthone)	240								7-*mono* 160, al, *di* 185, bz	*di* 221 2, 214	7-Me eth, 130-5
568	**1,6-Dihydroxypyrene** (1,6-Pyrenediol)	240 d, sinters at 175										Sol red with grn fluor In alkali red soln with bl fluor, Zn dust → pyrene, 149-50
569	**4-Amino-2,5-dimethylphenol**	242 d, al										N-Acetyl, 177 9, al, Et eth, 69 5
570	**3,8-Dihydroxyphenanthrene** (3,8-Phenanthrenediol)	247, lt red, w -al								*di* 184, al		Di-Me eth, 117, me al
571	**3-Hydroxy-1-naphthoic acid**	248								169 70	222-3	Amide, 209-11, Anilide, 112-3
572	**2,5-Dihydroxypyridine** (2,5-Pyridinediol)	248								5-*mono* 156		Hydrochloride, 106 (hyd), 154 (anh)
573	**1,4-Dihydroxyisoquinoline** (1,4-Isoquinolinediol)	>250, ac a turns red at 200								4-*mono* 207-8		4-Me eth, 171, acet -pet eth
574	**2,3-Dihydroxyquinoline** (3-Hydroxycarbostyril, 2 3-Quinolinediol)	257 8, >300								3-*mono* 211	3-*mono* 286 7, *di* 45 6, pet eth	

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Phenyl urethane	α-Naphthyl urethane	p-Nitrobenzoate	3,5 Dinitrobenzoate	Bromo derivative	p-Toluene sulfonate	Acetate	Benzoate	Miscellaneous
575	**1,5-Dihydroxynaphthalene** (1,5-Naphthalenediol)	265, 258								*di* 159–61, dil al	*di* 235, 242, pyr	Di-Me eth, 183 4, Di-Et eth, 130, w-al, 2 Naphthylamine add comp, 229 5
576	**2,7-Dihydroxyphenanthrene** (2,7-Phenanthrenediol)	265, w-al								*di* 181 5, al		Di-Me eth, 169–70, me al
577	**Phenolphthalein**	265 (cor), 261		*di* 135, bz						*di* 143, al	*di* 169, bz-lgr	
578	**1,5-Dihydroxyanthracene** (Rufol, 1,5-Anthracenediol)	265 d, yel								*di* 198, et ac		Di-Me eth, 224, me al, Di-Et eth, 179, al
579	**4,4'-Biphenol** (4,4'-Dihydroxybiphenyl)	274 5, al							*di* 189 90, bz	*di* 161, dil al, 164 (cor)	*di* 241, ac a	Aryloxyacetic acid, 274, Di-Me eth, 173 (subl), Di-Et eth, 176
580	**1-Amino-2-naphthol**	276 d										O,N-Diacetyl, 206, O,N-Dibenzoyl, 235
581	**2,7-Dihydroxyanthracene** (2,7-Anthracenediol)	280–5 d, bz, turns dk at 250								282		Di-Me eth, 216 7, ac a, Di-Et eth, 192–3
582	**2,3-Dihydroxyanthracene** (2,3-Anthracenediol)	282 d, yel								*di* 175		Di-Me eth, 204, al
583	**4,4'-Dihydroxystilbene** (4,4'-Stilbenediol)	284, ac a								*di* 213		Di-Me eth, 214–5, Di-Et eth, 208
584	**3,5'-Dimethoxy-5,7,4'-trihydroxyflavonol** (Syringetin)	288 9, pa yel, ac a								*tetra* 224–6		4'-Benzyl eth, 240 1
585	**2,7-Dihydroxy-4-methylquinoline**	290–300, w-al (+1H_2O), turns br at 280								7-*mono* 250–4, al	7-*mono* 288, al	
586	**2,6-Dihydroxyanthracene** (Flavol 2,6-Anthracenediol)	295–300 d, al, turns dk at 270								*di* 260 1, ac a		Di-Me eth, 255–6, ac a, Di-Et eth, 230–1
587	**Bi-α-naphthol** (4,4'-Dihydroxy-1,1'-binaphthyl)	300, 250								*di* 217		Di-Me eth, 252, Di-Et eth, 211
588	**2,8-Dihydroxyacridine** (2,8-Acridinediol)	>300, turns red at 275										Di-Me eth, 138–9, Di-Et eth, 142 3
589	**2,6-Dibromo-1,5-dihydroxynaphthalene**	>300, 224 d turns dk at 200								1-*mono* 273, *di* 228	*di* 262, pyr	1-Acetate, 5-benzoate, 164, Di-Me eth, 161, Di-Et eth, 148
590	**3,7-Dihydroxyacridine** (3,7-Acridinediol)	324, pa yel, w-al										In al sol → grn fluor
591	**3,8-Dihydroxypyrene** (3,8-Pyrenediol)	330, Tri-cl-bz-ph hydraz, turns dk at 280								*di* 224, ac a		Di-Me eth, 244, cl-bz

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE VII. ORGANIC DERIVATIVES OF PHENOLS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Phenyl urethane	α-Naphthyl urethane	*p* Nitro benzoate	3 5-Di nitro benzoate	Bromo derivative	*p*-Toluene sulfonate	Acetate	Benzoate	Miscellaneous
592	**1,3-Dihydroxyacridone**	370								*mono* 200, yel	*mono* 295 7	Me eth (i) 203, dk br , (ii) 252, yel , Di-Me eth , 286-7 d , Anil , 269 70, Zn dust → acridine, 111

*Derivative data given in order m p , crystal color, solvent from which crystallized

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EXPLANATIONS AND REFERENCES TO TABLE VIII

Cleavage to alkyl bromide or alkyl iodide

$$ROR' + 2HBr \rightarrow \underset{\text{Mixture of alkyl bromides}}{RBr + R'Br} + H_2O$$

$$ROR' + 2HI \rightarrow \underset{\text{Mixture of alkyl iodides}}{RI + R'I} + H_2O$$

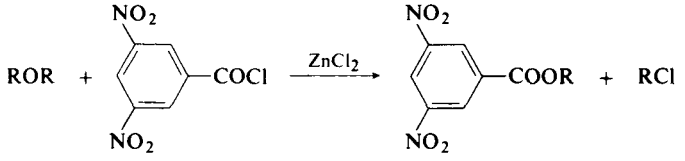
$$ArOR + HI \rightarrow \underset{\text{Phenol}}{ArOH} + \underset{\text{Alkyl iodide}}{RI}$$

From the ether with concentrated hydrochloric acid

For directions and examples see Cheronis, p 543, Linstead, pp 46 7, Shriner, p 116, Vogel, p 316

NOTE For directions and examples for preparation of derivatives of alkyl iodides and alkyl bromides formed on cleavage of ethers see explanations and references to Table V, pp 52, 53, 54

Alkyl 3 5-dinitrobenzoate *



Alkyl 3 5-dinitrobenzoate

From a symmetrical aliphatic ether with freshly fused zinc chloride and 3,5-dinitrobenzoyl chloride

For directions and examples see Cheronis, pp 542, 543, Linstead, p 46, Shriner, p 239, Vogel, p 316, Wild, p 96 H W Underwood, O L Baril and G C Toone, *J Amer Chem Soc*, **52**, 4087 (1930)

Bromo derivative

$$ArOR \xrightarrow{Br_2} \underset{\text{Bromoaryl ether}}{Ar(OR)Br}$$

$$ArOR \xrightarrow{nBr_2} \underset{\text{Polybromoaryl ether}}{Ar(OR)Br_n}$$

From alkyl aryl or diaryl ether with bromine in glacial acetic acid or chloroform

For directions and examples see Cheronis, p 545, Shriner, p 240

From the aromatic ether with bromine in alcohol, acetic acid, ether, chloroform or petrol ether

See Wild, pp 98–9, 101, H W Underwood, O L Baril and G C Toone, *J Amer Chem Soc*, **52**, 4087 (1930)

Sulfonamide *

$$ArOR \xrightarrow{ClSO_2OH} \underset{\text{Sulfonyl chloride}}{Ar(OR)SO_2Cl} \xrightarrow{(NH_4)_2CO_3} \underset{\text{Sulfonamide}}{Ar(OR)SO_2NH_2}$$

The sulfonyl chloride is prepared from the aromatic ether with chlorosulfonic acid in chloroform or without solvent The sulfonamide is obtained from the sulfonyl chloride with ammonium carbonate and/or aqueous ammonia

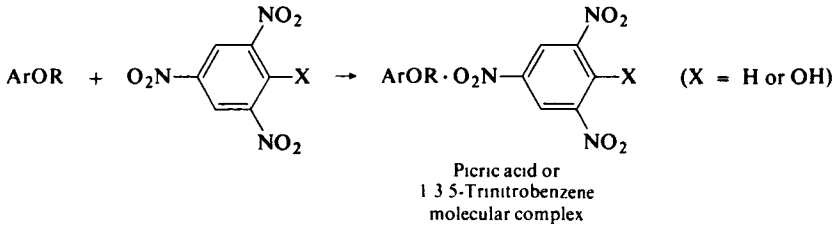
For directions and examples see Cheronis, pp 545, 546, Linstead, pp 47, 50, Shriner, p 241, Vogel, p 672, Wild, pp 27, 101, E H Huntress and F H Carten, *J Amer Chem Soc*, **62**, 511, 603 (1940)

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

EXPLANATIONS AND REFERENCES TO TABLE VIII (Continued)

Picric acid and 1,3,5-trinitrobenzene addition complexes



Picric acid or
1 3 5-Trinitrobenzene
molecular complex

From the aromatic ether with the aromatic polynitro compound in chloroform

For directions and examples see Cheronis, pp 545, 547, Linstead, pp 47, 50, Shriner, p 241, Vogel, p 672, Wild, p 100, O L Baril and G A Megrdichian, *J Amer Chem Soc*, **58**, 1415 (1936), E K Andersen, *Acta Chem Scand*, **8**, 157 (1954)

From the aromatic ether with picric acid in ethanol

See V H Dermer and O C Dermer, *J Org Chem*, **3**, 289 (1938)

NOTE For additional information regarding directions and examples for the derivatization of aromatic ethers (nitration, side-chain oxidation, etc) see explanations and references to Table IV, pp 32, 33, 34

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE VIII. ORGANIC DERIVATIVES OF ETHERS

a) Liquids (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	D_4^{20}	Picrate	Sulfon amide	Nitro derivative	Bromo derivative	1 3 5 Tri-nitro-benzene addition com pound	3 5 Dinitro benzoate	Miscellaneous
1	**Ethylene oxide** (Epoxyethane)	10 7	−111 7	1 3614[4]	$0\ 89713_4^0$							HBr → Ethylene bromohydrin, b p 149
2	**Ethyl methyl ether**	10 8, 10			$0\ 7260_4^0$							
3	**Furan**	31 27	−85 6	1 42157	0 9366							Maleic anhydride → 3,6-Endoxo-Δ^4-tetrahydrophthalic anhydride, 125d, 118d, abs eth
4	**Diethyl ether** (Ethyl ether)	34 60	−116 3, stab, −123 3, unst	1 3526	0 71352						93	Iodide, b p 72
5	**Propylene oxide** (1,2-Epoxypropane)	35		1 466	0 830							Heating with dil H_2SO_4 → *d l*-propylene glycol, b p 187 4
6	**Ethyl vinyl ether**	35 75	−115 8	1 3768	0 7589							Dil acid → al + acetaldehyde
7	**Methyl *n*-propyl ether**	39		1 3579	$0\ 7356_4^{13}$							
8	**Allyl methyl ether**	46							*β,γ-di* b p 185, D_4^{20} 1 8329			
9	**Ethyl isopropyl ether**	53 4			0 7211 ($0\ 745_4^0$)							Heating with 1% H_2SO_4 (sealed tube) → al + isopropyl alcohol
10	***tert*-Butyl methyl ether**	55 2		1 3689	0 7405							Constant boil mixt with w, b p 52 6, with 4% w
11	**2,3-Epoxybutane**	*cis* 58 9^{745} *trans* 53–4[741]			*cis* $0\ 8226_4^{25}$, *trans* $0\ 8010_4^{25}$							Normal crude mixt is 65% *trans* + 35% *cis*
12	**Chloromethyl methyl ether**	59		1 3974	1 015	163						
13	**α-Butylene oxide** (1,2-Epoxybutane)	61–2		1 385[17]	0 837[17]							
14	**Ethyl *n*-propyl ether**	63 6	< −79	1 36948	0 7386							Constant boil mixt with al, b p 61 2, with 25% al
15	**2-Methylfuran** (Sylvan)	64		1 434	0 913							
16	**Tetrahydrofuran**	65		1 407	0 889							
17	**Allyl ethyl ether**	66–7[742]		1 3881	0 7651				*β,γ-di* b p 193–5			Heating with 2% H_2SO_4 → al + allyl alcohol
18	**Di-isopropyl ether** (*Isopropyl ether*)	67 5	−60	1 3688	0 726						123, 120–1, CCl_4	

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE VIII. ORGANIC DERIVATIVES OF ETHERS

a) Liquids (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Picrate	Sulfonamide	Nitro derivative	Bromo derivative	1,3,5-Trinitrobenzene addition compound	3,5-Dinitro benzoate	Miscellaneous
19	***n*-Butyl methyl ether**	70	−115 5	1 3728, 1 3736	0 7455, 0 774							Oxid by alkaline $KMnO_4$ at 35 40° → ac a + methoxyacetic acid
20	***tert*-Butyl ethyl ether**	73 1 (cor)		1 3760	0 7404							Constant boil mixt with w , b p 65 2, with 6% w
21	**Tetrahydrosylvan**	79		1 407	0 855							
22	**Chloromethyl ethyl ether**	80, 83d		1 40398	1 014							
23	**Ethyl isobutyl ether**	81 1 (cor)		$1\ 3739^{25}$	$0\ 7323_4^{25}$							
24	***sec*-Butyl ethyl ether**	81 2 (cor)		1 3802	0 7503							
25	**Isopropyl *n*-propyl ether**	83		1 376	0 7370							
26	**Ethylene glycol dimethyl ether**	84 7		1 37965	0 8665							
27	**Dihydropyran**	86		1 440	0 923							
28	***tert*-Amyl methyl ether**	86 3		1 3885	0 7703							Constant boil mixt with w , b p 73 8, with 9% w , Constant boil mixt with me al , b p 62 3, with 50% me al
29	**Tetrahydropyran**	88		1 421	0 881							
30	**Di-*n*-propyl ether** (*n*-Propyl ether)	90 1	−122	1 38829	0 74698						74	Constant boil mixt with w , b p 75 4, Constant boil mixt with *n*-propyl alcohol, b p 85 8
31	***n*-Butyl ethyl ether**	92 3 (cor)	−124	1 3820	0 7505							
32	**2,5-Dimethylfuran**	94		$1\ 4363^{21\ 6}$	$0\ 888_4^{20\ 1}$				*penta* 180, chl			Maleic anhydride → 3,6-Endoxo-3,6-dimethyl-Δ^4-tetrahydrophthalic anhydride, 78, eth
33	**α-Chloroethyl ethyl ether**	98		1 404	0 966							
34	***n*-Amyl methyl ether**	99–100		1 3873	0 761							
35	***tert*-Amyl ethyl ether**	101		1 3912	0 7657							Constant boil mixt with 13% w , b p 81 2
36	**1,4-Dioxane**	101 4	11 8	1 4232	1 03361				65–6			Iodine derivative, 84 5, Constant boil mixt with 48 mole % dioxane, b p 82 8

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VIII. ORGANIC DERIVATIVES OF ETHERS
a) Liquids (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Picrate	Sulfon amide	Nitro derivative	Bromo derivative	1 3 5 Tri nitro benzene addition com pound	3 5 Dinitro benzoate	Miscellaneous
37	**Ethylene glycol mono-ethyl monomethyl ether** (1-Ethoxy-2-methoxyethane)	102		1 38677	0 8529							
38	**Cyclopentyl methyl ether**	105		1 4206	0 862							
39	**β-Chloroethyl ethyl ether**	107		1 411	0 989							
40	***n*-Butyl isopropyl ether**	108^{738}		$1\ 3889^{21.9}_{5461}$	$0\ 7594^{15}$							Boil HI → *n*-butyl iodide + isopropyl iodide
41	**α-Epichlorohydrin**	115 7		1 438	1 181							
42	**α,α′-Dichloroethyl ether**	116, 114		$1\ 4183^{24}$	$1\ 138^{12}_4$							
43	***n*-Amyl ethyl ether**	118		1 3927	0 762							
44	**Di-*sec*-butyl ether**	121		$1\ 3928^{25}$	0 760				b p 90 1 n_D^{25} 1 250		75 5	
45	**Cyclopentyl ethyl ether**	122		1 423	0 853							
46	**Di-isobutyl ether** (Isobutyl ether)	123			$0\ 7616^{15}_{15}$						87, 84 5 5 5	
47	**Ethylene glycol monomethyl mono-*n*-propyl ether** (1-Methoxy 2-*n* propoxyethane)	124 5		1 39467	0 8472							
48	***n*-Hexyl methyl ether**	126		1 3972	0 772							
49	**2-Methoxy-1-propanol**	130^{758}									97	α-Naphthylurethane, 60
50	**Cyclohexyl methyl ether**	134		1 435	0 875							
51	**Ethylene glycol monoethyl ether** ("Cellosolve", 2-Ethoxyethanol)	134 8, 135 1		1 40797	0 9297 0 9311						75	Miscible with w , with al and with eth , Diphenylurethane, 43, Xanthate, 202 5 (cor), acet abs eth
52	**3-Ethoxy-2-methyl-2-butanol**	141										Phenylurethane, 226
53	***n*-Hexyl ethyl ether**	142		1 4008	0 772							
54	**Di-*n*-butyl ether** (Butyl ether)	142 4, 144	−98	1 3989	0 76829						62 3, 64	
55	**Cyclohexyl ethyl ether**	149		1 435	0 864							
56	**Anisole** (Methoxybenzene, Methyl phenyl ether)	153 8, 155 (43^{10})	−37 5	1 52211	0 99393	79 81, unst in air	113, 110 1, al	2,4-*dt* 86 9, al , 95 5	2,4-*dt* 61, al		87	
57	**3-Methoxy-2-methyl-1-propanol**	155		$1\ 4140^{27}$							64	
58	**Diethylene glycol dimethyl ether**	162 0	−75	1 4099	$0\ 9440^{20}_{20}$							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VIII. ORGANIC DERIVATIVES OF ETHERS
a) Liquids (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	D_4^{20}	Picrate	Sulfon amide	Nitro derivative	Bromo derivative	1,3 5 Tri-nitro benzene addition com pound	3,5-Dinitro-benzoate	Miscellaneous
59	**Furfuryl alcohol** (2-Furancarbinol)	170		1 4868	1 1351						80-1, pyr	*p*-Nitrobenzoate, 76, N-Phenyl-urethane, 45
60	**Ethylene glycol mono-*n*-butyl ether** (*n*-Butyl "cellosolve")	171[743]		1 4177	0 9188				172		oil	3-Nitrophthalate, 120
61	**Benzyl methyl ether**	170-1 (cor)		1 5008	0 9649	115 6						
62	**2-Methoxytoluene** (2-Methyl anisole, Methyl 2-tolyl ether, 2-Cresyl methyl ether)	171		1 505	0 9853	116, 113 4, pa yel	137, al	3,5-*di* 69, pa yel , me al	5-*mono* 63-4, al			Oxid → *o*-Meth-oxybenzoic acid, 101
63	**Phenyl ethyl ether** (Phenetole)	172	-33	1 5080, 1 5074	0 9666	92	150	*p-mono* 58				
64	**Di-isoamyl ether** (Iso-amyl ether)	172 5		1 409	0 778						60 1	Constant boil mixt with w , b p 97 2
65	**4-Methoxytoluene** (4-Methylanisole, Methyl 4-tolyl ether, 4-Cresyl methyl ether)	173, 176		1 512	0 970	88-9, yel -or	182, al					Oxid → *p*-Anisic acid, 184-6, 184, w
66	**3-Methoxytoluene** (3-Methylanisole, Methyl 3-tolyl ether, 3-Cresyl methyl ether)	173, 177 (cor)		1 513	0 972	113 4, yel -or	129 30, al	2-*mono* 54-5, pet eth , 2,4,6-*tri* 92, al				Oxid → *m*-Meth-oxybenzoic acid, 110
67	**Tetrahydrofurfuryl alcohol**	117		1 45167	1 0544						83-4	*p*-Nitrobenzoate, 46-8, N-Phenyl-urethane, 61, pet eth
68	**Phenyl isopropyl ether**	178		1 4992	0 975							conc H_2SO_4 + ac a → *o*-Isopro-pylphenol, b p 213-4, m p 130
69	**β,β'-Dichloroethyl ether**	178		1 4568	1 220							
70	**2-Ethoxytoluene** (2-Cresyl ethyl ether, Ethyl 2-tolyl ether)	184		1 505	0 953	117 5 8 5, pa yel	148-9, al	*di* 51				Oxid → *o*-Ethoxy-benzoic acid, 25, 19 0- 5, well dried
71	**Benzyl ethyl ether** (Homophenetole)	184-6 (cor)		1 4958	0 9478							Refluxed in bz + P_2O_5 → Ethylene + Diphenyl-methane, 25 1
72	**Di-*n*-amyl ether** (*n*-Amyl ether)	187 5	-69 3	1 416	0 78298						42 3	
73	**Diethylene glycol diethyl ether**	188		1 411	0 906							
74	**Phenyl *n*-propyl ether** (*n*-Propoxybenzene)	188, 189 3 (cor)		1 5014, 1 5011	$0\ 9494_{20}^{20}$		116 7, al					

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VIII. ORGANIC DERIVATIVES OF ETHERS
a) Liquids (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point, °C	n_D^{20}	D_4^{20}	Picrate	Sulfonamide	Nitro derivative	Bromo derivative	1,3,5-Trinitrobenzene addition compound	3,5-Dinitrobenzoate	Miscellaneous
75	**4-Ethoxytoluene** (4-Cresyl ethyl ether Ethyl 4-tolyl ether)	190 5		1 505	0 949	110 1, or yel	138 0 5, al					Oxid → *p*-Ethoxybenzoic acid, 198, 195 0- 5, al
76	**3-Ethoxytoluene** (3-Cresyl ethyl ether Ethyl 3-tolyl ether)	190 5		1 506	0 949	114 5 or -yel	110 1 al					Oxid → *m*-Ethoxybenzoic acid, 137
77	**Diethylene glycol monomethyl ether**	194		*1* 4244	*1* 035$_{20}^{20}$							*p*-Nitrophenylurethane, 73 5
78	**3-Chloroanisole**	194					131					
79	**2-Chloroanisole**	195		1 5433^{25}	1 1865$_4^{25}$			95				
80	**Diethylene glycol monoethyl ether**	196		1 4298	1 023$_{20}^{20}$						oil	*p*-Nitrophenylurethane, 66
81	**4-Chloroanisole**	200			1 1851$_4^{12\ 8}$		151	2-*mono* 95				
82	***n*-Butyl phenyl ether** (*n*-Butoxybenzene)	206		1 5049		110-2, pa yel chl	103 4, al					
83	**2-Chlorophenetole**	208	17				133	82				
84	**2-Bromoanisole**	210					140	106				
85	**Benzyl isobutyl ether**	210 2 (cor)		1 4826	0 9233							
86	***p*-Bromoanisole**	215, 216			1 494$_4^9$		148	88				
87	**Methyl thymyl ether**	216			0 954$_4^0$			*tri* 92				
88	**Triethylene glycol dimethyl ether**	216	-47	1 4233	0 9871$_{20}^{20}$							
89	**1,3-Dimethoxybenzene** (Resorcinol dimethyl ether)	217 (cor)	-58, -52	1 4233	1 0552$_{25}^{25}$	56 8, or -yel , unst in air	166-7, al	2,4-*di* 72, pa yel , al , 4,6-*di* 157 al , 2,4,6-*tri* 123-4, pa red, al	4,6-*di* 140, al			
90	**2-Bromophenetole**	218					135	98				
91	**Benzyl *n*-butyl ether**	219-21 (cor)		1 4833	0 9227							
92	**Creosol** (4-Methylcatechol 2-methyl ether)	221	5 5	1 5353^{25}	1 0919$_4^{25}$	112, yel						
93	***n*-Butyl 2-tolyl ether** (2-Butoxytoluene)	223			0 9437$_0^0$		95-6, al					
94	**2-Methoxyaniline** (2-Anisidine)	225	5		1 0978$_{15}^{15}$							N-Formyl, 83 5, N-Acetyl, 87-8
95	**Di-*n*-hexyl ether** (*n*-Hexyl ether)	228-9^{761}			0 7936						54 5-5 5	
96	**Safrole** (4-Allyl-1,2-methylenedioxybenzene)	233	11	1 5383	1 100	104 0 5 5, or -red			*tri* 108, *penta* 169-70, bz	51		
97	**4-Bromophenetole**	233, 229	12				145	47				

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VIII. ORGANIC DERIVATIVES OF ETHERS

a) Liquids (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^t	Picrate	Sulfonamide	Nitro derivative	Bromo derivative	1 3 5 Trinitro benzene addition compound	3 5 Dinitro benzoate	Miscellaneous
98	**Resorcinol diethyl ether**	235	12 4			109	184		*tri* 69			
99	**Eugenol methyl ether** (4-Allyl-1,2-dimethoxybenzene)	244		1 5360	1 0336	114 5, red-br, chl	7		*tri* 78, abs al			
100	**2-Iodophenetole**	246			1 800	84			*tri* 110			
101	***trans*(β)-Isosafrole** (1,2-Methylenedioxy-4-propylbenzene)	248	6 8	1 5782	1 122	74 5, dk red, chl			*di* 52-3, eth, *tri* 109 10, pet eth	85 6, brt scar		
102	**3-Methoxyaniline** (3-Anisidine)	251				169d, yel						N-Formyl, 57, N-Acetyl, 81, N-*p*-Toluenesulfonyl, 68
103	**Di-*n*-heptyl ether** (*n*-Heptyl ether)	263, 260		1 427	$0\ 8056_{20}^{20}$						47	
104	**Isoeugenol methyl ether**	264	16-7	1 5692	1 0528	42 5, dk red, chl			*di* 101 0 5, abs eth	69-70, brt scar		Oxid → Veratric acid, 181
105	**Tetraethylene glycol dimethyl ether**	266, 275		1 432	1 009							
106	**Methyl 1-naphthyl ether** (1-Methoxynaphthalene)	271 (cor)	< −10	$1\ 6940^{25}$	1 09159	129 5 30 5 yel-or, chl	156 7, al	2-*mono* 80, 4 *mono* 85, yel, al	4-*mono* b p 181-2, 5-*mono* 67 5 8 0, *x*-*mono* 46, al, 2,4-*di* 54 5, al	139 40, 137 8, yel		
107	**2-Nitroanisole**	277	10	1 562	1 254							Reduct → *o*-anisidine, b p 225
108	**Ethyl 1-naphthyl ether** (1-Ethoxynaphthalene)	280 5 (cor)	5 5	$1\ 5973^{25}$	1 074	118 5 9 0 (cor)	164-5, al	2-*mono* 84, 4-*mono* 116-7, al	4-*mono* 48, al	125 5, yel		
109	**Dibenzyl ether** (Benzyl ether)	290 300d	3 6		1 0428	77 8, or-yel, chl			*di* 107-8, al		112	
110	**Isoamyl 1-naphthyl ether**	317 5 (cor)	< −10	$1\ 57049^{14\ 2}$	$1\ 00689_4^{14\ 2}$	96 0-7 0						

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE VIII. ORGANIC DERIVATIVES OF ETHERS

b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point, °C	n_D^{20}	D_4^{20}	Picrate	Sulfon amide	Nitro derivative	Bromo derivative	1,3,5-Tri nitro-benzene addition com-pound	3,5 Dinitro ben zoate	Miscellaneous
1	**4-Chlorophenetole** (1-Chloro-4-ethoxybenzene)	21	212	1 5227[19]	1 1231 $^{20}_{20}$		134		2,6 *di* 54			
2	**Veratrole** (1,2-Dimethoxy-benzene)	22 5	207, 205	1 5287[21]	1 080	56 7, red	135 6, al	95	4,5-*di* 92-3			
3	**Anethole** (1-Methoxy-4-propenylbenzene)	22 5, al	235	1 558	0 989 $^{25}_{4}$	69 70d, or -red, al			*di* 67, eth, 65, 62 4, *tri* 108, pet eth			
4	**4-Methoxybenzyl alcohol** (Anisyl alcohol)	24	151[27], 138[14]									Phenylurethane, 93 *p*-Nitroben-zoate, 94
5	***n*-Amyl 2-naphthyl ether**	24 5	327 5 (cor)	1 5587[20]		66 5 7 0, or , h al	159	*di* 135	*di* 58			
6	**4-Iodophenetole** (1-Ethoxy-4-iodobenzene)	27	252					96				
7	**Diphenyl ether** (Phenyl ether)	28	259	1 5826[24]	1 073	110	*di* 159, al	4,4'-*di* 144 4, al , 2,4,2',4'-*tetra* 195 7, pa yel , ac a	4,4'-*di* 54 5, al			
8	**Isoamyl 2-naphthyl ether**	28 0 5	321 0 (cor)			93 5-4 0, al						
9	**2-Methoxyphenol** (Guaia-col, Catechol mono-methyl ether)	28 2	205	1 5441	1 1287 $^{20.4}_{vac}$	86 7			4,5,6-*tri* 116, al		141 2 (cor), al	
10	**2-Methoxybiphenyl** (2-Biphenyl methyl ether)	29, pet eth	274					5-*mono* 95 6, pa yel , me al				
11	**β-Bromoethyl phenyl ether**	32							56			
12	**Isobutyl 2-naphthyl ether**	33	304			84 5						
13	**Didodecyl ether** (Dilauryl ether)	33, 28-30	190-5[1]									
14	**2-Ethoxybiphenyl** (2-Biphenyl ethyl ether)	34	132[6]									
15	***sec*-Butyl 2-naphthyl ether**	34	298 5 (cor)			86						
16	**3-Ethoxybiphenyl** (3-Biphenyl ethyl ether)	35	158[8]									
17	**3-Nitrophenetole**	35	284									Reduct → *m*-Phenetidine, (Picrate, 158)
18	***n*-Butyl 2-naphthyl ether**	35 5	309 (cor)			67						
19	**Ethyl 2-naphthyl ether** (Neonerolin)	36, 37	282 (cor)	1 5932[17]	1 064	101	161-3, al		1-*mono* 66, pet eth , 1,6-*di* 94, pet eth			
20	**3-Aminodiphenyl ether**	37, lgr	315									N-Hydrochloride, 141, 139, N-Acetyl, 83, lgr

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE VIII. ORGANIC DERIVATIVES OF ETHERS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	n_D^{20}	D_4^{20}	Picrate	Sulfonamide	Nitroderivative	Bromo derivative	1,3,5-Trinitrobenzene addition compound	3,5 Dinitrobenzoate	Miscellaneous
21	**3-Nitroanisole**	39	258		1 373[18]							Reduct → *m*-Anisidine, (Picrate, 169d)
22	**Isopropyl 2-naphthyl ether**	40	285			95						
23	**2-Naphthyl *n*-propyl ether**	40	297			81						
24	**Catechol diethyl ether** (1,2-Diethoxybenzene)	43, dil al	217			69–71, red-br, unst in air	3,4-*di* 162 3, al	*tri* 122				
25	**bz-Tetrahydro-6-methoxyquinoline**	43	130	1 5718[50]								
26	**2,4,6-Trichlorophenetole**	44	246					*di* 100				
27	**8-Methoxyquinoline**	45	175[29]			162						
28	**2-Aminodiphenyl ether**	47	173[14]									Acetate, 81
29	**Pyrogallol trimethyl ether** (1,2,3-Trimethoxybenzene)	47, dil al	241			78 5–80 0, yel	2,3,4-*tri* 123 4	5-*mono* 106, ac a	*mono* oil, *di* oil, 4,5,6-*tri* 73 4	81, pa yel		
30	**4-Iodoanisole**	52	139									
31	**Phloroglucinol trimethyl ether** (1,3,5-Trimethoxybenzene)	52 3, al	255 5 (cor)						2 *mono* 96 7, dil al, 2,4-*di* 129–30, al, 2,4,6-*tri* 145, al			
32	**Hydroquinone monomethyl ether**	52 5	244[754 2]									
33	**4-Nitroanisole**	54	274	1 5707[60]	1 233$_4^{20}$							Reduct → *p*-Anisidine, 57
34	**Hydroquinone dimethyl ether** (1,4-Dimethoxybenzene)	56, 75% al	213 (cor)			47–8, or-red, unst in air	148, al	2-*mono* 72, yel, 2,3-*di* 177, 2,5-*di* 202	*di* 142, ac a	*di* 86 5, red		
35	**4-Methoxyaniline** (4-Anisidine)	57	246		1 071$_4^{55}$							N-Formyl, 81, N-Acetyl, 130–2, w, N-Benzoyl, 216 7
36	**4-Cyclohexylphenyl methyl ether**	59	116[4]									
37	**2,4,6-Trichloroanisole**	60						*di* 95				
38	**1,3-Diphenoxypropane** (Trimethylene glycol diphenyl ether)	61, al	338–40 (cor)				4,4′-*di* 245 55, al					
39	**Catechol dibenzyl ether** (1,2-Dibenzyloxybenzene)	63 4, wh, me al						4-*mono* 98, pa yel, al				
40	**1-Phenyl-2-phenoxymethanol**	64										*p*-Nitrobenzoate, 84
41	**α-Glyceryl phenyl ether**	70	187[15]									
42	**2,4,6-Tribromophenetole**	72						79				

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE VIII. ORGANIC DERIVATIVES OF ETHERS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	n_D^{20}	D_4^{20}	Picrate	Sulfon amide	Nitro derivative	Bromo derivative	1,3,5-Trinitrobenzene addition compound	3,5-Dinitrobenzoate	Miscellaneous
43	**Hydroquinone diethyl ether** (1,4-Diethoxybenzene)	72						*mono* 49, yel, 2,3-*di* 130, yel, al, 2,5-*di* 176, yel, al		86 5		
44	**Methyl 2-naphthyl ether** (Nerolin)	73 (cor), eth	273			116 5-7 0, dk yel, 113 0-3 5	150 1, al	1-*mono* 128, 1,6,8-*tri* 215d	*x-mono* 62 3, pet eth, 1-*mono* 83-4, 3-*mono* 77 8, 6-*mono* 108	93 5, yel		
45	**2,4,5-Tribromophenetol**	73						79				
46	**4-Ethoxybiphenyl** (4-Biphenyl ethyl ether)	76, 74	188[13]									
47	**Benzyl 1-naphthyl ether**	77 (cor)	200[12]			85-100 (cor)						
48	**2-Phenyl-2-phenoxyethanol**	81										*p*-Nitrobenzoate, 87
49	**4-Aminodiphenyl ether**	83 5, 84, w	189[14]									N-Acetyl, 127, N-HCl, 122
50	**Biphenylene oxide** (Dibenzofuran)	86, wh, al	288 (cor)			94		3-*mono* 181-2, *di* 245, ac a		96, yel		
51	**4-Methoxybiphenyl** (4-Biphenyl methyl ether, 4-Phenylanisole)	90, 89					3-*mono* 91 2, al, 3,5-*di* 137-8, yel, al, 3,4'-*di* 171	3-*mono* 79, 4'-*mono* 144, pet, 3,4'-*di* 134, 3,5-*di* 87, pet				
52	**1,2-Diphenoxyethane** (Ethylene glycol diphenyl ether)	98, al					4,4'-*di* 228-9, al	2',4'-*di* 215 2 (cor), pa yel, acet	*di-p* 134-5, al			
53	**Benzyl 2-naphthyl ether** (2-Benzyloxynaphthalene)	101 5 (cor), al	d			123 0 (cor)						
54	**Anisoin** (4,4'-Dimethoxybenzoin)	113										Methyl ether, 52-3, yel, CCl_4, Ethyl ether, 103-4, al-w
55	**Hydroquinone dibenzyl ether** (1,4-Dibenzyloxybenzene)	128-9, al						83				

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE VIII. ORGANIC DERIVATIVES OF ETHERS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	n_D^{t}	D_4^{t}	Picrate	Sulfonamide	Nitro derivative	Bromo derivative	1 3 5 Trinitrobenzene addition compound	3 5-Dinitrobenzoate	Miscellaneous
56	**Anisil** (4,4'-Dimethoxybenzil)	133, yel										Monoxime, 133, *syn*-Dioxime, 217, *anti*-Dioxime, 195, bz , Disemicarbazone, 254 5, dil ac a , Dihydrazone, 118
57	**Antiarol** (5-Hydroxy-1,2,3-trimethoxybenzene)	148, w										Acetyl, 74, al , Methyl ether, 47, b p 271
58	**Anhalamine** (6,7-Dimethoxy-8-hydroxy-1,2,3,4-tetrahydroisoquinoline)	187-8, al				234-6						Dibenzoyl, 128-9, N-Benzoyl, 167 8
59	**7-Methoxyquinoline**	210	287^{758}			229						

*Derivative data given in order m p , crystal color, solvent from which crystallized

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EXPLANATIONS AND REFERENCES TO TABLES IX AND X

Phenylhydrazone *

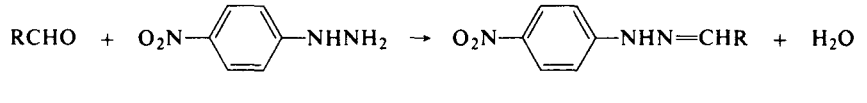
$$RCHO + H_2NNHC_6H_5 \rightarrow RCH{=}NNHC_6H_5 + H_2O$$

$$RR'CO + H_2NNHC_6H_5 \rightarrow RR'C{=}NNHC_6H_5 + H_2O$$

Phenylhydrazone

From the carbonyl compound with phenylhydrazine in methanol or ethanol
For directions and examples see Cheronis pp 497 8 Shriner, p 131
From the carbonyl compound with phenylhydrazine in aqueous acetic acid
See Wild, p 111
From the carbonyl compound with phenylhydrazine in methanol in the presence of acetic acid
See Cheronis, p 511
From the carbonyl compound in alcohol with phenylhydrazine hydrochloride and sodium acetate in water
See Vogel, p 721

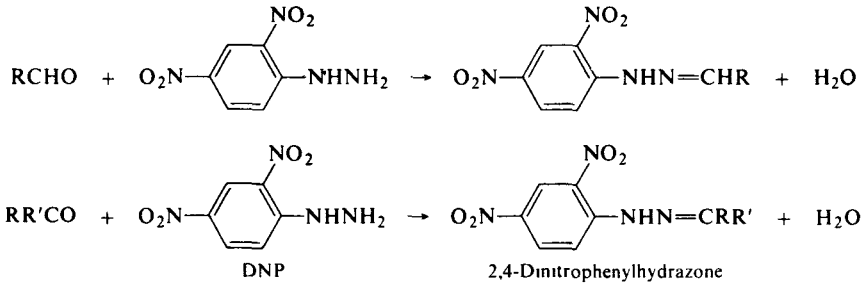
p-Nitrophenylhydrazone *



p Nitrophenylhydrazone

From the carbonyl compound with *p*-nitrophenylhydrazine and a catalytic amount of acetic acid in alcohol
For directions and examples see Shriner, pp 131, 219, Vogel, p 722, Wild, p 112
From the carbonyl compound in alcohol or water with *p*-nitrophenylhydrazine in aqueous acetic-hydrochloric acids
See G Petit, *Bull Soc Chim France*, 141 (1948)

2 4-Dinitrophenylhydrazone (DNP-derivative) *



DNP 2,4-Dinitrophenylhydrazone

From the carbonyl compound with 2,4-dinitrophenylhydrazine and sulfuric acid in methanol or ethanol
For directions and examples see Linstead, p 26, Shriner, p 219, Vogel, p 344, Wild, pp 114-5, O L Brady and G V Elsmie, *Analyst*, **51**, 77 (1926), O L Brady, *J Chem Soc*, 756 (1931), H H Strain, *J Amer Chem Soc*, **57**, 758 (1935), O L Brady and S G Jarret, *J Chem Soc*, 1021 (1950)
From the carbonyl compound with 2,4-dinitrophenylhydrazine and 1% hydrochloric acid in methanol or ethanol
See Cheronis, pp 499-501, 511, Vogel, p 722, Wild, pp 112-4, C F H Allen, *J Amer Chem Soc*, **52**, 2955 (1930), C F H Allen and J H Richmond, *J Org Chem*, **2**, 222 (1937)
From the carbonyl compound with 2,4-dinitrophenylhydrazine and acetic acid in diglyme (diethylene glycol dimethyl ether)
See H J Shine, *J Org Chem*, **24**, 1790 (1959)
From the carbonyl compound in 95% ethanol with 2,4-dinitrophenylhydrazine and concentrated hydrochloric acid in diglyme (diethylene glycol dimethyl ether)
See Cheronis, p 501, H J Shine, *J Org Chem*, **24**, 252 (1959), *J Chem Ed*, **36**, 575 (1959)

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

From the carbonyl compound in ethanol with 2,4-dinitrophenylhydrazine in 85% phosphoric acid
See Vogel, p 344, G D Johnson, *J Amer Chem Soc*, **73**, 5888 (1951), **75**, 2720 (1953)
From the carbonyl compound with 2,4-dinitrophenylhydrazine and sulfuric acid in isopropyl alcohol
See N R Campbell, *Analyst*, **61**, 391 (1936)
From the carbonyl compound with 2,4-dinitrophenylhydrazine in pyridine
See E A Braude and C J Timmons, *J Chem Soc*, 3131 (1953)

Semicarbazone *

$$RCHO + H_2NNHCONH_2 \rightarrow RCH{=}NNHCONH_2 + H_2O$$

$$RR'CO + H_2NNHCONH_2 \rightarrow RR'C{=}NNHCONH_2 + H_2O$$

$$RR'CO + (CH_3)_2C{=}NNHCONH_2 \rightarrow RR'C{=}NNHCONH_2 + (CH_3)_2CO$$

Semicarbazone

From the carbonyl compound with aqueous semicarbazide hydrochloride and sodium acetate
For directions and examples see Cheronis, pp 503–504, 512, Shriner, p 218, Vogel, p 344, Wild, p 121, A Michael, *J Amer Chem Soc*, **41**, 417 (1919)
From the carbonyl compound in ethanol with aqueous semicarbazide hydrochloride and sodium acetate
See Linstead, p 27, Shriner, p 218, Wild, p 122, R L Shriner and T A Turner, *J Amer Chem Soc*, **52**, 1267 (1930)
From the carbonyl compound and acetone semicarbazone in acetic acid
See B Angla, *Ann Chim Anal Chim Appl*, **22**, 10 (1940)

Thiosemicarbazone *

$$RCHO + H_2NNHCSNH_2 \rightarrow RCH{=}NNHCSNH_2 + H_2O$$

$$RR'CO + H_2NNHCSNH_2 \rightarrow RR'C{=}NNHCSNH_2 + H_2O$$

Thiosemicarbazone

From the carbonyl compound with thiosemicarbazide and sodium acetate in water, alcohol or acetic acid
For directions and examples see Cheronis, pp 503, 512, Wild, p 128, F J Wilson and R Burns, *J Chem Soc*, **121**, 873 (1922), W Baird, R Burns and F J Wilson, *J Chem Soc*, 2527 (1927), M Busch, *J prakt Chem*, **124**, 301 (1930), P P T Sah and T C Daniels, *Rec Trav Chim*, **69**, 1545 (1950)

Phenylsemicarbazone *

$$RCHO + H_2NNHCONHC_6H_5 \rightarrow RCH{=}NNHCONHC_6H_5 + H_2O$$

$$RR'CO + H_2NNHCONHC_6H_5 \rightarrow RR'C{=}NNHCONHC_6H_5 + H_2O$$

Phenylsemicarbazone

From the carbonyl compound with phenylsemicarbazide in alcohol or acetic acid
For directions and examples see P P T Sah and T -S Ma, *J Chinese Chem Soc*, **2**, 32 (1934), *C A*, **28**, 3713 (1934)

Oxime *

$$RCHO + NH_2OH \rightarrow RCH{=}NOH + H_2O$$

$$RR'CO + NH_2OH \rightarrow RR'C{=}NOH + H_2O$$

Oxime

From the carbonyl compound with hydroxylamine hydrochloride and pyridine in ethanol or without solvent
For directions and examples see Cheronis, p 513, Shriner, p 254, Vogel, p 345, J B Buck and W S Ide, *J Amer Chem Soc*, **53**, 1536 (1931), W E Bachmann and C H Boatner, *J Amer Chem Soc*, **58**, 2097 (1936), W E Bachmann and M X Barton, *J Org Chem*, **3**, 300 (1938)
For a modification of the above method in aqueous alcohol
See W M D Bryant and D M Smith, *J Amer Chem Soc*, **57**, 57 (1935)
From the carbonyl compound with hydroxylamine hydrochloride and sodium hydroxide in methanol or aqueous ethanol

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

See: Cheronis, p. 513; Shriner, p. 255; Vogel, p. 721; Wild, p. 121.

From the carbonyl compound with hydroxylamine hydrochloride and potassium hydroxide in 95% ethanol.

See: Shriner, p. 255.

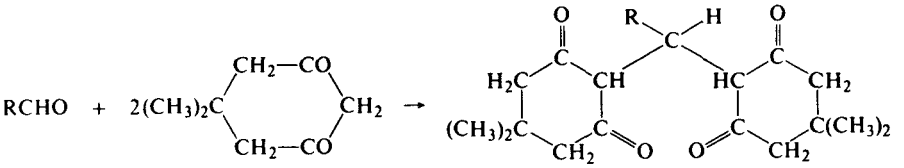
From the carbonyl compound with hydroxylamine hydrochloride and sodium or potassium acetate in water or aqueous ethanol.

See: Linstead, p. 27; Vogel, pp. 343, 345; J. S. Buck and W. S. Ide, *J. Amer. Chem. Soc.*, **53**, 1536 (1931).

From the carbonyl compound with hydroxylamine hydrochloride and sodium carbonate or bicarbonate in water or aqueous ethanol.

See: Wild, p. 120.

*Dimethone derivative (Methone derivative).**



This derivative is specific for aldehydes only.

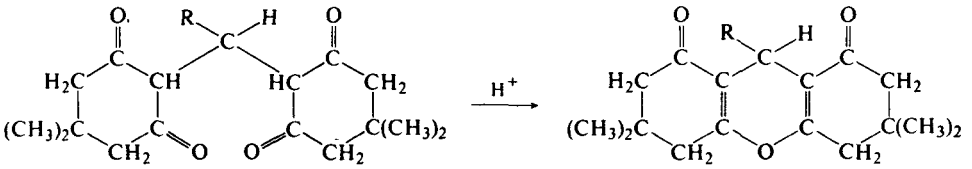
From the aldehyde and methone (dimedone; 5,5-dimethyl-1,3-cyclohexanedione; dimethyl dihydroresorcinol) in aqueous ethanol or methanol.

For directions and examples see: Cheronis, p. 505; Linstead, p. 27; Shriner, p. 220; Vogel, p. 333; Wild, pp. 136–7; D. Vorlander, *Z. Anal. Chem.*, **77**, 241 (1929); *Z. Angew. Chem.*, **42**, 46 (1929); W. Weinberger, *Ind. Eng. Chem., Anal. Ed.*, **3**, 365 (1931).

From the aldehyde with methone and a catalytic amount of piperidine in aqueous ethanol.

See: E. C. Horning and M. G. Horning, *J. Org. Chem.*, **11**, 95 (1946).

*Anhydride of dimethone derivative (substituted octahydroxanthene).**



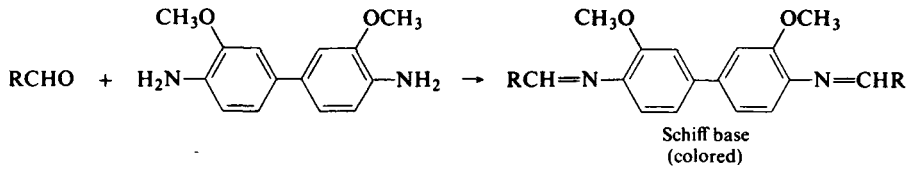
From the dimethone derivative with acetic anhydride.

For directions and examples see: Cheronis, p. 505; Vogel, p. 333.

From the dimethone derivative and a catalytic amount of hydrochloric acid in water or in ethanol.

See: Cheronis, p. 505; Linstead, p. 27; Shriner, p. 220; Vogel, p. 333; Wild, p. 137; E. C. Horning and M. G. Horning, *J. Org. Chem.*, **11**, 95 (1946).

o-Dianisidine spot test.



This test is usually applicable to aldehydes only.

From the aldehyde and a saturated solution of *o*-dianisidine (4,4'-diamino-3,3'-dimethoxybiphenyl) in glacial acetic acid.

For directions and examples see: F. Feigl, *Spot Tests in Organic Analysis*, 6th Ed., Elsevier Publishing Co., New York, 1960, p. 225; R. Wasicky and O. Frehden, *Mikrochim. Acta*, **1**, 55 (1927).

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

a) Liquids 1) Listed in order of increasing atmospheric b.p.*

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	Semi carbazone	2 4-Di nitrophenyl hydrazone	*p*-Nitro phenylhydra zone	Phenylhydrazone	Oxime	Dimethone deriv (Dimedone deriv)	Dimethone anhydride	Miscellaneous	*o*-Dianisidine spot test		
													Cold	Hot	Limit γ
1	**Formaldehyde** (Methanal)	−21	−91		169	167, yel al	181 2, yel , bz	145	oil	189, al , 191 4			pa yel	or br	50
2	**Trifluoroacetaldehyde**	−20				151									
3	**Acetaldehyde** (Ethanal)	20 2	−123 5	1 3392[18], 1 3316	162 3	stable 168, al unstable 157, mixture 148	128 5	57, 99	47	139, al	175-6, al	Thiosemicarbazone, 146	or	dk br	30
4	**Propionaldehyde** (Propanal)	48 9	−81	1 364	89, bz - lgr , 154, w	148, or , 150, red, 155	125, yel , 50% al	oil	40	154 6, al	143	Picrate, 156-7	dk ol gn	red	20
5	**Glyoxal**	50	15		270	328	311	180	178	*mono* 186, *di* 228	*mono* 224	Phenylosazone, 169-70			
6	**Acrolein** (Acraldehyde)	52 4	−87 7	1 4025	171, w	165	150-1	50 1, hot lgr , pyrazoline		192, 50% al	163, al		red br	vlt br	0 1
7	**Propynal** (Propargyl aldehyde)	55										Cu deriv , 160			
8	**2,2,2-Trifluoropropionaldehyde**	56[745]			,	151									
9	**Isobutyraldehyde**	64	−65 9	1 3730	125 6	187, or - yel , al , 182	130 1, or - yel , al	oil	oil	154	144				
10	**2-Methyl-2-propenal** (Methacrolein)	73 5		1 4191	198	206		74, pyrazoline							
11	***n*-Butyraldehyde** (Butanal)	74 7	−97 1	1 38433	95 5, lgr , 106	123, al	87, yel , al , 93 5, red	93 5	b p 152[715]	134, 142	141				
12	**Trimethylacetaldehyde** (Pivaldehyde)	75	3, 6	1 3791	190	210, yel			41						
13	**Chloroacetaldehyde**	85-6			134-5d, 148, al				oil						
14	**2-Chloropropionaldehyde**	86		1 431[17]								Hydrate, b p 80 5-81			
15	**Dichloroacetaldehyde**	89 5-90 5			155-6, using only 1 equivalent of reagent				b p 67-9[17], using only 1 equivalent of reagent						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

a) Liquids 1) Listed in order of increasing atmospheric b.p.* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	Semicarbazone	2,4-Dinitrophenylhydrazone	*p*-Nitrophenylhydrazone	Phenylhydrazone	Oxime	Dimethone deriv (Dimedone deriv.)	Dimethone anhydride	Miscellaneous	*o*-Dianisidine spot test		
													Cold	Hot	Limit, γ
16	**Methoxyacetaldehyde**	92		1.3950		124-5	115								
17	**3-Methylbutanal** (Isovaleraldehyde)	92.5	−51	1.39225	107	123, yel-or., al	110.1, al	oil	48.5	154-5, al	173 (cor.)	Thiosemicarbazone, 52.3			
18	**2-Methyl-1-butanal** (α-Methylbutyraldehyde)	92-3	20, tri-	1.3942	103.5, bz-pet eth	120									
19	**Trichloroethanal** (Chloral, Trichloroacetaldehyde)	98	−57.5	1.45572	90d	131	131, yel		56			Hydrate, 51.7			
20	**Pentanal** (Valeraldehyde)	103.4	−91.5	1.3947		98, yel., al., 107			52, pet eth	104.5	113	Thiosemicarbazone, 65			
21	***tert*-Butylacetaldehyde**	103		1.4150		147									
22	**2-Butenal** (Crotonaldehyde)	104	−69	$1.4362^{20.5}$	199	190, crim., bz-lt pet	184.5	56	119	183	163, sint., 167	Phenylsemicarbazone, 126-7	dk red	dk br-red	2
23	**Dimethylethylacetaldehyde**	104													
24	**Ethoxyacetaldehyde**	106		1.3956		116.7 me al	113.4, al								
25	**2-Isopropylacrolein**	107.9		1.4223		165									
26	**2-Butynal**	105 110^{755}		1.446^{19}		136									
27	**Methylisopropylacetaldehyde**	114		1.3998^{25}		124									
28	**2-Bromoisobutyraldehyde**	115		1.4518^{25}								Decomposes in w			
29	**Diethylacetaldehyde** (2-Ethylbutyraldehyde)	116 117		1.4025	99, bz-lt pet	95, pa-or., lt pet., 129 30, al				102, me al					
30	**Methyl-*n*-propylacetaldehyde**	116^{737}			102	103									
31	**2-Methyl-2-butenal**	116.9			216										
32	***n*-Propoxyacetaldehyde**	119^{748}				86									
33	**Isobutylacetaldehyde** (Isocaproaldehyde)	121^{743}			127	99			b.p. 103^{35}						
34	**Paraldehyde** (Acetaldehyde trimer)	124.4^{752}	12.6	1.4049								Dilute acid → Acetaldehyde, b.p. 20.2	dk ol grn	dk red br	4
35	**2-Pentenal**	125			180		123								
36	**3-Methoxyisobutyraldehyde**	129		1.4030^{27}		102									

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

a) Liquids 1) Listed in order of increasing atmospheric b.p.* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	Semi carba zone	2 4-Di nitro phenyl hydra zone	*p* Nitro phenyl hydra zone	Phenyl hydra zone	Oxime	Dimeth one deriv (Dime done deriv)	Dimeth one anhy dride	Miscel laneous	*o*-Dianisidine spot test		
													Cold	Hot	Limit γ
37	**3-Chloropropion-aldehyde**	130–1		1 475[15]								Trimer 35 5, dil HCl-abs al b p 170 5[12–5]			
38	**Hexanal** (Capro-aldehyde)	131		1 4068	106, bz - pet eth	104, or - yel			51, pet eth me al	108 5, dil al		Phenyl-semicar-bazone, 135–6			
39	**Ethylisopropylacet-aldehyde**	133 5		1 4086[25]		121									
40	**3,3-Dimethyl-pentanal**	134		1 4292		102									
41	**3-Methyl-2-butenal** (3-Methylcroton-aldehyde)	135		1 4526	223	182									
42	**Cyclopentanecar-boxaldehyde**	136			124										
43	**2-Methylpenten-2-al-1** (3-Ethyl-2-methylacrolein)	136 8		1 4488	207	159, red al		58–60	48–48 8						
44	**Tetrahydrofurfural**	142–3[779]		1 4473 1 43658	166	134						Conc HCl → brt red col α Benzyl-α phenyl hydra zone 67 me al			
45	**5-Methylhexanal**	144[750]		1 4114	117	117									
46	**3-Furaldehyde**	144[732]		1 4945	211			149 5							
47	**1-Cyclopentenyl-formaldehyde**	146		1 4828[21]	208		188								
49	**2-Chloro-2-butenal** (2-Chlorocroton-aldehyde)	147–50		1 478[23]								Cyano-hydrin b p 137 8[26], n_D^{17} 1 4762			
50	**2-Hexenal**	150		1 4470[13]	176		139								
51	**3-Hexenal**	150			147										
52	**Heptanal** (Enanth-aldehyde)	155	−45	1 4125	109, al	108, yel , al	73		57	135	112		red-br	red	9
53	**Ethylisobutylacet-aldehyde**	155			98										
54	**Di-*n*-propylacetal-dehyde**	161		1 4142[15]	101				b p 126[47]						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

a) Liquids 1) Listed in order of increasing atmospheric b.p.* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	Semicarbazone	2,4-Dinitrophenylhydrazone	*p* Nitrophenylhydrazone	Phenylhydrazone	Oxime	Dimethone deriv (Dimedone deriv.)	Dimethone anhydride	Miscellaneous	*o*-Dianisidine spot test		
													Cold	Hot	Limit, γ
55	**2-Furancarboxaldehyde** (Furfural)	161.7	−36.5	1.52608	202	212.4, yel., 230 (cor.), red, mixture 185	54	97	α 75-6, pet. eth., β 91.2, al.	160d	162.5	Phenylsemicarbazone, 180.1	dk. red-vlt.	dk. bl.-vlt.	0.02
56	**Hexahydrobenzaldehyde**	162		1.4495[19]	173, 176, w.	172			90-1, pet. eth			Oxime-HCl, 107-8d			
57	**2-Ethylhexanal-1** (*n*-Butylethylacetaldehyde)	163		1.4150	254d	114.5, dil. al., 120.1, yel., al.									
58	**2,2,3-Trichloro-*n*-butyraldehyde** (*n*-Butylchloral, Crotonchloral)	164.5 5.5		1.47554					65			NH_3 → Butylchloral ammonia, 62			
59	**Butanedial** (Succinaldehyde)	169-70d		1.4254		280			*di* 172			Polymer, 65			
60	**Octanal** (*n*-Octaldehyde Caprylaldehyde)	171		1.42167	98, dil. me. al. 101	106, yel., al., 96	80, brt. yel.		60, me. al.	90, dil. al.	101	Thiosemicarbazone, 94-94.5			
61	**2-Ethyl-3-*n*-propylacrolein**	173		1.4518[22]	150.1, 153 -	124.5 122									
62	**3-Fluorobenzaldehyde**	173					202	114	63						
63	**2,2,2-Tribromoethanal** (Bromal)	174, yel.							115			Monohydrate, 53.5	no reac.	dk. grn.	40
64	**4-Fluorobenzaldehyde**	174.5[52]					212	147	*syn* 116.7, *anti* 86						
65	**2-Fluorobenzaldehyde**	175	−44.5				205	90	63						
66	**Benzaldehyde**	179	−26, f.p. −55.6	1.5446	222, 233-5, r. htng.	237, or. al.	190, red. al. 234.6, 262	158, 154.5	α 35 (stable) β 130, eth.	193	200	Phenylsemicarbazone, 180.1	or.	red-or.	3
67	**Nonanal** (Pelargonaldehyde)	185		1.4273	100.84, me. al.	100 (cor.), yel., al.			64, pet. eth.	86		Phenylsemicarbazone, 131.2			
68	**5-Methylfurfural**	187		1.5147[25]	211*	212 (cor.)	130, red.	147-8	*syn* 112, *anti* 51-2						
69	**Glutaraldehyde**	187-9d		1.4330[25]			169		*di* 175, 178, w.						
70	**Phenylethanal** (Phenylacetaldehyde)	194	33	1.53191	153, dil. al., 156	121, grn.-yel., al., 110		58, lgr., 62-3	97-8, eth., 100	165	126		dk. br.-red	dk. br.	polym.

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

a) Liquids 1) Listed in order of increasing atmospheric b.p.* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	Semi carba zone	2 4-Di nitro phenyl hydra-zone	*p* Nitro-phenyl hydra zone	Phenyl hydra zone	Oxime	Dimeth-one deriv (Dime done deriv)	Dimeth one anhy dride	Miscel-laneous	*o*-Dianisidine spot test		
													Cold	Hot	Limit, γ
71	**2-Hydroxybenz-aldehyde** (Salicyl-aldehyde)	197 (cor)	−7, f p 1 6	1 574	231	248, red, abs al 252d , lt red, ac a	227, red-br , al	142	57, 63		208, 70% al	*p*-Nitro-benzo-ate, 128	or	or	5
72	**2-Thiophenecarbox-aldehyde**	198		1 5950[16]		242		119 139							
73	**3-Methylbenz-aldehyde** (3-Tolu-aldehyde)	199		1 5413[21]	204 223 4	212, 194	157	91, lgr , 84	60, lgr	172	206		dk or - red	ch red	5
74	**2-Methylbenz-aldehyde** (2-Tolu-aldehyde)	200		1 5481	209 al , 212, 218	193 4, red, ac a	222, red, al	101, 105 6, 111	49	167	215		dk or - red	ch red	5
75	**4-Methylbenz-aldehyde** (4-Tolu-aldehyde)	204 5		1 5454	234, al , 215	232 5 4 5 (cor) or - yel al $PhNO_2$	200 5 (cor), dk red, ac a	112-3, al , 121	79-80, 110				dk or - red	ch red	5
76	***d*-Citronellal** (*d*-Rhodinal)	207		1 4485	83-4, chl , ppt by lgr 91 2	78, yel , al			oil	77 9, dil al	173		dk grn	brt red	10
77	**Decanal** (Capralde-hyde)	207-9		1 4287	102	104, yel			69, dil me al	91 7, dil al		Thio-semicar-bazone, 99-100	pa ol	dk br	200
78	**2-Chlorobenz-aldehyde**	213-4	11	1 56708	146, yel , 225, pyr , 229-30, me al	213 6 (cor), 209, or red, xyl	237 8, red, al , 241, br - red, 249, or	86	α 75-6, al , β 101 3	205d , al	224 6 (cor), al				
79	**Phenoxyethanal** (Phenoxyacetalde-hyde, Glycolalde-hyde phenyl ether)	215d		1 5380[21]	145			86, pa yel , al	95, pet eth						
80	**3,5-Dimethylbenz-aldehyde**	220-2	9	1 5385	201 2							Oxid → acid, 170, al			
81	**3-Phenylpropion-aldehyde** (Hydro-cinnamaldehyde)	224			127, al	149, yel , al	122 3, yel , dil al		93-4 5, dil al 97 (cor)						
82	**Citral a.** (Geranial)	228d		1 48752	164, me al	108-10, red-or al , 116			143 5				dk red	red blk	0 1
83	**Citral b.** (Neral)	228d		1 4900	HCl 171, mix-ture 132, NaOAc	96, red-or , al							dk red	red blk	0 1

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

a) Liquids 1) Listed in order of increasing atmospheric b.p.* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	Semi carba zone	2 4 Di nitro phenyl-hydra-zone	*p* Nitro phenyl hydra zone	Phenyl hydra zone	Oxime	Dimeth-one deriv (Dime-done deriv)	Dimeth one anhy dride	Miscel laneous	*o* Dianisidine spot test		
													Cold	Hot	Limit γ
84	**2,6-Dimethylbenz-aldehyde**	228^{742}	11		158										
85	**3-Methoxybenz-aldehyde** (3-Anis-aldehyde)	230	3 4	1 5538	233d		171	76	39 40 pet eth , 112			Phenyl-thio-semicar-bazone, 153	dk or	red br	0 4
86	**3-Bromobenz-aldehyde**	234–6			205		220	141	72						
87	**4-Isopropylbenz-aldehyde** (Cumal-dehyde)	236		1 5301	211, me al	241, red bz , 243, red, ac a , 244 5, al -chl	190, al	129, al	α 52, al β 111	170–1, al	172 3		dk red	ol yel	3
88	**3-Ethoxybenz-aldehyde**	245 5		1 5408											
89	**4-Methoxybenz-aldehyde** (4-Anisal-dehyde)	248	2 5	1 5731	210, 203	253 4d , red, ac a , 250, red, xyl	160, red-vlt	120 1, wh , dil al	α' 64-5, bz α 4 5 (from α' on fu-sion) β 133, bz	144 5 (cor), al	243 (cor), al		dk or	red-br	0 4
90	**3-Phenylpropenal** (Cinnamaldehyde)	252d	−7 5	1 61949	215 6 w	255d , red, ac a	195, red, al	168, yel , dil al	α 64-5, lgr , β 138 5, bz	213 (cor), al 161, al	175, al		dk ch red	ch red	0 05
91	**4-Ethoxybenz-aldehyde**	255, 249	13–4		202d , al , 208				*syn* 157 *anti* 118						
92	**3,4-Diethoxybenz-aldehyde** (Proto-catechualdehyde diethyl ether)	277–80							98			Oxid → acid, 165			
93	**Diphenylacetalde-hyde**	315–6d			162				α 120, β 106			Oxid → Benzo-phenone 48			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

a) Liquids 2) Reduced pressure b.p. only (listed in order of increasing semicarbazone m.p.)*

No	Name	Boiling point °C	Melting point °C	n_D^{20}	Semi carba zone	2 4 Di nitro phenyl hydra zone	*p* Nitro phenyl hydrazone	Phenyl hydra zone	Oxime	Di meth one deriv (Dime done deriv)	Di meth one anhy dride	Miscellaneous	*o* Dianisidine spot test		
													Cold	Hot	Limit γ
1	**7-Methyloctanal**	94^{120}			80	100									
2	**3-(2-Furyl)propionaldehyde**	70^{14}		1 4470	80										
3	**2-Methyloctanal**	83^{20}			80										
4	**2,3-Dichloro-*n*-butyraldehyde**	58 60^{20}		1 4618[21]	96 7				oil						
5	**Octanal** (*n* Octalde hyde)	81^{32}		1 4217	98 101	106 yel	80		59 60	89 8					
6	**Undecanal** (Hen decanal)	120^{20}	−4	1 4324[23]	103 me al	104 yel			72 wh me al			Trimer 47 8			
7	**Tridecanal** (*n* Tridecyl aldehyde)	136^{8}	15		106 al	108			80 5 dil al			Trimer 61 5 eth			
8	**2-Hydroxypropionaldehyde**	114^{9}			114 w		127								
9	**2-*n*-Amylcinnamaldehyde** (2 *n* Pentyl cinnamaldehyde Jasminaldehyde)	161 3^{13}		1 5381	118	164 red al			74 al w						
10	**2-Methyl-3-phenylpropionaldehyde**	90^{6}			123										
11	**2-Hydroxy-2-methyl hexanal** (*n* Butyl methylglycolalde hyde)	87 8^{3}			143										
12	**Phenoxyacetaldehyde**	83		1 5360	146	138			95						
13	**2-Ethyl-2-hexenal**	73^{20}			152	125									
14	**2-Ethyl-3-hexenal**	84^{52}			156										
15	**Cyclohexylacetaldehyde**	58^{10}		1 4509[25]	159	125									
16	**2-Nonenal**	126^{21}		1 4426	165	126	113								
17	**2-Heptenal**	85^{14}		1 4314	169		116								
18	**2,3,6-Trimethylbenzaldehyde**	114^{10}			169				126						
19	**3,5-Dimethylhexahydrobenzaldehyde**	71^{14}			171										
20	**2-Hydroxy-2-phenylpropionaldehyde** (Methylphenylglycol aldehyde)	101^{4}			182 3										
21	**2,4,6-Trimethylbenzaldehyde**	98^{6} 128^{15}		1 5524	188										
22	**2-Hydroxy-2-phenylbutyraldehyde** (Ethyl phenylglycolaldehyde)	110 11			188										
23	**2-Hydroxybutyraldehyde** (Aldol)	83^{4}			194		109 11 red yel dil al		*syn* 112 *anti* 51 2	146 8 30^{9} me al	126	4 Bromo phenylhydrazone 127 8			
24	**1,2,3,4-Tetrahydro-2-naphthaldehyde**	92^{1}			197										
25	**2-(1-Naphthyl)-propionaldehyde**	132^{2}			204										

* Derivative data given in order m p crystal color solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

a) Liquids 2) Reduced pressure b.p. only (listed in order of increasing semicarbazone m.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	Semi carba zone	2 4 Di nitro phenyl hydra zone	*p* Nitro phenyl hydrazone	Phenyl hydra zone	Oxime	Di meth one deriv (Dime done deriv)	Di meth one anhy dride	Miscellaneous	*o* Dianisidine spot test		
													Cold	Hot	Limit γ
26	**1,6-Hexanedial** (Adipic dialdehyde)	94[12], 70[3]		1 4350	*di* 206				*di* 185 6 w						
27	**2-Methylcinnamaldehyde**	124[14]		1 6057[17]	208, al - w										
28	**Phenylglyoxal**	108[15]			*mono* 208 9d yel al *bis* 229d		309					91 (mono hyd) w 2 Thio semicarba zone, 170 yel al			
30	**Cyclohexenecarboxaldehyde**	70[13]		1 4921[1]	213				99						
31	**2-Phenoxybenzaldehyde**	153[1]			215										

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

a) Liquids 3) Miscellaneous; reduced pressure b.p. only (listed alphabetically)*

No	Name	Boiling point °C	Melting point, °C	n_D^{20}	Semi carba zone	2,4 Di nitro phenyl-hydra-zone	*p*-Nitro-phenyl hydra-zone	Phenyl-hydra-zone	Oxime	Di meth one deriv (Dime done deriv)	Di meth-one anhy-dride	Miscellaneous	*o* Dianisidine spot test		
													Cold	Hot	Limit γ
1	**2-Chloroacrolein**	29 31^{17}		1 463								Diethylacetal, b p 158 60			
2	**4-Chloro-*n*-butyraldehyde**	50 1^{11}		1 44662[8.5]		134 5	110		74 5						
3	***d,l*-2,3-Dichloropropion-aldehyde**	48^{14}		1 4762								Dimethylacetal, b p 78-82^{14}, n_D^{18} 1 144			
4	**2-Heptynal**	54^{13}		1 4521[17]		74									
5	**2,4-Hexadienal** (Sorbalde-hyde)	65^{11}		1 5372[22]				102	160						
6	**4-Hydroxy-*n*-butyr-aldehyde**	68^{8}		1 4403		118									
7	**3-Hydroxy-2-isopropyl-propionaldehyde**	84^{10}				126									
8	**3-Hydroxy-3-methyl-*n*-butyraldehyde**	$67^{1.5}$					142								
9	**4-Methoxy-2-methyl-*n*-butyraldehyde**	66^{55}		1 4280[25]		88									
10	**5-Methyl-2-thiophene-carboxaldehyde**	114^{25}		1 5782[29]				126							
11	**3-Methyl-2-thiophene-carboxyaldehyde**	114^{25}		1 5833[25]				149							
12	**4-Octenal**	84^{13}		1 4463[25]		108									
13	**Phenylpropargyl alde-hyde**	116 7^{17}		1 6032[25]					108, lgr						
14	**2-Phenylpropionaldehyde**	76^{4}				135									
15	**3-Pyridinecarboxaldehyde** (Nicotinaldehyde)	99^{20}						158							
16	**2,2,4-Trichloro-*n*-butyr-aldehyde**		f p -78									HNO_3 → acid, 73 5			
17	**2,4,6-Trihydroxybenzalde-hyde** (Phloroglucinalde-hyde)		d						195d , (hyd), w			2,4,6 Triacetate 156 7, al 2-Benzoate 198 200, chl			
18	**4-Vinylbenzaldehyde** (4-Formylstyrene)	93^{14}		1 5960[25]				131							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point °C	Boiling point °C	Semi carba zone	2 4-Di-nitro phenyl hydra zone	*p* Nitro phenyl-hydrazone	Phenyl hydra zone	Oxime	Dimeth one deriv (Dime done deriv)	Di meth one anhy dride	Miscellaneous	*o* Dianisidine spot test		
												Cold	Hot	Limit γ
1	**3-Chlorobenzaldehyde**	17 8	213 4	228, pyr 230, me al	248, dk red, xyl , 256, or - yel	216, dil al	134 5, abs al	*α, anti* 70 1, al *β, syn* 118			$n_D^{20.2}$ 1 55908			
2	**2,3,5,6-Tetramethyl-benzaldehyde**	20	135[11]	270d				125						
3	**2-Ethoxybenzaldehyde** (Salicylaldehyde ethyl ether)	20 2 6-7	247 9	219, al				57 9, pet *eth*			Diacetate 88 9, ac *anh*			
4	**Tetradecanal** (Myristaldehyde)	23 3 5	166[24]	106 5, dil al	108	95 brt yel		82 5 3 5, dil al			Trimer, 65			
5	**Pentadecanal**	24 5	160[14]	106 5, al	106 7, yel , pyr -al	94 5, yel , al		86, dil al			Trimer, 69 70			
6	**Hexadecanal** (Palmitaldehyde)	34		107, dil al , 108-9	108	96 5, yel , eth		88, yel			Trimer, 73 Thiosemicarbazone, 106 9			
7	**1-Naphthaldehyde**	34	292 162[18]	221		224	80	98 90						
8	**Phenylacetaldehyde**	34	195	156, 163	121	151	*mono* 63, 58, *di* 101-2	99, 103	165					
9	**4-Methoxy-1-naphthaldehyde**	34, wh	200[11]				113				Azine 185, yel , al			
10	**(5-Hydroxymethyl) furfural**	35 6	115 $20^{0.5}$	195d al, recr tol - lgr	184 red	185 dk red, al	140 1, tol	77 8, 108						
11	**Heptadecanal** (Margaric aldehyde)	35-6, 63						89 5, et ac			Trimer, 77-8, lt pet			
12	**3,4-Methylenedioxybenzaldehyde** (Piperonal)	37	263	230, 234, 237	265d , xyl , 266d , red, ac a	199 200, red	102 3, yel , al , 99, 106	*syn* 146, me al , *anti* 112, w	177 8, 193, yel , al	220 (cor)		brt red	dk red	4
13	**2-Iodobenzaldehyde**	37	129[14]	206			79	108						
14	**Octadecanal** (Stearaldehyde)	38		108-9	101, 110	101, yel , me al		89			Thiosemicarbazone, 111			
15	**2-Methoxybenzaldehyde** (*o*-Anisaldehyde, Salicylaldehyde methyl ether)	38-9	243-6 (cor)	215d , al	253 5 (cor), red, xyl	204-5, br red		92, dil al			n_D^{20} 1 5598			
16	**2-Aminobenzaldehyde**	40				220	221	135						
17	**4-Diethylaminobenzaldehyde**	41	172[7]	241d , al			103, yel - br	93						
18	**Dodecanal** (Lauraldehyde)	2 forms a) 42-3 b) 11	238	103, 106	106, yel	90		76-7, eth , 77-8, me al			Thiosemicarbazone, 100			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Semi carbazone	2 4 Di nitrophenyl hydrazone	*p*-Nitrophenylhydrazone	Phenylhydrazone	Oxime	Dimethone deriv (Dimedone deriv)	Di methone anhydride	Miscellaneous	*o* Dianisidine spot test		
												Cold	Hot	Limit, γ
19	**3,4-Dichlorobenzaldehyde**	43 4	247 8			276 7, or		*syn* 120 al , on fusing → *anti* 114 5 118-9						
20	**3-Phenylcinnamaldehyde**	44	210[14]	214 5	196		173, yel							
21	**2,4,5-Trimethylbenzaldehyde**	44	120[10]	243			127							
22	**2-Nitrobenzaldehyde**	44		256	265	263	156	*anti* 102 *syn* 154, bz				grn br	red br	5
23	**3,4-Dimethoxybenzaldehyde** (Veratraldehyde)	44, 58	285	177	261 3 (cor), or , $PhNO_2$ 264 5		121, al	94 5, lgr	173					
24	**4-Chlorobenzaldehyde**	48	214 5 6 5	230, pyr 233, me al	254 (cor), or	237, dk br , al	127 7 5, lt yel , dil al	α 110, β 146						
25	**2-Pyrrolecarboxaldehyde**	50	217 9	183 5, w		182 3, red, xyl	139, lgr	164, bz			n_D^{15} 1 5939			
26	**Benzylglycolaldehyde**	52	121[4]	137							Benzoate, 70			
27	**Furfural diacetate**	52, eth	220											
28	**4-Chloro-2-hydroxybenzaldehyde**	52 5		212 pa yel , ac a		257, or , ac a		155, col , al						
29	**Quinoline-4-carboxaldehyde**	51 3, tol (anh), 84 4 5 (monohyd)	123[4]			261 2 yel al		181 2 me al			Picrate, 179			
30	**2-Ethyl-4-hydroxybenzaldehyde**	53	145[1]											
31	**2-(2-Furyl)-acrolein**	54, lgr	95[9]	219 5			132, pet eth	110 1						
32	**2,3-Dimethoxybenzaldehyde** (*o*-Veratraldehyde)	54	137[12]	231d			138	99, al -w						
33	**9-Hydroxynonanal**	54	120[0 1]											
34	**2,3-Diphenylpropionaldehyde**	54	170[11]	125										
35	**3-Benzyloxybenzaldehyde**	54	218[20]											

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point °C	Semicarbazone	2,4-Dinitrophenylhydrazone	*p*-Nitro phenylhydrazone	Phenylhydrazone	Oxime	Dimethone deriv (Dimedone deriv)	Dimethone anhydride	Miscellaneous	*o*-Dianisidine spot test		
												Cold	Hot	Limit, γ
36	**3-Chloro-2-hydroxybenzaldehyde** (3-Chlorosalicylaldehyde)	54 5 5 5		240-3, 50% ac a				167-8, dil al			5 Nitro deriv, 129, yel, dil al			
37	**Octatrienal**	55												
38	**Isoquinoline-1-carboxaldehyde**	55 5		197			171 2							
39	**Phthalaldehyde**	56					*di* 191					brt yel ppt	brt yel ppt	
40	**2,3,5-Trichlorobenzaldehyde**	56 col, dil al									Oxid $\xrightarrow{KMnO_4}$ acid, 162 3			
41	**2-Hydroxy-5-methylbenzaldehyde** (5-Methylsalicylaldehyde)	56 dil al	217 8				149 yel, al	105, w			Diacetate, 94, al			
42	**3-Iodobenzaldehyde**	57		226		212	155	62						
43	**4-Bromobenzaldehyde**	57		228, 229	128, 257	207 8	113	*syn* 157, *anti* 111						
44	**3-Nitrobenzaldehyde**	58		246	293d	247	120, 124	120 122						
45	**2,5-Dichlorobenzaldehyde**	58	231-3				104-5, al	127 5-8, dil al						
46	**2,4,6-Trichlorobenzaldehyde**	58-9												
47	**2-Phenanthraldehyde**	59, 59 5		282				175						
48	***Paraisobutyraldehyde*** (2,4,6-Tri-isopropyl-1,3,5-trioxan)	59 60	195 (cor), sl depolym								See Isobutyraldehyde b p 64			
49	**1-Hydroxy-2-naphthaldehyde**	59 60, gm-yel, al-w						145, bz						
50	**2-Naphthaldehyde**	60, w	150^{15}	245, al	270	230	205 6 d, al, 217 8	156, dil al						
51	**4-Phenylbenzaldehyde**	60		243d, al	239d, scar, xyl		189d	149-50						
52	**3-Methoxy-1-naphthaldehyde**	60, pet eth		200, al-w		197, red, ac a		102, al-w						
53	**4-Ethoxy-3-methoxybenzaldehyde**	64												
54	**3,5-Dichlorobenzaldehyde**	65	235 40^{748}				106 5, yel, pet eth	112						
55	**2,3-Dichlorobenzaldehyde**	65 7												
56	**5-Methoxy-1-naphthaldehyde**	66, yel, pet eth		246, ac a-w		246, red, ac a-w		104, w						

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Semicarbazone	2,4-Dinitrophenylhydrazone	*p*-Nitrophenylhydrazone	Phenylhydrazone	Oxime	Dimethone deriv (Dimedone deriv)	Dimethone anhydride	Miscellaneous	*o*-Dianisidine spot test		
												Cold	Hot	Limit, γ
57	**Dibenzofuran-2-carboxaldehyde**	68					162							
58	**2,6-Dichlorobenzaldehyde**	70–1									*o*-Nitrophenylhydrazone, 154, *p*-Bromophenylhydrazone, 142			
59	**2,4-Dimethoxybenzaldehyde** (β-Resorcylaldehyde dimethyl ether)	71, dil al, 69	165[10]					106, w			5-Nitro deriv 188 9, me al			
60	**Quinoline-2-carboxaldehyde**	71, pet eth (anh), 51 (monohyd), w				250, yel, 225, subl	204, yel, al	188						
61	**4-Ethoxy-1-naphthaldehyde**	72									Hydrazone, 160 182, dk red, Azine, 209, yel, $PhNO_2$			
62	**4-Aminobenzaldehyde**	72		153			156	124				or br	red br	0 4
63	**2,4-Dichlorobenzaldehyde**	72, 74 5						136 7			Oxime HCl, 133 5			
64	**4-Dimethylaminobenzaldehyde**	74		222	325	182	148	185						
65	**4-Methylthiazole-5-carboxaldehyde**	75, 72 5	118[21]				159, 161							
66	**Quinoline-6-carboxaldehyde**	75 6 (anh), 55 (hyd)		239, yel, al			185, red, al	191, yel, al			Methiodide, 218, yel, al			
67	**3,4,5-Trimethoxybenzaldehyde** (Gallaldehyde trimethyl ether)	78, 75	163–5[10]	219–20		201–2		83 4						
68	**4-Iodobenzaldehyde**	78		224	257	201	121							
69	**3-Phenanthraldehyde**	80		275				145						
70	**4-Hydroxy-3-methoxybenzaldehyde** (Vanillin)	80 1, w	285d	230, 240d.	271d (cor), red, ac ac, 268	227, ac a, 223	105, bz	117, w, 122	196–8 (cor), al	228	2,4-Dinitrophenyl ether, 131	brt or red	ch red	3
71	**2-Hydroxy-1-naphthaldehyde**	82, al	192[27]	240, yel, me al				157			Picrate, 120	or	brk red	10
72	**Stilbene-2-carboxaldehyde**	83												
73	**2-Methoxy-1-naphthaldehyde**	84, al	200–1[11]								Azine, 255–6, yel, $PhNO_2$			

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point °C	Semicarbazone	2,4-Dinitrophenylhydrazone	*p*-Nitrophenylhydrazone	Phenylhydrazone	Oxime	Dimethone deriv (Dimedone deriv)	Dimethone anhydride	Miscellaneous	*o*-Dianisidine spot test		
												Cold	Hot	Limit, γ
74	**2,3,6-Trichlorobenzaldehyde**	86 7									Ac anh + ac a + NaOAc → 2,3,6-trichlorocinnamic acid, 189, ac a			
75	**Isophthalaldehyde**	89					242	180						
76	**3,4,5-Trichlorobenzaldehyde**	90 1, al		252-4, al		342d, or, $PhNO_2$	147				2-Nitro deriv, 118 5 9 0 Oxid alk $KMnO_4$ → 3,4,5-trichlorobenzoic acid, 210			
77	**Phenylglyoxal hydrate**	91		α 217d		309	*dl* 152	α 129, *dl* 168						
78	**2,3,4-Trichlorobenzaldehyde**	91									Ac anh + ac a + NaOAc → 2,3,4-trichlorocinnamic acid, 185			
79	**Quinoline-8-carboxaldehyde**	94 5, dil al		238 9, bz			176, yel, al	115, dil al						
80	**2-Phenylcinnamaldehyde**	94, al, 95	195 200[1]	188-9, al, 195			125 6, yel, ac a, 141	165-6, al						
81	**3,5-Dichloro-2-hydroxybenzaldehyde** (3 5-Dichlorosalicylaldehyde)	95 6		227d, ac a			153, pa yel, al	195-6, al-w (4 1)			Ac anh + ac a + NaOAc → dichlorocoumarin, 160, bz			
82	**Hydroxyacetaldehyde** (Glycolaldehyde)	96 7					162				Phenylosazone, 178 9, yel, eth, *p*-Nitrophenylosazone, 311			
83	**3-Chloro-*n*-butyraldehyde** (Trimer)	96 7	28-33[13]											
84	**2,2-Dimethyl-3-hydroxypropionaldehyde**	97	85[15]											
85	**2,3,4,6-Tetrachlorobenzaldehyde**	97 8												
86	**Benzaldehyde-2-carboxylic acid** (2-Formylbenzoic acid, Phthalaldehydic acid)	98 9 (hyd), 240-50 (anh)		202				120, w						
87	**3-Hydroxy-2-naphthaldehyde**	99-100		>270, me al			246-8	207d						

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Semi carbazone	2,4-Dinitrophenylhydrazone	*p*-Nitrophenylhydrazone	Phenylhydrazone	Oxime	Dimethone deriv (Dimedone deriv)	Dimethone anhydride	Miscellaneous	*o* Dianisidine spot test		
												Cold	Hot	Limit, γ
88	**5-Chloro-2-hydroxybenzaldehyde**	99 100	105[12]	286-7, ac a			150 2	128 w 123 4						
89	**9-Phenanthraldehyde**	101		223		265		157						
90	**3-Hydroxybenzaldehyde**	104 108 (cor), w	240	198, 199	259, scar, xyl 260d, red, al	221 2, dil ac a	130 1 5, tol, 147, recr bz	90, 88				dk br red	dk ch red	4
91	**9-Anthraldehyde**	105		219, yel, al			207, or, al	187						
92	**4-Nitrobenzaldehyde**	106		221, 211	320	249	159, 153	*anti* 133, 129, *syn* 182 4				or br	red br	1
93	**2,3,4,5-Tetrachlorobenzaldehyde**	106 6 5												
94	**2,3-Dihydroxybenzaldehyde**	108		226d			167							
95	**2-Chloro-5-hydroxybenzaldehyde**	110 5-1 5, ac a		236, pa yel			250 1, red, dil al		146 7, abs al					
96	**1-Phenanthraldehyde**	111 5						189						
98	**2,4,5-Trichlorobenzaldehyde**	112-3, al									Ac anh + ac a + NaOAc → 2,4,5-trichlorocinnamic acid, 200 1			
99	**3-Hydroxy-2,4,6-trichlorobenzaldehyde**	113-6 5, 50% ac a				272-3d, yel or	,	170-2, dil al						
100	**2-Ethoxy-1-naphthaldehyde**	115, al		214-5, yel, al			91				Azine, 184, yel, $PhNO_2$-al			
101	**Metaldehyde**	115, 246, (polymers)									Dil a → acetaldehyde, b p 20 2			
102	**4-Hydroxybenzaldehyde**	116-7, w		224, 280d	280d, purp, ac a, 260 (monohyd), red, w	266	177 8, al, 184, slow htng	72, 112 (anh)	188-90 (cor), 184	246		dk or red	ch red	5
103	**Terephthalaldehyde**	116, 118	245			*di* 281	*di* 278d, 154	*di* 200						
104	**2,4,6-Trimethoxybenzaldehyde**	118						201-3, me al						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Semi carba zone	2 4 Di-nitro phenyl hydra zone	*p* Nitro phenyl hydrazone	Phenyl hydra zone	Oxime	*Dimeth* one deriv (Dime done deriv)	Di meth one anhy dride	Miscellaneous	*o* Dianisidine spot test		
												Cold	Hot	Limit γ
105	**1-Bromo-2-naphthaldehyde**	118									Oxid → acid 186			
106	**4-Chloro-3-hydroxybenzaldehyde**	121		238 9, pa yel		226 7 vlt red dil al		126 (anh) 106 10d (monohyd)						
107	**Pyrene-3-carboxaldehyde**	126												
108	**1,2,3,4-Tetrahydrophenanthrene-9-carboxaldehyde**	129												
109	**4,6-Dichloro-3-hydroxybenzaldehyde**	129 30									2 Nitro deriv 157			
110	**2,4-Dihydroxybenzaldehyde** (β-Resorcylaldehyde)	135-6, yel , w		260d	286d brt red AmOH		156 60d	191, w						
111	**3-Chloro-4-hydroxybenzaldehyde**	139 (cor)		210d , yel , v dil ac a				144 5, w						
112	**2-Chloro-3-hydroxybenzaldehyde**	139 9 5		236 7, pa yel		244 5 or red, al		149 dil al						
113	**2,6-Dichloro-3-hydroxybenzaldehyde**	140 2						174 5 dil al						
114	**2,4-Dichloro-3-hydroxybenzaldehyde**	141, ac a				277 8, or red		188, al						
115	*d,l*-**Glyceraldehyde** (dimer)	142, 40% me al		160d	166 7 (cor), 50% me al			117 8	197 (cor) 50% al 203	172 50% al				
116	**2-Chloro-4-hydroxybenzaldehyde**	147 8 w		214, yel al		284d dk red al		194 al						
117	**3,4-Dihydroxybenzaldehyde** (Protocatechualdehyde)	153 4, w		230d	275d , dk red, me al		175 6d , w 121 8	157, xyl	145d , al		Dibenzoate 96 7, al			
118	**3,5-Dihydroxybenzaldehyde** (α-Resorcylic aldehyde)	156 7		223 4										
119	**3,5-Dichloro-4-hydroxybenzaldehyde**	158 9 (cor), 156, dil al		236 7d (cor), grn-yel , ac a				185, dil al						
120	**Hydroxypyruvic aldehyde**	160						135						
121	**Diphenylglycolaldehyde**	163		242				124						
122	**Benzaldehyde-3-carboxylic acid** (3-Formylbenzoic acid)	175, w		265			164	188d						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE IX. ORGANIC DERIVATIVES OF ALDEHYDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Semi carba zone	2 4 Di nitro-phenyl-hydra-zone	*p* Nitro phenyl-hydrazone	Phenyl-hydra-zone	Oxime	Dimeth one deriv (Dime-done deriv)	Di-meth one anhy dride	Miscellaneous	*o*-Dianisidine spot test		
												Cold	Hot	Limit γ
123	**2-Hydroxybenzalde-hyde-3-carboxylic acid** (3-Formyl-salicylic acid)	179					188, al	193, yel , w						
124	**4-Hydroxy-1-naphthal-dehyde**	181, yel , w		224							Hydrazone, 220-36, dk red Azine, 236, yel , $PhNO_2$			
125	**Indole-3-carboxalde-hyde**	195, 198					198							
126	**Pentachlorobenz-aldehyde**	202 5					152 5 (cor), yel , al	201 (cor), bz						
127	**3,4-Benzypyrene-5-carboxaldehyde**	203												
128	**3,4,5-Trihydroxybenz-aldehyde** (Gallalde-hyde)	212d , (mono-hyd)				226, 234-6d		195-200d						
129	**4-Hydroxybenzalde-hyde-3-carboxylic acid** (5-Formyl-salicylic acid)	248-9					219, al	179						
130	**Benzaldehyde-4-carboxylic acid** (4-Formylbenzoic acid)	256, w , subl					226	208-10						

*Derivative data given in order m p , crystal color, solvent from which crystallized

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EXPLANATIONS AND REFERENCES TO TABLES IX AND X

Phenylhydrazone *

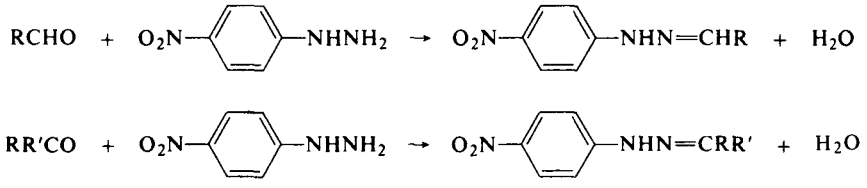
$$RCHO + H_2NNHC_6H_5 \rightarrow RCH{=}NNHC_6H_5 + H_2O$$

$$RR'CO + H_2NNHC_6H_5 \rightarrow RR'C{=}NNHC_6H_5 + H_2O$$

Phenylhydrazone

From the carbonyl compound with phenylhydrazine in methanol or ethanol
For directions and examples see Cheronis pp 497 8 Shriner, p 131
From the carbonyl compound with phenylhydrazine in aqueous acetic acid
See Wild, p 111
From the carbonyl compound with phenylhydrazine in methanol in the presence of acetic acid
See Cheronis, p 511
From the carbonyl compound in alcohol with phenylhydrazine hydrochloride and sodium acetate in water
See Vogel, p 721

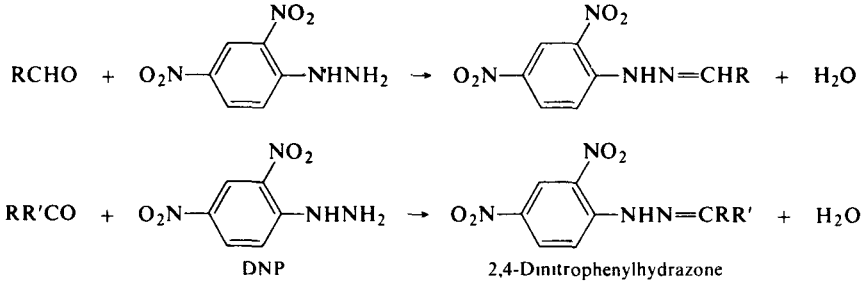
p-Nitrophenylhydrazone *



p Nitrophenylhydrazone

From the carbonyl compound with *p*-nitrophenylhydrazine and a catalytic amount of acetic acid in alcohol
For directions and examples see Shriner, pp 131, 219, Vogel, p 722, Wild, p 112
From the carbonyl compound in alcohol or water with *p*-nitrophenylhydrazine in aqueous acetic-hydrochloric acids
See G Petit, *Bull Soc Chim France*, 141 (1948)

2 4-Dinitrophenylhydrazone (DNP-derivative) *



DNP 2,4-Dinitrophenylhydrazone

From the carbonyl compound with 2,4-dinitrophenylhydrazine and sulfuric acid in methanol or ethanol
For directions and examples see Linstead, p 26, Shriner, p 219, Vogel, p 344, Wild, pp 114-5, O L Brady and G V Elsmie, *Analyst*, **51**, 77 (1926), O L Brady, *J Chem Soc*, 756 (1931), H H Strain, *J Amer Chem Soc*, **57**, 758 (1935), O L Brady and S G Jarret, *J Chem Soc*, 1021 (1950)
From the carbonyl compound with 2,4-dinitrophenylhydrazine and 1% hydrochloric acid in methanol or ethanol
See Cheronis, pp 499-501, 511, Vogel, p 722, Wild, pp 112-4, C F H Allen, *J Amer Chem Soc*, **52**, 2955 (1930), C F H Allen and J H Richmond, *J Org Chem*, **2**, 222 (1937)
From the carbonyl compound with 2,4-dinitrophenylhydrazine and acetic acid in diglyme (diethylene glycol dimethyl ether)
See H J Shine, *J Org Chem*, **24**, 1790 (1959)
From the carbonyl compound in 95% ethanol with 2,4-dinitrophenylhydrazine and concentrated hydrochloric acid in diglyme (diethylene glycol dimethyl ether)
See Cheronis, p 501, H J Shine, *J Org Chem*, **24**, 252 (1959), *J Chem Ed*, **36**, 575 (1959)

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

From the carbonyl compound in ethanol with 2,4-dinitrophenylhydrazine in 85% phosphoric acid
See Vogel, p 344, G D Johnson, *J Amer Chem Soc*, **73**, 5888 (1951), **75**, 2720 (1953)
From the carbonyl compound with 2,4-dinitrophenylhydrazine and sulfuric acid in isopropyl alcohol
See N R Campbell, *Analyst*, **61**, 391 (1936)
From the carbonyl compound with 2,4-dinitrophenylhydrazine in pyridine
See E A Braude and C J Timmons, *J Chem Soc*, 3131 (1953)

Semicarbazone *

$$RCHO + H_2NNHCONH_2 \rightarrow RCH{=}NNHCONH_2 + H_2O$$

$$RR'CO + H_2NNHCONH_2 \rightarrow RR'C{=}NNHCONH_2 + H_2O$$

$$RR'CO + (CH_3)_2C{=}NNHCONH_2 \rightarrow RR'C{=}NNHCONH_2 + (CH_3)_2CO$$

Semicarbazone

From the carbonyl compound with aqueous semicarbazide hydrochloride and sodium acetate
For directions and examples see Cheronis, pp 503–504, 512, Shriner, p 218, Vogel, p 344, Wild, p 121, A Michael, *J Amer Chem Soc*, **41**, 417 (1919)
From the carbonyl compound in ethanol with aqueous semicarbazide hydrochloride and sodium acetate
See Linstead, p 27, Shriner, p 218, Wild, p 122, R L Shriner and T A Turner, *J Amer Chem Soc*, **52**, 1267 (1930)
From the carbonyl compound and acetone semicarbazone in acetic acid
See B Angla, *Ann Chim Anal Chim Appl*, **22**, 10 (1940)

Thiosemicarbazone *

$$RCHO + H_2NNHCSNH_2 \rightarrow RCH{=}NNHCSNH_2 + H_2O$$

$$RR'CO + H_2NNHCSNH_2 \rightarrow RR'C{=}NNHCSNH_2 + H_2O$$

Thiosemicarbazone

From the carbonyl compound with thiosemicarbazide and sodium acetate in water, alcohol or acetic acid
For directions and examples see Cheronis, pp 503, 512, Wild, p 128, F J Wilson and R Burns, *J Chem Soc*, **121**, 873 (1922), W Baird, R Burns and F J Wilson, *J Chem Soc*, 2527 (1927), M Busch, *J prakt Chem*, **124**, 301 (1930), P P T Sah and T C Daniels, *Rec Trav Chim*, **69**, 1545 (1950)

Phenylsemicarbazone *

$$RCHO + H_2NNHCONHC_6H_5 \rightarrow RCH{=}NNHCONHC_6H_5 + H_2O$$

$$RR'CO + H_2NNHCONHC_6H_5 \rightarrow RR'C{=}NNHCONHC_6H_5 + H_2O$$

Phenylsemicarbazone

From the carbonyl compound with phenylsemicarbazide in alcohol or acetic acid
For directions and examples see P P T Sah and T -S Ma, *J Chinese Chem Soc*, **2**, 32 (1934), *C A*, **28**, 3713 (1934)

Oxime *

$$RCHO + NH_2OH \rightarrow RCH{=}NOH + H_2O$$

$$RR'CO + NH_2OH \rightarrow RR'C{=}NOH + H_2O$$

Oxime

From the carbonyl compound with hydroxylamine hydrochloride and pyridine in ethanol or without solvent
For directions and examples see Cheronis, p 513, Shriner, p 254, Vogel, p 345, J B Buck and W S Ide, *J Amer Chem Soc*, **53**, 1536 (1931), W E Bachmann and C H Boatner, *J Amer Chem Soc*, **58**, 2097 (1936), W E Bachmann and M X Barton, *J Org Chem*, **3**, 300 (1938)
For a modification of the above method in aqueous alcohol
See W M D Bryant and D M Smith, *J Amer Chem Soc*, **57**, 57 (1935)
From the carbonyl compound with hydroxylamine hydrochloride and sodium hydroxide in methanol or aqueous ethanol

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

See: Cheronis, p. 513; Shriner, p. 255; Vogel, p. 721; Wild, p. 121.

From the carbonyl compound with hydroxylamine hydrochloride and potassium hydroxide in 95% ethanol.

See: Shriner, p. 255.

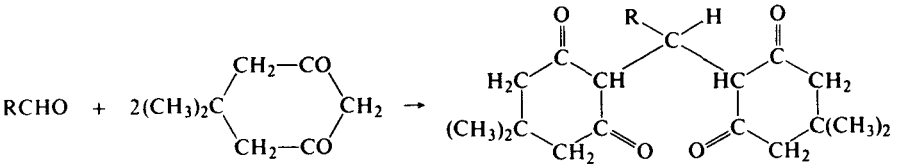
From the carbonyl compound with hydroxylamine hydrochloride and sodium or potassium acetate in water or aqueous ethanol.

See: Linstead, p. 27; Vogel, pp. 343, 345; J. S. Buck and W. S. Ide, *J. Amer. Chem. Soc.*, **53**, 1536 (1931).

From the carbonyl compound with hydroxylamine hydrochloride and sodium carbonate or bicarbonate in water or aqueous ethanol.

See: Wild, p. 120.

*Dimethone derivative (Methone derivative).**



This derivative is specific for aldehydes only.

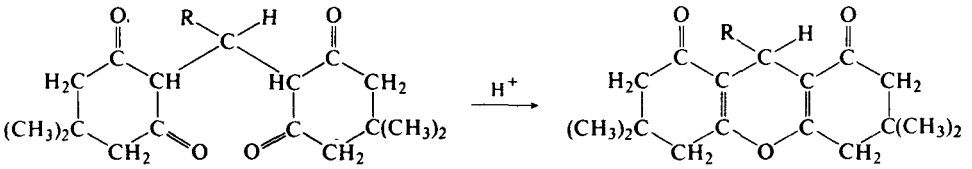
From the aldehyde and methone (dimedone; 5,5-dimethyl-1,3-cyclohexanedione; dimethyl dihydroresorcinol) in aqueous ethanol or methanol.

For directions and examples see: Cheronis, p. 505; Linstead, p. 27; Shriner, p. 220; Vogel, p. 333; Wild, pp. 136–7; D. Vorlander, *Z. Anal. Chem.*, **77**, 241 (1929); *Z. Angew. Chem.*, **42**, 46 (1929); W. Weinberger, *Ind. Eng. Chem., Anal. Ed.*, **3**, 365 (1931).

From the aldehyde with methone and a catalytic amount of piperidine in aqueous ethanol.

See: E. C. Horning and M. G. Horning, *J. Org. Chem.*, **11**, 95 (1946).

*Anhydride of dimethone derivative (substituted octahydroxanthene).**



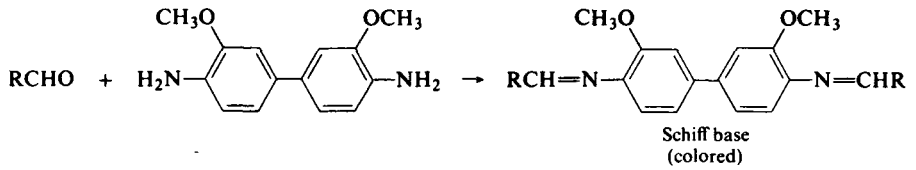
From the dimethone derivative with acetic anhydride.

For directions and examples see: Cheronis, p. 505; Vogel, p. 333.

From the dimethone derivative and a catalytic amount of hydrochloric acid in water or in ethanol.

See: Cheronis, p. 505; Linstead, p. 27; Shriner, p. 220; Vogel, p. 333; Wild, p. 137; E. C. Horning and M. G. Horning, *J. Org. Chem.*, **11**, 95 (1946).

o-Dianisidine spot test.



This test is usually applicable to aldehydes only.

From the aldehyde and a saturated solution of *o*-dianisidine (4,4'-diamino-3,3'-dimethoxybiphenyl) in glacial acetic acid.

For directions and examples see: F. Feigl, *Spot Tests in Organic Analysis*, 6th Ed., Elsevier Publishing Co., New York, 1960, p. 225; R. Wasicky and O. Frehden, *Mikrochim. Acta*, **1**, 55 (1927).

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

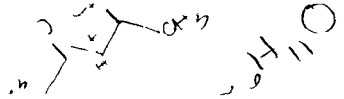


TABLE X. ORGANIC DERIVATIVES OF KETONES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point °C	Melting point °C	n_D^t	D_4^t	Semicarbazone	2,4-Dinitrophenylhydrazone	*p*-Nitrophenylhydrazone	Phenylhydrazone	Oxime	Miscellaneous
1	**Acetone** (2-Propanone)	56	−95	1.3592		190 w	126-128 yel al	148-9 yel al	42	59	Thiosemicarbazone 179
2	**3-Buten-2-one** (Methyl vinyl ketone)	81		1.4095[2]		141-140					
3	**2-Butanone** (Ethyl methyl ketone)	80-82	86.4	1.3791	0.804	146	116-7 115 yel al	128-9 yel w al	oil	b.p. 152	Phenylsemicarbazone 168
4	**3-Butyn-2-one** (Ethynyl methyl ketone)	86					181	143			
5	**2,3-Butanedione** (Biacetyl)	88 gr yel	f.p. 2.4	1.3927		*mono* 235 (cor.) w *di* 278-9 c.a.	*di* 314-5 (cor.) red or PhNO	*mono* 230 or yel	*mono* 134 yel dil al *di* 243d yel bz	*mono* 76 *di* 245-6 (cor.) 234-5 subl dil al	
6	**2-Methyl-3-butanone** (Isopropyl methyl ketone)	94.3		1.3879	0.8046	113.4-112.3 al	120-117 or yel al chl	108-9 or yel al	oil	oil	
7	**2-Methyl-1-buten-3-one** (Isopropenyl methyl ketone)	97[1]		1.4232-1.4235		173	181				
8	**Cyclobutanone**	100		1.4189			146				
9	**3-Pentanone** (Diethyl ketone)	102	39.8	1.3922		138-9	156 pr or al	144 or yel 50 al	oil	b.p. 165	
10	**2-Pentanone** (Methyl *n*-propyl ketone)	102.3		1.3902-1.39012	0.80639	112-106	143-4 yel or al	117	oil	b.p. 167	
11	**1-Penten-3-one** (Ethyl vinyl ketone)	102[1]		1.4192			129				
12	**3,3-Dimethyl-2-butanone** (*tert*-Butyl methyl ketone, Pinacolone)	106	49.8	1.3960-1.3956	0.8114	157.8	125 or yel al fusion[2] 131		oil	75-79	
13	**1-Methoxy-2-propanone** (Methoxymethyl methyl ketone)	115		1.3981			163-159	111-109			
14	**1-Methoxy-3-butanone** (1-Methoxyethyl methyl ketone)	116		1.3936		141					
15	**4-Methyl-2-pentanone** (Isobutyl methyl ketone)	116.8		1.3956	0.8008	132-130	95 or red al			b.p. 176	
16	**3-Methyl-2-pentanone** (*sec*-Butyl methyl ketone)	118		1.3990		94-5 pet eth	71.2			oil b.p. 89[20]	
17	**1-Chloro-2-propanone** (Chloroacetone)	119				150-164d	125			b.p. 171[73]	
18	**2-Methyl-1-penten-3-one** (Ethyl isopropenyl ketone)	119		1.4270[1]		161					
19	**1,1-Dichloro-2-propanone** (1,1-Dichloroacetone)	120			1.305[5]	163					
20	**2,4-Dimethyl-3-pentanone** (Di-isopropyl ketone)	124		1.4001	0.8108	160 (cor.) 149	88-85-6 or 94-8				
21	**Methyl neopentyl ketone**	125-122		1.4018[25]			100				
22	**3-Hexanone** (Ethyl *n*-propyl ketone)	125		1.4007	0.81491[4]	113	130			b.p. 86[17]	
23	**2,2-Dimethyl-3-pentanone** (*tert*-Butyl ethyl ketone)	125[23]		1.4052			144				
24	**2-Hexanone** (*n*-Butyl methyl ketone)	128		1.40069	0.81127	125 (cor.) 121 rapid htng	106 red or al 110	88	oil	49	Thiosemicarbazone 110

* Derivative data given in order: m.p., crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	D_4^{20}	Semi carbazone	2 4-Di-nitrophenyl hydrazone	*p*-Nitro-phenyl hydrazone	Phenyl hydrazone	Oxime	Miscellaneous
25	**4-Methyl-3-penten-2-one** (Iso-propylideneacetone Mesityl oxide)	130		1 44397	0 86532	α 164 β 133 4, bz	200, red, al , 203, red, ac a	132 4, or -yel , al	142	β 48–9, me al	
26	**3,3-Dimethyl-2-pentanone** (*tert*-Amyl methyl ketone)	130[733]		1 4100			112				
27	**Cyclopentanone**	130 7	−51 3	1 4366 1 4370	0 94869	210 203, 216–7, rapid htng	146, or ac a , 142, or - yel , al	154	55, lt pet	56 5, pet eth	
28	**5-Hexen-2-one** (Allylacetone)	132		1 4174[25]		102	108				
29	**1-Methoxy-2-butanone** (Ethyl methoxymethyl ketone)	133[757]		1 4063			198				
30	**2,2,4-Trimethyl-3-pentanone** (*tert*-Butyl isopropyl ketone)	135		1 4065		132				144	
31	**5-Methyl-3-hexanone** (Ethyl isobutyl ketone)	135[735]		1 407		152					
32	**2-Methyl-1-penten-4-one**	135 45d				192					
33	**1-Bromo-2-propanone** (Bromo-acetone)	136				135d				36	
34	**2-Methyl-3-hexanone** (Isopropyl *n*-propyl ketone)	136		1 4075		119					
35	**4-Methyl-3-hexanone** (*sec*-Butyl ethyl ketone)	136		1 402		137	78				
36	**2-Methoxy-3-pentanone** (Ethyl 1-methoxyethyl ketone)	136[750]		1 4019		120					
37	**Cyclobutyl methyl ketone**	136		1 4283[28]		149					
38	**3-Methyl-2-hexanone**	137				70					
39	**3-Methyl-1-hexen-5-one**	138		1 4197[25]		112					
40	**1-Chloro-2-butanone** (Chloro-methyl ethyl ketone)	138		1 4372							
41	**3-Methyl-1-penten-4-one**	138				201				75 6	
42	**3,4-Dimethyl-2-pentanone**	138		1 4094		113					
43	**4-Hexen-3-one**	139		1 4388		157					
44	**2,4-Pentanedione** (Acetylacetone)	139	−30	1 4465[25 6]	0 976	*mono* 122, *di* 209	209, yel , al			*di* 149, al	
45	**2-Methylcyclopentanone**	139		1 4364		184, 182				b p 103[22]	
46	**3-Ethyl-2-pentanone**	139[746]		1 4073		99					
47	**3-Hydroxy-3-methyl-2-butanone** (Acetyl diethyl carbinol)	140				165				87	
48	**4-Methyl-2-hexanone**	142, 139		1 4057[25]		120, 128					
49	**1-Propoxy-2-propanone** (Iso-propoxymethyl methyl ketone)	142		1 4004			142 144				
50	***d*-3-Methylcyclopentanone**	143		1 4340[19]		184 5				α 91–2, β 67–9	$[\alpha]_D^{12}$ + 132 9
51	**3,4-Dimethyl-4-penten-2-one**	144				114					
52	**4-Heptanone** (Di-*n*-propyl ketone)	144	−34 0	1 4069	0 8175	132, pet eth	75, yel - or , al			b p 193	
53	**2,4-Dimethyl-3-hexanone** (*sec*-Butyl isopropyl ketone)	145		1 4059, 1 4080		71					
54	**3-Hydroxy-2-butanone** (*d l*-Acetoin)	145, 148	−72, 15	1 4178	0 9861[30]	185, al , 202	*di* 318, or , $PhNO_2$ tol				Phenylosazone, 243d , yel , bz
55	*d l*-3-Methylcyclopentanone	145[755]		1 4329		185					
56	**1-Methoxy-3-methyl-2-butanone** (Isopropyl methoxymethyl ketone)	145[748]		1 4078			163				

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point, °C	n_D^{20}	D_4^{20}	Semi-carbazone	2 4-Di nitrophenyl hydrazone	*p*-Nitro phenyl hydrazone	Phenyl-hydrazone	Oxime	Miscellaneous
57	**2,2-Dimethyl-3-hexanone** (*tert*-Butyl *n*-propyl ketone)	145[738]		1 4107			124 116				
58	**1-Hydroxy-2-propanone** (Acetol)	146	−17	1 4295		196, al	128 5 (cor), or , al	173			
59	**4-Chloro-3-methyl-2-butanone** (α-Chloroisopropyl methyl ketone)	146		1 4390			116				
60	**1-Hepten-4-one**	146 7				110, w -al				b p 92 3[13]	
61	**3,4-Dimethyl-3-penten-2-one**	147		1 4506[14]		200					
62	**1-Ethoxy-2-butanone** (Ethoxy-methyl ethyl ketone)	147[752]		1 4068							
63	**2,5-Dimethyl-3,4-hexanedione** (Di-isobutyryl)	148		1 42057						*mono* 125, *di* 172	
64	**3-Heptanone** (*n*-Butyl ethyl ketone)	148		1 4092		101, 103, 152					
65	**5-Methyl-4-hexen-3-one**	148		1 4496[15]		163					
66	**5-Methyl-5-hexen-2-one** (Meth-allylacetone)	149		1 4285[25]		137					
67	**2-Methyl-4-heptanone** (Isobutyl *n* propyl ketone)	150[750]				124					
68	**4,4-Dimethyl-3-hexanone** (*tert* Amyl ethyl ketone)	150 2				98					
69	**2-Heptanone** (*n*-Amyl methyl ketone)	151 2	−35 5	1 40069		123, al , 127	89, yel or , al 74		207		
70	**3-Ethyl-5-hexen-2-one**	152		1 4260[25]			53				
71	**5-Hepten-2-one** (Crotylacetone)	153		1 4280[25]	0 8446	105 97					
72	**1-Methoxy-2-pentanone** (Meth oxymethyl *n*-propyl ketone)	153[745]		1 4119							
73	**3,3-Dimethylcyclopentanone**	153[748]				178					
74	**2,2,4,4-Tetramethyl-3-pentanone** (Di-*tert*-butyl ketone)	154		1 4392, 1 4194							
75	**1-Bromo-2-butanone** (Bromo-methyl ethyl ketone)	155, 50[12]		1 4670							
76	**Cyclopentyl methyl ketone**	155				143					
77	**2,2,5,5-Tetramethylcyclo-pentanone**	155		1 4280							
78	**1-Methoxy-3-hexanone** (1-Meth-oxyethyl *n*-propyl ketone)	155[746]		1 4091		169, 170					
79	**Cyclohexanone**	156	−16 4	1 4507		166–7	160, 162, yel al	146 7, 90% al	81 2, 50% al	91, lgr	
80	**4-Methyl-6-hepten-3-one**	156					80				
81	**2-Hepten-4-one**	156 7				147, w - me al					
82	**2,3-Hexanedione**	158								*di* 175	
83	**3,4-Dimethyl-2-hexanone**	158, 155				120, 118, 126					
84	**3,4-Dimethyl-3-hexen-2-one**	158		1 4476[15]		142					
85	**2,2,4-Trimethyl-3-hexanone** (*tert*-Butyl isobutyl ketone)	158				145					
86	**2-Ethyl-1-hexen-3-one**	158[742]		1 4408[18]		119					
87	**3,3-Dimethyl-1-methoxy-2-butanone** (*tert* Butyl methoxy-methyl ketone)	159[743]		1 4193							
88	**1-Isopropoxy-3-methyl-2-butanone**	160					88				
89	**2-Methyl-3-cyclopentenone**	161		1 4771		220				127	

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Semi carbazone	2 4-Di-nitrophenyl-hydrazone	*p*-Nitro-phenyl-hydrazone	Phenyl-hydrazone	Oxime	Miscellaneous
90	**1-Ethylcyclopentanone**	161[755]				189					
91	**3-Methyl-2-heptanone**	162		1 415		82					
92	**4,5-Dimethyl-5-hexen-3-one**	162[750]				110					
93	**3,5-Dimethyl-4-heptanone** (Di-*sec*-butyl ketone)	162, 170-3				83-4					
94	**6-Methyl-3-heptanone** (Ethyl isoamyl ketone)	163, 160				132					
95	**2-Methoxy-3-methyl-2-pentanone** (*sec*-Butyl methoxymethyl ketone)	164[757]		1 4162							
96	**1-Methoxy-4-methyl-2-pentanone** (Isobutyl methoxymethyl ketone)	164[751]		1 4140							
97	**2-Methylcyclohexanone**	165 1, 166	−14 0	1 4885	0 92500	191 197d, al, rapid htng	135 5 7 0, al 137 (cor)	132	b p 220[35-41]	43, eth	
98	**4-Hydroxy-4-methyl-2-pentanone** (Diacetone alcohol)	166, 164					202 3			58	3,5-Dinitro-benzoate, 55
99	**4,5-Dimethyl-4-hexen-3-one**	166[750]				209					
100	**2,2-Dimethyl-3-heptanone** (*n*-Butyl *tert*-butyl ketone)	166[745]		1 4167		145					
101	**2,6-Dimethyl-4-heptanone** (Di-isobutyl ketone, Isovalerone)	168 0		1 4173[25]		122, 126	66, or-red 92				
102	**2-Methyl-4-octanone** (*n*-Butyl isobutyl ketone)	168				132					
103	**2,5-Dimethyl-4-heptanone** (*sec*-Butyl isobutyl ketone)	169, 167				133					
104	***d*-3-Methylcyclohexanone**	169		1 4456[21]		180, me al				43	$[\alpha]_D^{25}$ +13 38
105	***d l*-3-Methylcyclohexanone**	168, 169 6	−73 5	1 4430 1 4463	0 91535	179, me al 191 4d, rapid htng	155 yel	119	94, w -al		
106	**1-Methoxy-2-hexanone** (*n*-Butyl methoxymethyl ketone)	169[744]		1 4173							
107	**4-Octanone** (*n*-Butyl *n*-propyl ketone)	170				96					
108	**Methyl acetoacetate**	170	−40 6	1 41964	1 0765	152					
109	**2,2-Dimethylcyclohexanone**	170 171		1 4482		201 193	140-2				
110	**6-Methyl-2-heptanone** (Isohexyl methyl ketone)	171		1 4146		154	77				
111	***trans*-2,4-Dimethylcyclohexanone**	171		1 4429[16]		136					
112	**4-Methylcyclohexanone**	171 25	−40 6	1 4445	0 91562	199, me al, 203 5d, rapid htng		128 5, yel, al	109 10, al	37 9	
113	***d,l*-2,5-Dimethylcyclohexanone**	171-3		1 4446		α 122, β 173				111, al	
114	**2-Octanone** (Hexyl methyl ketone)	173	−21 5	1 41518, 1 4154	0 81853	122 3 (cor), pet eth -al	58, or, al	92 3, yel, al			
115	**5-Ethyl-3-heptanone**	173				134					
116	***d*-2,5-Dimethylcyclohexanone**	173-4				176 7				97 8	$[\alpha]_D^{20}$ +11 6
117	**3-Ethyl-2-methylcyclopentanone**	174				170, al					

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES

a) *Liquids* 1) (*Listed in order of increasing atmospheric b.p.*)* (*Continued*)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Semicarbazone	2,4-Dinitrophenylhydrazone	*p*-Nitrophenylhydrazone	Phenylhydrazone	Oxime	Miscellaneous
118	**2,6-Dimethylcyclohexanone**	174		1 4500, 1 4470							
119	**2-Isopropylcyclopentanone**	174		1 4395[29]		202					
120	**Acetoxyacetone**	174–5, 74[18]		1 4150	1 0749	145 me al		144, yel , bz	60d , eth	b p 144[20]	
121	**2,4-Heptanedione** (*n*-Butyrylacetone)	174 5									Cu salt, 165 161, pa bl
122	**3-Methyl-3-hepten-2-one**	175				164					
123	*cis*-**2,4-Dimethylcyclohexanone**	176		1 4430[25]		200, 190				98 9	
124	**4-Ethyl-4-hydroxy-3-hexanone**	178[742]				177					
125	**2,3-Dimethylcyclohexanone**	178–9		1 4505		203–4					
126	**2,2,6-Trimethylcyclohexanone**	179[767]		1 4480		209	141				
127	**3,3-Dimethylcyclohexanone**	179[748]		1 4482[17]		219					
128	**5-Ethyl-4-hepten-3-one**	179[740]				105					
129	**3-Ethyl-4-methylcyclopentanone**	180				208–9 w -al				oil, b p 117[11]	
130	**Cyclohexyl methyl ketone**	180		1 4514		177		154		60	
131	*trans*-**3,5-Dimethylcyclohexanone**	*d l* 180 1		1 4475[21]	*d l* 0 897 *d* 0 9083 *l* 0 9074	*d l* 193–4, *d* 193–4, *l* 189				*d l* oil, b p 116–8[14]	*d* $[\alpha]_D^{20}$ +4 65 *l* $[\alpha]_D^{20}$ −7 91
132	**5-Hydroxy-4-octanone** (Butyroin)	180–90					99				
133	**Ethyl acetoacetate**	181				133, 129d	93				
134	**Cycloheptanone**	181, 182				163	148	137		23	
136	*cis*-**3,5-Dimethylcyclohexanone**	182–3		1 4407	0 890	202 3				74	
137	**2-Propylcyclopentanone**	183		1 4429		214d , al				oil, b p 109–11[9]	
138	**2,2,6,6-Tetramethylcyclohexanone**	184[772]	15	1 4473							
139	**3-Methyl-2,4-hexanedione**	184 183									Cu salt, 177
140	**5-Nonanone** (Di-*n*-butyl ketone)	186–7	f p -5 9	1 421[15]	0 8222	90, al					
141	**3,4-Dimethylcyclohexanone**	187		1 4520 1 4507	0 906	189					
142	**3-Nonanone** (Ethyl *n*-hexyl ketone)	187[751]				112					
143	**2,5-Dimethylcyclohexen-3-one**	189 90		1 4753[22]		165, me al				92 3, me al 169, al	
144	**Methyl 2-pyridyl ketone** (2-Acetylpyridine)	190								121	
145	**3-Propylcyclopentanone**	190–1		1 4456[12]		178 9, me al				oil, b p 121 2[12]	
146	**3-Ethylcyclohexanone**	192		1 4537, 1 4511		182, 175					
147	**1,5-Dimethylcyclohexen-4-one**	192–3, 194								102	
148	**2,5-Hexanedione** (Acetonylacetone)	194	−9	1 428, 1 449	0 97370	*mono* 185d , *di* 224	*di* 257 pyr	*di* 210 2 red al	*di* 120, dil al	*mono* b p 130[11], *di* 137	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Semicarbazone	2,4-Dinitrophenylhydrazone	*p*-Nitrophenylhydrazone	Phenylhydrazone	Oxime	Miscellaneous
149	***d*-Fenchone**	195–6		1 46355[18]	0 947[19]	184, 172	140		b p 202–3[18]	*d* or *l* α+ 165 β+ 123, *d l* α+ 159 β+ 129	Hydrazone 56 7
150	**2-Nonanone** (*n*-Heptyl methyl ketone)	195 3	−8	1 42072	0 82133 0 82217	118 9 al					
151	**1-Acetyl-4-methylcyclohexanone**	195–7		1 4509[18]		α 159, me al β 175				57 9	
152	**Methyl levulinate**	196 0		1 42333	1 04945	143	142, al		96 105, al		
153	**4-Fluoroacetophenone**	196		1 5081[25]		219					
154	***d l*-2-Ethyl-5-methylcyclohexanone**	197		1 4485		178–81				80, w -al	
155	**1-Acetyl-2-methylcyclohexanone**	197 200				172 3					
156	**2-*n*-Propylcyclohexanone**	198–9[748]		1 4558[13]		133d , w -al				67 8	
157	**1-Acetylcyclohexene**	200		1 4892		220				59	
158	**3-(Trifluoromethyl)acetophenone**	202									
159	**β-Thujone**	202, 76[10]				174	114				
160	**Acetophenone** (Methyl phenyl ketone)	205, 202	20	1 541 1 5339	1 02810	198–9 (cor), 50% al , 203	238–40, al , 249–50, or -red , ac a	184–5, or -red	105, wh , al , → dk	60	
161	**2-Ethyl-4-methylcyclohexanone**	205[747]		1 4452							
162	**Ethyl levulinate**	206		1 42288	1 01114	148 51 2	102		104		
163	**4-Decanone**	206 7									
164	**1,5-Dimethylcyclohexen-3-one**	208–9		1 4819[22]		179–80, yel , al , 168 71			76 8		Thiosemicarbazone, 195d
165	***l*-Menthone**	209, 207	−6 6	1 4505		189, 187, 184	146, or , al		53	59, eth	
166	**2-Decanone** (Methyl *n*-octyl ketone)	211, 215 5	14, f p 3 1	1 42523	0 82370	124, 126, pet eth					
167	**Methyl 4-pyridyl ketone**	212								142	
168	**4-*n*-Propylcyclohexanone**	212[740]		1 4514[25]		180					
169	**2-Acetylthiophene** (Methyl 2-thienyl ketone)	213	10 5	1 5666		190, bz		181	96	81	
170	**2-Methylacetophenone** (Methyl 2-tolyl ketone)	214, 216		1 5320		205, al , 210	159, yel , al 161			61	
171	**6-Bromo-2-hexanone**	214[720]		1 4713			81				
172	**1,5,5-Trimethylcyclohexen-3-one** (Isophorone)	215		1 4789[21 5]	0 9255[20 5]	199 5d , al , 191			68, dil al	79 5, pet eth , 76	
173	***n*-Propyl 2-pyridyl ketone**	217–8							82	48	Picrate, 75
174	**Propiophenone** (Ethyl phenyl ketone)	218, 220	20, 18 6	1 5270	1 0105	173 4 (cor), al , 182, rapid htng	190 1, red, bz , 189			54, 53, pet eth	
175	**Methyl 3-pyridyl ketone**	220, 218							137	113	
176	**3-Methylacetophenone** (Methyl 3-tolyl ketone)	220		1 5306	1 007	198, 203	207			55, 57, al	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point, °C	n_D^{20}	D_4^{20}	Semicarbazone	2,4 Dinitrophenylhydrazone	*p*-Nitrophenylhydrazone	Phenylhydrazone	Oxime	Miscellaneous
177	**Isobutyrophenone** (Isopropyl phenyl ketone)	222 217		1 5190	$0\ 9863_4^{16.9}$	181, al	163, or-red, dil ac a		73	94, lt pet	
178	**Acetyl benzoyl ketone**	222, yel		$1\ 537^{19}$		*di* 229 32		*di* 256	*α* 143	*α*, *mono* 166, *β*, *mono* 114 *di* 240	
179	**5-Ethyl-1-methylcyclohexene-3-one**	223 7				162 8d, al					Thiosemicarbazone, 150 1
180	**4[8]-*p*-Menthen-3-one** (Pulegone)	224, 221 2		$1\ 48705^{18}$		174 175 6	142			119	
181	**Pivalophenone** (*tert* Butyl phenyl ketone)	224^{754}		1 5082 1 5102		150	194 5			167	
182	**1-Phenyl-2-butanone** (Benzyl ethyl ketone)	226				135 146					
183	**6-Undecanone** (6-Hendecanone Di-*n*-amyl ketone)	228 (cor)	15	1 42875	0 82471	oil				oil	
184	**3-Chloroacetophenone**	228				232		176		88	
185	**Ethyl 1-thienyl ketone**	228				167				55-6	
186	**2-Undecanone** (2-Hendecanone Methyl *n*-nonyl ketone)	228	12 1 12 7	1 42899	0 82564	122 0 5	63, al	90 1, yel, al		44 5	
187	**2,4-Dimethylacetophenone**	228 234 5		1 5381 1 5340		185 7				63 4, pet eth	
188	**2-Chloroacetophenone**	229		$1\ 685^{25}$		160				113	
189	**1-Phenoxy-2-propanone** (Phenoxyacetone)	229 30 120^{19}		1 5228	1 0903	173, 176 (cor), 50% al					
190	***n*-Propyl 4-pyridyl ketone**	229 31									Picrate, 96
191	***n*-Butyrophenone** (Phenyl *n*-propyl ketone)	230, 218 21	11 5 13 0	1 5196 1 5203		187 8, al, 191	190, or-red, dil ac a			50, abs eth	
192	***d*-Carvone**	230		1 49952	0 9608	162-3, 142 3, *d l* 154 6	191, red, ac a	174 5, red-br		*d α* 72-3, al *d*, *β* 56-7, *l*, *α*, (−) 72, *l*, *β*, (+) 57-8, *d*, *l* 93-4	$[\alpha]_D^{20}$ +62 9
193	**2,5-Dimethylacetophenone**	230		1 5291 1 5306		168 9					
194	**4-Chloroacetophenone**	232 236	12			204 160, 146	231	239	114	95	
196	**4-Phenyl-2-butanone** (Methyl-*β*-phenylethyl ketone)	235				142				87	
197	**Isovalerophenone** (Isobutyl phenyl ketone)	236				210				76, 64 5	
198	**3,5-Dimethylacetophenone**	236 7		$1\ 5276^{25}$				179 80, yel, ac a		114, me al	
199	**2-Methoxyacetophenone** (2-Acetylanisole)	239, 245		1 5395	1 089	183			114, al	83, 96 0 5, pet	
200	**3-Methoxyacetophenone** (3-Acetylanisole)	240, 252		$1\ 5583^{15.4}$	$1\ 0993_4^{15.4}$	196					
201	**5-Phenyl-3-pentanone**	244		1 5125		80					
202	**5-Isopropyl-2-methylacetophenone** (2-Acetyl-*p*-cymene)	245		1 51849	$0\ 9654_{20}^{20}$	147	140 2, clearing at 160			91-2 5	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Semi carbazone	2,4-Di nitrophenyl-hydrazone	*p*-Nitro phenyl hydrazone	Phenyl hydrazone	Oxime	Miscellaneous
203	**α-Bromopropiophenone**	245 50		1 5686^{25}							
204	**3,4-Dimethylacetophenone**	246 7, 251		1 5400		233 4				85	
205	**2,4,5-Trimethylacetophenone**	246 7				204				85 6	
206	***n*-Propyl 3-pyridyl ketone**	246 52		1 5128		169 70			182		Picrate, 104
207	***n*-Valerophenone** (*n*-Butyl phenyl ketone)	248 5 242		1 5150	0 988$_{20}^{20}$	160, w -al	166, brt red, ac a	161 5 2 5, or - red, al	162	52 0- 5, pet eth	
208	**2-Aminoacetophenone**	250 2d	20			290d , al			108, al	109, subl , w	
209	**2,5-Dichloroacetophenone**	251	14							130	
210	**4-Isopropylacetophenone**	252 4									
211	**1,1,1-Tribromoacetone**	255d									
212	**Ethyl benzoylacetate**	265				125					
213	***n*-Enanthophenone** (*n*-Hexyl phenyl ketone)	283 3	16 4	1 50760$_{He}^{t}$	0 95155	119, dil al		127 8		55	
214	**3-Phenylcyclohexanone**	287 8^{736}				167, al				128 9, al	
215	**1-Acetylnaphthalene** (Methyl 1-naphthyl ketone)	302		1 629		288 5-9 5, 232-3			146	140, 137 5	
216	**Ethyl 1-naphthyl ketone**	305 7		1 6109						58	Picrate, 77-8, al , 79
217	**2-Benzoylpyridine** (Phenyl 2-pyridyl ketone)	317		1 6056			199		136, yel , al	150 165	Picrate, 130, al
218	**2,4,5-Trimethylbenzophenone**	328			1 0332$_{4}^{18}$						
219	**2,4,4'-Trimethylbenzophenone**	340								132, al	
220	**α-Methylstyryl phenyl ketone** (Dypnone)	340 5 sl d			1 108$_{0}^{20}$	151, bz				*syn* 134, al , *anti* 78	
221	**1,5-Diphenyl-3-pentanone** (Dibenzylacetone)	352, 348	13 4							95 6	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES

a) Liquids 2) (Reduced pressure b.p. only) (Listed in order of increasing semicarbazone m.p.)*

No	Name	Semi-carbazone	Boiling point, °C	n_D^{20}	D_4^{20}	Miscellaneous
1	**1-Chloro-2-methyl-3-pentanone**	70	64[9]			
2	**4-Methyl-2-octanone**	70	94[40]			
3	**1-*Hepten*-5-*one***	82 3, w al	46 7[12]	1 4254[18 3]	0 8487[18 3]	
4	**3-Dodecanone**	89 w -al	134[18]			m p 19
5	**1,3-Diethoxy-2-propanone** (*sym*-Diethoxyacetone)	91	105[35]	1 4202		
6	**1-Ethoxy-2-propanone** (Ethoxyacetone)	96	36[28]	1 4000		
7	**3-Cyclopentyl-2-butanone** (α-Cyclopentyl-α-methylacetone)	98	79[17]	1 4470		
8	**7-Methyl-1-octen-5-one**	101 2	62 3[14]	1 4288[12 5]		
9	**Cyclohexyl methoxymethyl ketone**	102	111[21]	1 4552[25]		
10	**1-Phenoxy-2-butanone** (Ethyl phenoxymethyl ketone)	102	100[5]	1 5201		
11	**1-Naphthoxyacetone**	103	205 8[14]			
12	**1-Hepten-6-one**	108 w -al	41 3[10]	1 4350[18]	0 8673[18]	
13	**1-Phenoxy-2-pentanone** (Phenoxymethyl *n*-propyl ketone)	108	112[4]	1 5148		
14	**3-Octyn-2-one**	109	76[15]	1 4446[25]		2 4 Dinitrophenylhydrazone 88
15	**3-Hepten-6-one**	109 10 wh	61 2[20]	1 4290[21]	0 8618[21]	
16	**3-Methyl-4-phenyl-2-butanone**	112 114	130[17]	1 5090[19]		
17	**3-Methyl-3-hepten-5-one**	114	82 6[42]	1 4488[25]		
18	**1-Chloro-2-ethyl-3-hexanone**	115	92[12]			
19	**1,3-Dimethoxy-2-propanone** (*sym*-Dimethoxyacetone)	120	78[18]	1 4174		
21	***trans*-3-Hepten-2-one**	125 128	60[16]	1 4421 1 4430	0 8445	
22	**5-Hydroxy-5-methyl-3-heptanone**	125	86[14]	1 4386[14]		
23	**α-Ethoxyacetophenone**	128	122[15]	1 5250		
24	**3-Propylpropiophenone** (Ethyl 3-propylphenyl ketone)	128	145[20]			
25	**α-Methoxyacetophenone**	129	126[19]			
26	**1-Phenyl-4-hexen-1-one**	130	97[1]	1 5270[25]		
27	**5-Phenyl-2-*pentanone***	130	122[6]			
28	**2-Methyl-3-octen-6-one**	131 2	73 7[11]	1 44533		
29	**1-Phenyl-1-hexen-5-one**	132 et ac	153 5[10]	1 5458[25]		
30	**3-Phenyl-1-hexen-5-one**	132	153 5[10]	1 5193[25]		2 4 Dinitrophenylhydrazone, 103
31	**4-Phenyl-2-pentanone**	137	115[13]	1 5124		
32	**3-Propyl-3-hexen-2-one**	142	72[9]			
33	**3-Acetylfuran**	150	84[21]			
34	**3-Hydroxy-3-methyl-2-pentanone**	150	73[50]	1 4200		
35	**1-Cyclopentyl-2-propanone** (1-Cyclopentylacetone)	150	67[12]			
37	***cis*-3-Hepten-2-one**	152	70[15]	1 4505[22]	0 8555[22]	
38	**3-Hydroxy-3-methyl-2-heptanone**	152	84[19]			
39	***d*-2-Ethyl-5-methylcyclohexanone**	152 4	83 4[18]		0 9016$_4^{15}$	$[\alpha]_D$ +8 5
40	**5-Hydroxy-2-pentanone**	155	86[10]	1 4350[25]		
41	**3-Phenyl-2-butanone**	158	107[22]	1 5092		
42	**3-Phenyl-3-hexen-5-one**	158	138[14]			
43	**Dicyclopentyl ketone**	162	112[12]			
44	**2-Ethylcyclohexanone**	162 163	76[20]	1 4522		2,4-Dinitrophenylhydrazone 162
45	**2,3-Dimethyl-2-hepten-6-one**	163	76[13]			
46	**3-*n*-Propylcyclohexanone**	169	42[0 7]	1 4530		
48	**2-Cyclohexenone**	172, 168	68[22]	1 4879		2,4-Dinitrophenylhydrazone, 163 117
49	**2-Chloropropiophenone** (2-Chlorophenyl ethyl ketone)	173	106[12]			
50	***d,l*-1-Acetyl-3-methylcyclohexanone**	174-5	99 100[38]			
51	**3-*n*-Propyl-2-cyclohexenone**	175	60[0 4]	1 4876[25]		2,4-Dinitrophenylhydrazone, 156
52	**2-Bromoacetophenone**	177	112[10]			2,4-Dinitrophenylhydrazone, 189

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES

a) Liquids 2) (Reduced pressure b.p. only) (Listed in order of increasing semicarbazone m.p.)* (Continued)

No	Name	Semi-carbazone	Boiling point °C	n_D^{20}	D_4^{20}	Miscellaneous
53	**2-Methyl-3-butenyl phenyl ketone**	177	100[2 1]	1 5223[25]		
54	**4-Methoxycyclohexanone**	178	85[14]	1 4560		2,4-Dinitrophenylhydrazone, 150
55	**5,5-Dimethyl-3-hexen-2-one**	178	79[40]	1 4430		
56	**Ethyl 2-methylstyryl ketone**	178	152[14]			
57	**2-*Bromopropiophenone*** (2-Bromophenyl ethyl ketone)	179	118[11]			
58	**3-Isopropyl-2-cyclohexenone**	179	60[0 3]	1 4842		2,4 Dinitrophenylhydrazone, 155
59	**2-Ethylacetophenone**	180	118[29]	1 5249		
60	**3-Pyridylacetone**	185	123[1]			
61	**/-6-Isopropyl-3-cyclohexenone**	185	98 100[10]	1 484		$[\alpha]_D^{18}$ −64 5 2,4-Dinitrophenyl-hydrazone, 137-8 *p*-Nitro-phenylhydrazone, 168-9
62	**4-*n*-Butylacetophenone**	185	141[14]			
63	**3-Phenyl-2-hexen-5-one**	185	138[14]			
64	**3-Ethyl-2-cyclohexenone**	186	57[0 9]	1 4913		
65	**3-Methyl-3-phenyl-2-butanone**	186	77[15]	1 5083		
66	**2-Methyl-3-octen-5-one**	187-8	68 78[24]	1 4748		
67	**4-Isopropylcyclohexanone**	188, 188-9	91[13]	1 4560		*p*-Nitrophenylhydrazone, 123-4
68	**4,4,6-Trimethyl-2-cyclohexen-1-one**	188, 185-7	73-5[13]			
69	**2-Acetyl-5-methylfuran**	191	73[8]			
71	**3-Phenyl-2-pentanone**		110[18]	1 5051		
72	**4-Phenylhexahydroacetophenone** (Methyl 4-phenylcyclohexyl ketone)	191	121[1 2]			
73	**2,6,6-Trimethylcycloheptanone**	191-2	85 5[12]	1 4568[18]	0 9095[18]	
74	**Acetyl phenyl carbinol**	194	137			2,4-Dinitrophenylhydrazone, 170 126 Oxime 113
75	**2-Tetralone**	194	131[11]	1 5555[25]		m p 18, Oxime, 88
76	**3-Isopropylcyclohexanone**	195	51[1]	1 4540		
77	**1-Propionylcyclohexene**	195, 189	102[14]			Oxime, 78
78	**α-Thienylacetone** (1-(α-Thienyl)-2-propanone)	195	106[12]	1 5366[14]		
79	**5,5-Dimethyl cyclohexen-3-one**	195	88 5[32]			H_2SO_4 → red → vlt → col
80	**2-Acetylbiphenyl**	197	105[1]			
81	**3-Methyl-2-cyclohexen-1-one**	199, 201	78[14]	1 4945		2,4-Dinitrophenylhydrazone, 176 178
82	**1-Acetyl-2,2-dimethylcyclohexene**	201	118[49]	1 4810[25]		
83	**1,1-Dimethyl-2-tetralone**	204	96[0 5]	1 538		
84	**2-Methyl-1-tetralone**	205, 195	138[16]	1 5447		
85	**6-Propionyltetralin**	209	163[11]	1 5508[29]		
86	**3-Methyl-2-*n*-propylcyclopentanone**	210	58[2]	1 4778		
87	**4-Methyl-1-tetralone**	211	111[1]			
88	**1-Acetylcyclopentene**	211	74[12]			
89	**2-Acetyl-5-methylthiophene**	217	83[2]	1 5622		
90	**1-Tetralone**	217, yel , al	170[49]			Oxime, 102, prisms, 88 9, needles, me al
91	**Neopentyl phenyl ketone**	218	116[11]	1 5078		Oxime, 114
92	**3-Methyl-2,5-hexanedione**	220	71[10]	1 4260		
93	***cis*-1-Decalone**	220d	116[18]	1 4939		
94	**3-Acetylbiphenyl**	223	138[1]	1 6140[25]		
95	**1,2-Dimethyl cyclohexen-3-one**	225d	118-9[12]			
96	**3-*Chloroacetophenone***	232	113[11]	1 5494		
97	**3-Bromoacetophenone**	233	132[17]	1 5755		
99	**6-Acetyltetralin**	234	156[10]	1 5591[25]		
100	**2,3-Dimethyl-2-cyclopentenone**	250	92[25]	1 4830		

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES

a) Liquids 2) (Reduced pressure b.p. only) (Listed in order of increasing semicarbazone m.p.)* (Continued)

No	Name	Semi carbazone	Boiling point °C	n_D^{20}	D_4^{20}	Miscellaneous
101	**1-Ethyl-2-methyl-3-cyclohexenone**	250	105^{19}			
102	**3-Acetylthianaphthene**	250	137^{3}			
103	**2-Oxopropionaldehyde** (Methylglyoxal, Pyruvic aldehyde)	*di* 254	52^{12}			*bis*-2,4-Dinitrophenylhydrazone 299 300, red, $PhNO_2$, Dioxime 157, al

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES

b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point °C	Semi-carbazone	2,4 Di-nitrophenyl-hydrazone	*p*-Nitro-phenyl-hydrazone	Phenyl hydrazone	Oxime	Miscellaneous
1	**2-Aminoacetophenone**	20	250 2d	290d, al			108, al	109, subl, w	
2	**2-Dodecanone** (*n*-Decyl methyl ketone)	20 5	246 7	122 3 dil al					n_D^{30} 1 42855, D_4^{30} 0 81982
3	***n*-Amyl phenyl ketone** (*n*-Pentyl phenyl ketone)	24 7	265 2	131 5, 50% al 133 (cor)	168 (cor), ac a				n_D^{25} 1 50272
4	**3,5-Dichloroacetophenone**	26	134 6[17]					138	
5	**Benzyl methyl ketone** (Phenyl-acetone)	27	216 5 (cor)	199 9 5, al, 188	156	145	86 7 lgr 83	68 70	n_D^{20} 1 5168
6	**4-Methylacetophenone**	28	226	204 5, al, 197	260 4 (cor), scar, ac a	198	97, al	87-8, pet eth	n_D^{20} 1 5348, D_4^{20} 1 003
7	**2-Hydroxyacetophenone**	28	215	210	210 12 212 3		110	118	
8	**Phorone** (Di-isopropylidene-acetone)	28, yel -gr	198	221, w 186	118			48	Tetrabromide, 88 9, al
9	**2-Tridecanone** (Methyl *n*-undecyl ketone *n*-Hendecyl methyl ketone)	28	263	123, al, 126, 117	69, or -yel	101-2		56 7, al - pet eth	n_D^{30} 1 43175
10	**Furfuralacetophenone**	29, yel - red	317d		169, scar				
11	**Ethyl 2-furyl ketone**	30, 28	183	189					
12	**4-Cyclohexylcyclohexanone**	30 31 29 2	100[0 1]	216	137			101 2, 104 5	
13	**2-(1'-Hydroxycyclopentyl)-cyclo-pentanone**	31	99[3]					78	
14	**7-Tridecanone** (Di-*n*-hexyl ketone)	31 2	255, 264			96			
15	**2-Acetylfuran** (2-Furyl methyl ketone)	32, 33	169-73	150, me al, 148	220	185 6, red, w - al	86, yel, w -al	104, eth - pet eth, 92	n_D^{20} 1 5017, D^{20} 1 098
16	**Levulinic acid** (3-Acetyl propionic acid)	33	245 6		206 (cor), or -yel, ac a	174 5	108, bz	45-6	
17	**2-Tetradecanone** (*n*-Dodecyl methyl ketone)	33-4, dil al		115 6, al					
18	**Methyl 1-naphthyl ketone** (1 Acetylnaphthalene)	34	302	222 5 4			146	136	n_D^{20} 1 6257, Picrate, 116, yel
19	**1,3-Diphenyl-2-propanone** (1 3 Diphenylacetone Dibenzyl ketone)	34, 35, 30	330	145 6, abs al, 125-6, dil al	100		121, al, 128 9	125, 123	
20	**2,2,6,6-Tetramethyl-4-piperidone**	34 9, red, dry eth, 58 (mono-hyd), eth	205-6	219 20, al				153 al	
21	**4-Chloropropiophenone**	36 35	118[2]	177, 175 6				62-3	
22	**2-Phenylcyclopentanone**	37	126-7[10]	218d					
23	**Furfuralacetone**	38, 39	116[10]		241 (cor)		131-2, al		
24	**4-Methoxyacetophenone**	38, 37	258	197 8, dil al	220 (cor), red, 231 8 (cor)	195-5 5, or, al	142, yel, al	86-7, wh, pet eth	
25	**1-Phenyl-1-hepten-3-one** (*n*-Butyl styryl ketone)	38 9, 40	159-67[11]				98, yel		Dimer, 175-6

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Semicarbazone	2 4-Di nitrophenylhydrazone	*p* Nitro phenylhydrazone	Phenylhydrazone	Oxime	Miscellaneous
26	**4,4-Dimethylcyclohexanone**	38 41	73^{14}	204			106 7		n_D^{24} 1 4537 D_4^{20} 0 932
27	**3,4-Methylenedioxypropiophenone** (Propiopiperone)	39		187 8			97	104	
28	**2-Hydroxybenzophenone**	39, w -al 153	250^{560}				155, al	*syn* 141, bz *anti* 143, bz	
29	**2-Methoxybenzophenone** (2-Anisyl phenyl ketone)	39						145 8, dil al fu sion → 130	
30	**3-Bromopropiophenone**	40		183					
31	**Benzalacetone**	41	212	187	227, 223	166	157	115	Thiosemicarbazone, 148
32	**1-Indanone** (α-Hydrindone)	42, 38	$241\ 2^{739}$	233 239	258	234 5, ac a	130 1 134 5 me al 124 8	146 144 bz pet eth	
33	**2,4-Dichloroacetophenone**	42	235 40	208				152	n_D^{20} 1 5640
34	**3-Aminopropiophenone**	42, yel	$168\ 9^{15}$	196 7				112 112 3	N-*p* Toluenesulfonyl deriv 97 al
35	**2-Bromobenzophenone**	42	345					133	
36	**8-Pentadecanone** (Di-*n*-heptyl ketone)	42	178					120	
37	**4-Phenyl-3-buten-2-one** (Methyl styryl ketone)	42	262	186, al , 198, 142	227, red, ac a 223, or - red, al	165 7, red, al	156 7 yel , al , 159	115 6, 60% al 87	H_2SO_4 → or -red
38	**3-Chlorobenzyl phenyl ketone**	43						102	
39	**8-Acetylguanine**	43 5	116°		253				
40	**2-Benzoylfuran** (2-Furyl phenyl ketone)	44	150^{3}					122	
41	**1,3-Dichloro-2-propanone** (1,3-Dichloroacetone)	45	175, 173						n_D^{16} 1 47144, D_4^{16} 1 3826
42	**2-Acetylquinoline**	46					54		
43	**3-Chloropropiophenone**	46		179-80					
44	**4-Bromopropiophenone**	46	140^{2}	171				90 1	
45	**Phenyl *n*-undecyl ketone** (*n*-Hendecyl phenyl ketone Laurophenone)	47, 44		94 5 95				63 63 5	
46	**2-Aminopropiophenone**	47, pet eth		190d , al				88 9, w	Hydrochloride, 184 5 N-Acetyl 70 1
47	**Benzophenone**	48, 49	306 (cor)	164-5, al , 167	238 9, or - yel , ac a , 229	154 5, yel , al , 144, red, al	137 8, al	142 3, me al , 144 140	D_{50}^{50} 1 0976
48	**2,4,6-Heptanetrione** (Diacetylacetone)	49	121^{10}	*mono* 203			*di* 142	2,6-*di* 68 5	n_D^{20} 1 4930, D_{40}^{40} 1 0681
49	**5-Phenoxy-2-pentanone** (Methyl 3-phenoxypropyl ketone)	50	121^{2}	108 10	110				
50	**9-Heptadecanone** (Di-*n*-octyl ketone)	50-50 5	250-3			54		111 2	
51	**Phenacyl bromide** (ω-Bromoacetophenone)	50, 51		146	212-3, yel , or			89 5, 97	
52	**4-Bromoacetophenone**	51, 50 5	225	208	230, 237 (cor)		126	128, 129	
53	**3-Bromophenacyl bromide**	51, lgr	174^{14}	163-4d , al					
54	**Ethynyl phenyl ketone**	51			214				

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Semicarbazone	2,4-Dinitrophenylhydrazone	*p*-Nitrophenylhydrazone	Phenylhydrazone	Oxime	Miscellaneous
55	**3,4-Dimethoxyacetophenone** (Acetoveratrone)	51, w -al	286–8	218, w al	206–7	227	131	140, w -al	
56	**Diphenylacetoin**	52		169					4-Nitrobenzoate 84
57	**Methyl 2-naphthyl ketone** (2-Acetylnaphthalene)	53 4, al , 56	301	234 5 237	262d , red, ac a		176–7, 171	149, 145 6	Picrate, 82
58	**Chloromethyl 2-phenylethyl ketone**	54	244 5	156	147, 146			89	
59	**2-Furyl-2-thenoylmethane**	55 5	195[6]						Cu salt, 274
60	**Phenyl 2-thienyl ketone** (2-Benzoylthiophene)	56	300	195–7				93	
61	**2-Nonadecanone** (*n*-Heptadecyl methyl ketone)	56		124–5 125 5 6				77	
62	**4-*n*-Caproylresorcinol** (2 4-Di hydroxy-*n*-caproylbenzene)	56 7	243 5d					190–1d , 50% al	
63	**2,2 -Dichlorobenzoin**	57							
64	**3-Propionylphenanthrene**	57						53 6 4 7	Picrate, 113
65	**9-Propionylphenanthrene**	57							Picrate, 107
66	**Benzalacetophenone** (Phenyl styryl ketone Chalcone)	58, pa yel al 57 8	345	α 168, β 170, yel , γ 179–80d	244d , or -red, ac a , 245 (cor)		120	140 68	Picrate, 93 7, Dimers, 124, 178, 195, 225 6
67	**2-Indanone**	58 58 9		218, 212–15 (dec)		232 (dec)		155	
68	**Phenacyl chloride** (ω-Chloroacetophenone)	59	244	156, 149	213 4d 214 5d			89	
69	**3-Phenyl-2,4-pentanedione**	60	134[20]						Cu salt, 224
70	**Mesitylacetone**	60	130[10]	205, 197					
71	**Ethyl 2-naphthyl ketone**	60	312 4	202				133, w -al	
72	**Difurfuralacetone**	60, yel					121–2		
73	**Desoxybenzoin** (Benzyl phenyl ketone)	60, al	321 (cor)	148, dil al	204 (cor), or	163, red-br , 160	116, yel , al	98, al	
74	**4-Methylbenzophenone** (Phenyl 4-tolyl ketone)	60, 55	326 (cor)	121–2, al	202 4 (cor), 199–200, or		109, wh , ac a	154, less soluble in w -ac a , 115, more soluble in w -ac a	
75	**1-Phenyl-1,3-butanedione** (Benzoylacetone Methyl phenacyl ketone)	61	261–2		151, pa yel , al	100–1, me al	150–3		
76	**1,1-Diphenylacetone**	61, al		170			131, bz	165	
77	**2,4′-Dibromobenzophenone**	62, pet eth	381–4 sl d					141–2	
78	**5-Isopropyl-1,3-cyclohexanedione**	62							
79	***Benzyl 3-chlorophenyl ketone***	62						120	
80	**4-Methoxybenzophenone** (4-Anisyl phenyl ketone)	62 4 al	354		180, dk or	198–9, al	132, 90	α 140 1, 137–8, β 115 6	
81	**2-Phenylcyclohexanone**	63, al , 60	160[15]	190	139			169	
82	**4-Methoxybenzil**	63						124	
83	**1-Acetyl-2-hydroxynaphthalene**	64							Benzoate, 85 6, pyr
84	**11-Henelcosanone** (Di-*n*-decyl ketone)	64, w -al						27 5	
85	**Benzoylformic acid** (Phenylglyoxylic acid)	66	147 51[12]		196 7d (cor), yel			α 127, eth , β 145d , w	Thiosemicarbazone, 188 9 (cor), yel
86	**2,2 -Dimethylbenzophenone** (Di-2-tolyl ketone)	67			190			105	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Semicarbazone	2,4-Dinitrophenylhydrazone	*p*-Nitrophenyl hydrazone	Phenyl hydrazone	Oxime	Miscellaneous
87	**1,5-Diphenyl-1,5-pentanedione** (1,3-Dibenzoylpropane)	67 5, 62–3						*di* 165 6d	
88	**3,5-Dibromoacetophenone**	68, al , 65	198[15]	268d , w - ac a			109–10, yel,, al		
89	**Cinnamalacetone**	68, eth		186, yel , al	222 3, vlt -red, ac a , 218–20, br -red, chl -me al		180, yel , al	153, al , 152	
90	**Benzoyl-2-furoylmethane**	68	169[3]						Cu salt, 248
91	**12-Tricosanone** (Di-*n*-undecyl ketone Di *n*-hendecyl ketone, Laurone)	69 5		179				39 40, al	
92	**Diphenyl triketone**	70, 69, yel , lgr							Heating with excess phenylhydrazine → 4 Benzene-azo-1,3,5 triphenylpyrazole, 156 7 yel -red, al
93	**2-Chlorobenzyl phenyl ketone**	71						86	
94	**Dihydroxyacetone**	72			277 8	160		84	Diacetate, 48 Dibenzoate, 120 5, Dimer 78 81
95	**3-Acetylphenanthrene**	72		230				193 4	Picrate, 125 6
96	**4-Methoxybenzalacetone** (Anisalacetone)	73, me al			229 (cor), red, ac a			119 20	
97	**Benzylacetophenone**	73		144				87	
98	**Phenoxymethyl phenyl ketone** (α Phenoxyacetophenone)	74	187[8]	187					
99	**9-Acetylphenanthrene**	74	170[1]	201				154-5	Picrate, 107 8
100	**1-Naphthyl phenyl ketone**	75 5–6 0	225[15]	385	α 246 7, red, β 243 4, or , mixt 220			161	
101	**9-Acetylfluorene**	75 5					139		
102	**2-Benzofuryl methyl ketone**	76, 72	136[11]	207			154		
103	**Benzyl 4-methoxyphenyl ketone**	77						118	
104	**4-Methoxybenzalacetophenone** (Anisalacetophenone 4-Methoxychalcone)	77, yel , al		α 168, al , β 190, al					Picrate, 87, or
105	**2-Naphthoxyacetone**	78, 77		203			154	123	
106	**4-Phenylcyclohexanone**	78		212, 229d , al				110	
107	**Benzoyl-2-thenoylmethane**	78	201[4]						Cu salt, 278
108	**4-Chlorobenzophenone**	78			185		106	β 105–6	
109	**1,4-Cyclohexanedione**	79	132[20]	*mono* 221 2, *di* 231	240			188	
110	**Di-*n*-tridecyl ketone** (Myristone)	79						57	
111	**Phenacyl phenyl ketone** (Dibenzoylmethane, ω-Benzoylacetophenone)	keto 81, enol 78, al		205			*mono* 105	*mono* 165	Dibromo deriv , 94–5, eth
112	**3-Nitroacetophenone**	81		257	228		128, 135	132	
113	**4-Bromobenzophenone**	82		350	230		126	α 116–7, β 110–1	
114	**1-Benzoylpropionic acid**	82–3d					100–4, br , bz		

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Semi carbazone	2,4 Di-nitrophenyl-hydrazone	*p*-Nitro phenyl-hydrazone	Phenyl-hydrazone	Oxime	Miscellaneous
115	**Fluorenone**	83, yel, bz	341 5		283 4	269	151 2, yel, al	195 6 (cor)	
116	**4-Iodoacetophenone**	85, eth	153[18]						
117	**Di-*n*-Heptadecyl ketone**	88 5, lgr, 89						67, 62 3	
118	**4,4'-Dimethylbenzophenone** (Di 4-tolyl ketone)	95, al	335	143 4	218 9		100, yel, al	163, al	Hydrazone, 108 10
119	**Benzil** (Dibenzoyl)	95, yel	347	*mono* 174-5 d, *di* 243 4d, al	*di* 189, yel, al, 185	*mono*· 192 3, dk or, ac a, *di* 290, yel, pyr -eth	*mono* 134, yel, al, *di* 235, chl rapid htng	*α mono* 137 8, 140, bz, *di* 237	
120	**β,β-Diphenylpropiophenone**	96 92						133	
121	**3-Hydroxyacetophenone**	96, 95	296	189 91	261				
122	**4-Chlorophenacyl bromide**	96-8							Acetate, 72
123	**2,3-Dihydroxyacetophenone** (3-Acetylcatechol)	97 8, dk yel, bz -lgr		166 7				96 7	Diacetate 109, bz Di-Me eth, b p 143 4[14] 143 4[14]
124	**2-Naphthylglyoxal**	98, (hyd), w 109	183[20]						Diacetate, 150, bz -pet eth osazone 184
125	**3-Aminoacetophenone**	98-9, pa yel, al		196d, w				192 4, w -al	Hydrazone, 98, al
126	**2-Benzoylacrylic acid**	99 (anh) 64 (mono hyd)		190			197	168d	Hydrazone, 185 6, al
127	**Di-2-thenoylmethane**	100							Cu salt, 263
128	**Di-1-naphthyl ketone**	100						200	Picrate 121 5 2 0
129	**1,3-Dibenzoylbenzene**	101 2, al						*mono* 201, *di* 70-3	
130	**2-Acetyl-1-hydroxynaphthalene**	102, gr -yel, al, 98, yel, bz	325 sl d	245 50, pa yel			136 7, wh, dil al	168 9	Acetate, 107 5, Benzoate, 128, al
131	**Cinnamacetophenone**	102, yel, al			222, red, ac a, 218 9d	*α* 135, al			
132	**1,3-Cyclohexanedione**	104						156	
133	**4-Tolil** (4,4'-Dimethylbenzil)	104 5						225	
134	**2-Propionylphenanthrene**	105, 104							Picrate, 107
135	**2-Aminobenzophenone**	105-6, pa yel, al						156, alk -stab, 127, a -stab	
136	**Benzoylnitromethane**	106					105 5 5, yel, al	96, w	
137	**4-Aminoacetophenone**	106, w	294	250, yel al	266 7, 263			147 8, al	4 Toluenesulfonamide, 203
138	**Benzalacenaphthenone**	107, yel, w -al						48	
139	**Benzyl 4-chlorophenyl ketone**	108						123	
140	**4-Bromophenacyl bromide**	108 9						115	Acetate, 72
141	**4-Hydroxyacetophenone** (4-Acetylphenol)	109		199	210, br, al		151, wh → yel	145, 143 4, bz	Acetate, 54, Benzoate, 134 5, al
142	***trans*-1,2-Dibenzoylethylene**	110						211	
143	**Piperonalacetone**	110-1, pa yel		*α* 217, al, *β* 168, bz			163	186, al	

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Semicarbazone	2,4-Dinitrophenylhydrazone	*p*-Nitrophenylhydrazone	Phenylhydrazone	Oxime	Miscellaneous
144	**2-Acetyldibenzothiophene**	112		235					
145	**1,5-Diphenyl-3-pentadienone** (Dibenzalacetone)	112, 111		187-90, al	180, red, ac a	173, yel, bz	152 3, 147 8, yel, al	142 4	Picrate, 114
146	**4,4'-Dimethoxybenzoin** (Anisoin)	113, dil al		185 (cor), w -al					Acetate, 94-5, al -pet eth
147	**1,4-Diacetylbenzene**	114	130[3]					240	
148	**3,4-Dihydroxyacetophenone** (4-Acetylcatechol)	116, w	127 33[11]					184d, et ac	3 4-Diacetate, 91
149	**3-Hydroxybenzophenone**	116, al						*syn* 76, *anti* 126, bz	
150	**α-Hydroxyacetophenone** (Phenacyl alcohol, Benzoyl carbinol)	117 8	118[11]	146 6 5, al			112, lgr -eth	70	Acetate, 49, eth, Benzoate, 118, dil al
151	**7-Acenaphthenone**	121 (cor), al					90, dk, al	175, al, 183 4, bz, *di* 222d	Picrate, 113
152	**4-Phenylacetophenone** (4-Acetylbiphenyl, Methyl 4-xenyl ketone)	121, al	325-7		241 5-2, red-or			186-7, al	
153	**Piperonalacetophenone** (3,4-Methylenedioxychalcone)	122, yel, al		α 203-5, abs al					Dibromide, 152, bz -lgr (1 1), Picrate, 126-8
154	**9-Hydroxyxanthene** (Xanthydrol)	122-4d							Heat → Dixanthyl ether, 219, Dixanthyl, 204, lgr
155	**4-Aminobenzophenone**	124, w -al						168, al, 127, w -al	Hydrazone, 139-40, yel, al
156	**4-Phenylphenacyl bromide**	124 5							Acetate, 111
157	**2-Naphthoin**	126						172	
158	**4-Phenylphenacyl chloride**	126-7							Acetate, 111
159	**Vanillalacetone** (4-Hydroxy-3-methoxystyryl methyl ketone)	129, yel, al			230 (cor), red		127-8, yel		
160	**Dianisalacetone**	129, yel, bz -pet eth			82-3			147 8	
161	**4,4'-Dimethoxybenzil** (Anisil)	133, yel		*di* 254 5, dil ac a				*mono* 133 *syn di* 217, *anti, di* 195, bz	Dihydrazone, 118
162	***d,l*-Benzoin**	133, al, 129	344	α 205-6, w	245, yel, al, 234		α 158-9, bz -lgr, β 106	α 151 2, bz, β 99	Acetate, 83, al, Benzoate, 124 5, 75% al
163	***cis*-1,2-Dibenzoylethylene**	134						*di* 210 1d	
164	**3,4,5-Tribromoacetophenone**	134 5, al		265d, ac a			129-34d, yel, pet eth		
165	**4-Hydroxybenzophenone** (4-Benzoylphenol)	134 5, w		194, bz	242 4 (cor), or		144, pet eth	81, Heat → 152	Acetate, 81, al Benzoate, 94 5, 115
166	**1-Furoin**	135, 138-9 (cor)			216 7, or -red, al		79-81, lgr -bz	α 161, al, β 102, pa yel, eth	Acetate, 76-7, Benzoate, 92 3
167	**Mesityl phenyl ketone**	137			232				
168	**4-Chlorobenzyl phenyl ketone**	138						96	

* Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point °C	Semi carbazone	2,4-Di nitrophenyl-hydrazone	*p*-Nitro-phenyl hydrazone	Phenyl-hydrazone	Oxime	Miscellaneous
169	**α-Anisal-α′-cinnamalacetone**	139, red, al					Pyrazo-line, 155 6, yel , al		Dibromide, 139-40, CS_2, Tetrabromide, 155 6, CS_2
170	**4-Aminopropiophenone**	140, w						153, al	N-Acetyl deriv 161, w
171	**3,3′-Dibromobenzophenone**	141						181 2d	
172	**2-Acetylphenanthrene**	143		260			187 8		
173	**Dicinnamalacetone**	144, yel , abs al			195 7 (cor), dk red		166, yel , al		Light → d
174	**1,2-Dibenzoylethane**	147			*di* 265		*mono* 116, *di* 179	204	
175	**2,4-Dihydroxyacetophenone** (Resacetophenone)	147, 144		218, 214 20d	206 8		156 8	202 3	2,4-Diacetate, 38 2,4 Dibenzoate, 81
176	**3,5-Dihydroxyacetophenone**	147 8, w		205 6, al		236 7, red, w -ac a			3,5-Diacetate, 91-2, lgr
177	**4,4′-Dichlorobenzophenone**	147-8			238-40			135	
178	**1,2-Dibenzoylbenzene**	148						*mono* 150	
179	**9-Benzoylanthracene** (9-Anthra-phenone)	148, yel , bz							H_2SO_4 → brief blue color
180	**4-Hydroxypropiophenone**	148			229				
181	**5,5-Dimethyl-1,3-cyclo-hexanedione** (Methone Dimedone)	148 9						*mono* 115 *di* 176	
182	**2,3,4,2′-Tetrahydroxybenzo-phenone**	149 (anh), 100 (hyd), yel , w							2,3,4,2′-Tetraacetate, 118, al
183	**Anthrone**	154, ac a							Al sol → bl fluorescence
184	**1,4-Dibenzoylbenzene**	161, al						*mono* 212-3, *di* 235	
185	**Furil** (2,2′-Bifuroyl)	165, yel , bz					*mono* 82 3, yel , *di* 184, yel , lgr	α, *mono* 106, β, *mono* 97-8, α, *di* 100, 166, β, *di* 188 90	
186	**Benzanthrone**	170, yel , al							H_2SO_4 → or -red sol , gr fluorescence
187	**Quinhydrone**	171, dk gr , subl					152	161	
188	**2,3,4-Trihydroxyacetophenone** (Gallacetophenone)	172, w		225, rapid htng				162 3	2,3,4-Triacetate, 85 Picrate, 133
189	**Xanthone** (Diphenylene ketone oxide)	174	350				152	161	
190	**4,4′-Bis(dimethylamino)benzo-phenone**	174					174 5	233	Hydrazone, 150, Picrate, 156
191	**4,4′-Dibromobenzophenone**	177	395					150-2	Hydrazone, 92-4
192	***d,l*-Camphor**	*d l* 178, *d* 179	209, 205	247-8d (cor), 236-7, al	*d, l* 164, *d* 177, or , al	217	233	*d* 118 9	*d* $[\alpha]_D^{20}$ + 44, Hydrazone, 55
193	**3-Acetylindazole**	182, yel , ac a			>320, red, $PhNO_2$			222, bz -al	N-Acetyl deriv , 123, ac a
194	**3,4,5-Trihydroxyacetophenone**	187-8, w		216-7, al		260d , red, w -ac a			3,4,5-Triacetate, 111-2, lgr

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE X. ORGANIC DERIVATIVES OF KETONES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Semi carbazone	2 4-Di nitrophenyl hydrazone	*p* Nitro phenyl hydrazone	Phenyl-hydrazone	Oxime	Miscellaneous
195	**3-Acetylindole**	190 1, bz						144 7, w	N-Acetyl deriv , 151, subl , pet eth -bz , Picrate, 183, yel , pet eth Diacetyl deriv , 165 6, bz
196	**2,5,2′,6′-Tetrahydroxybenzo-phenone**	200 2d w							2,5,2′,6′-Tetraacetate, 118 9, al
197	**2,5-Dihydroxyacetophenone** (Quinacetophenone)	202, yel gr , w				215 6		149 50, tol	2 5-Diacetate, 68, ac a
198	**2,4,5-Trihydroxyacetophenone**	206 7 red							2 4 5-Triacetate 165 6, bz
199	**2,3,5-Trihydroxyacetophenone**	206-7, yel , ac a				241 2d , w -al			2 3 5-Triacetate, 106 7, lgr
200	**2,4,6-Trihydroxyacetophenone** (Phloracetophenone)	219, anh , w							2,4 6-Triacetate, 103, 2,4,6-Tribenzoate, 117 8
201	**2,3-(3′,4′,5′-Triphenylcyclo-pentadieno)-indone**	222					246-7		
202	**3,4,3′4′-Tetrahydroxybenzo-phenone**	227 8, w						145, al	
203	**Ninhydrin** (Triketohydrindene hydrate)	243, 241d					*di* 207 8, or -red, al	201	Warm aqueous sol of α-amino acids → intense bl , vlt , etc At 125-30, loses w , turns red
204	**Phenacridone**	304 5, yel , ac a							N-Benzyl deriv , 188 9, yel , al

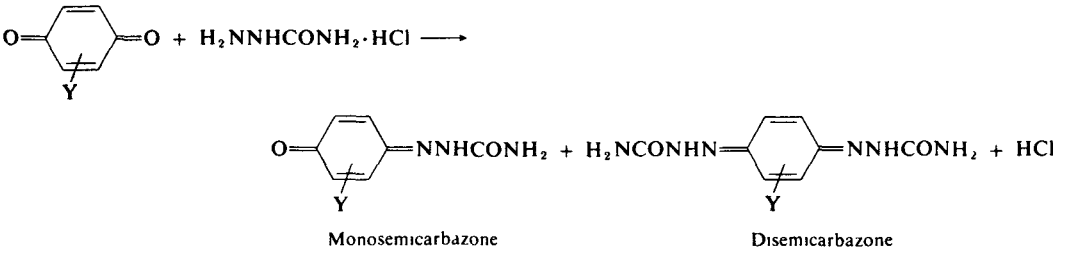
*Derivative data given in order m p , crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLE XI

The derivatives of quinones are usually similar to those of ketones Therefore, for directions and examples for their preparation see explanations and references to Tables 9 and 10, pages 141, 142, 143

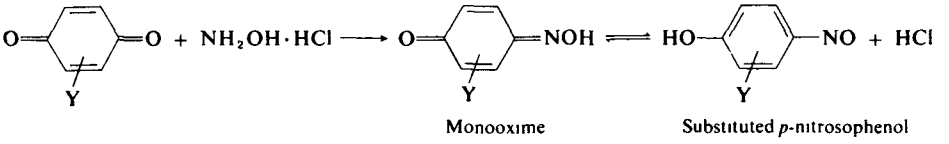
The derivatives listed as *phenylhydrazones*, *p-nitrophenylhydrazones* and *2,4-dinitrophenylhydrazones* of quinones in most cases are not real substituted phenylhydrazones, but either addition compounds or hydroxy derivatives of variously substituted aromatic azo compounds

Semicarbazone *



From the quinone with semicarbazide hydrochloride in water
For directions and examples see Linstead, p 30, Vogel, p 749

Oxime *



From the quinone with hydroxylamine hydrochloride in water
For directions and examples see Linstead, p 30

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE XI. ORGANIC DERIVATIVES OF QUINONES
(Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point, °C	Semi carbazone	2,4 Di nitrophenyl hydrazone	*p*-Nitro-phenyl-hydrazone	Phenyl hydrazone	Oxime	Miscellaneous
1	**2,3,5-Trimethyl-1,4-benzoquinone**	32, yel , eth		252 3 d , yel				1-*mono* 181 2, yel , al 4-*mono* 134, yel	
2	**2-Isopropyl-5-methyl-1,4-benzoquinone** (Thymoquinone)	45 5, or - yel	232	*mono* 201 2d , yel , al , *di* 237, yel	*mono* 179 80, dk red, al		93	1-*mono* 160 2, pa yel chl	
3	**2,3-Dimethyl-1,4-benzoquinone** (*o*-Xylo-*p* quinone)	55 (subl), yel						*mono* 166, yel	
4	**2-Bromo-1,4-benzoquinone**	56						1-*mono* 184, or 4-*mono* 196	
5	**2-Chloro-1,4-benzoquinone**	57, yel - red		4-*mono* 185d				1-*mono* 184, pa grn -yel , 4-*mono* 148d	
6	**2-Methyl-1,4-benzoquinone** (*p*-Toluquinone)	67 6 68 4		4-*mono* 178 9, yel , al *di* 240d , or -red	*di* 269, $PhNO_2$		130	*mono* 134 5d w , *di* 220d , yel -wh	
7	**2,6-Dimethyl-1,4-benzoquinone** (*m*-Xylo-*p*-quinone)	68 71, yel						1-*mono* 175, yel , al -w 4 *mono* 170 1, yel bz	
8	**4-Chloro-1,2-benzoquinone**	78 pa yel -red, hexane						*di* 128, br	
9	**2,5-Dimethyl-1,4-naphthoquinone**	94 yel me al					*mono* 226, red, ac a		
10	**Dunnione**	98 9, or - red, w		*mono* 232 3, w -me al	266 8, or				$[\alpha]_D^{18}$ +310° in chl
11	**2-Methyl-1,4-naphthoquinone**	106, yel , me al			4-*mono* 299d			*mono* 160, *di* 166-8	Benzoyl chloride + Zn dust → 1 4-dibenzyloxy-2-methylnaphthalene, 180 0-0 5, col , al
12	**Quinone** (1,4-Benzoquinone)	116, yel 113		*mono* 166, yel , 165-6d , red, 178, *di* 243d , red	*mono* 185 6, br , al , *di* 231		152	240	Picrate, 79, Quinhydrone, 171
13	**2-Chloro-1,4-naphthoquinone**	117, yel , w						4-*mono* 200d 198, pa yel , bz	
14	**1,4-Naphthoquinone** (α-Naphtho-quinone)	117 8, yel , al		*mono* 247, grn -yel , ac a	*mono* 278, yel , pyr	*mono* 277 9, or -red, $PhNO_2$	*mono* 205-6d , dk vlt , bz		

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XI. ORGANIC DERIVATIVES OF QUINONES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Semicarbazone	2,4 Dinitrophenylhydrazone	*p*-Nitrophenylhydrazone	Phenyl hydrazone	Oxime	Miscellaneous
15	**2,5-Dimethyl-1,4-benzoquinone** (*p*-Xylo-*p*-quinone)	125, yel, al					122 4, yel, 154 5, or	*mono* 168, yel, w, *di* 272, yel, al, 254	Monobenzoylphenylhydrazone, 122 4, yel, lgr
16	**2,6-Dibromo-1,4-benzoquinone**	131, yel, al		4-*mono* 225d, yel, al				4-*mono* 170d, br	
17	**2,6-Diphenyl-1,4-benzoquinone**	137 8, red						242-4d	
18	**2,5-Dihydroxy-3-*n*-dodecyl-1,4-benzoquinone** (Embelin)	143, or-red, eth-bz		*di* 236			*di* 189 90	*tetra* 175	Diacetate, 54 Dibenzoate, 97-8
19	**1,2-Naphthoquinone** (β-Naphthoquinone)	145 7d, red, eth, 120		1-*mono* 184d, yel, al		1-*mono* 250 1, 2-*mono* 236, dk red, ac a	2-*mono* 138, dk red, al	1-*mono* 109 5, 2-*mono* 162-4d, *di* 169, yel, al	
20	**3,7-Dimethyl-1,2-naphthoquinone**	151 2, red, al						2-*mono* 222d, or	
21	**5-Hydroxy-1,4-naphthoquinone** (Juglone)	153 4, or, bz						*mono* 167 0 7 5, red, ac a, *di* 225 (exp), dk br, ac a	Acetate, 154-5
22	**3-Chloro-1,2-naphthoquinone**	172, red, chl						1-*mono* 167 8, or	
23	**1,8-Dihydroxy-2-methyl-9,10-anthraquinone** (2-Methylchrysazin)	175							Diacetate, 205
24	**2-Methyl-9,10-anthraquinone**	177 9, 177, pa yel							Diacetate, 217, pa yel, ac a
25	**3,5-Dihydroxy-2-methyl-1,4-naphthoquinone** (Droserone)	181, pa yel, al						*di* 151	Diacetate, 119, me al
26	**2,3,4-Trihydroxy-9,10-phenanthraquinone**	185d, br-red		*mono* 270d, br-red, al					Phenazine, 255d, br, al
27	**6-Bromo-1,4-dihydroxy-9,10-anthraquinone** (6-Bromoquinizarin)	185 5, red-br, bz							Di Me eth, 176 5, or-yel, al, Diacetate, 220 5, yel, al
28	**1,2-Anthraquinone**	185 90d, or-br						1-*mono* 188d, or-br, 2-*mono* 200d, or-br	
29	**4-Chloro-1,2-naphthoquinone**	188, red br, bz						2-*mono* 157, pa yel	
30	**7-Isopropyl-1-methyl-9,10-phenanthraquinone** (Retenequinone)	197, or, al		*mono* 200, yel, pyr		*mono* 222 3, red, ac a	*mono* 160, or, bz-al	*mono* 128 5, 130 1 (cor), yel, al	

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE XI. ORGANIC DERIVATIVES OF QUINONES
(*Listed in order of increasing m.p.*)* (*Continued*)

No	Name	Melting point, °C	Boiling point, °C	Semi-carbazone	2,4 Dinitro-phenyl-hydrazone	*p*-Nitro-phenyl hydrazone	Phenyl-hydrazone	Oxime	Miscellaneous
31	**Camphorquinone**	199, yel, dil al		3 *mono* (α) 236d, al	*mono* 36, *di* 190	239	183 90, pa yel, al, 170	*mono* α 153 β 114 5, *di* (four forms) α 201d, β 248d, γ 136 δ 194d	3-*p*-Bromophenylhydrazone, 215 6, ac a, Hydrazone, 182
32	**1-Hydroxy-9,10-anthraquinone**	200, or-red, al, 193	subl						Acetate, 176 9, yel, al
33	**1,4-Dihydroxy-9,10-anthraquinone** (Quinizarin)	200 2 (cor), red, ac a, 195							Diacetate, 207 8, yel, pyr, 200-1, yel, ac anh
34	**9,10-Phenanthraquinone**	206 7 5, or-yel, 208, or	>360, subl → or-red	*mono* 220d	*mono* 312-3d, dk red	*mono* 245, red, xyl	*mono* 165, dk red, al	*mono* 158, grn-yel, al, *di* 202d	Conc H_2SO_4 → dull grn
35	**1,4-Anthraquinone**	218d, yel, turns dark at 200 10						233 br, turns dark at 205	
36	**4-Chloro-1,2,3-trihydroxy-9,10-anthraquinone**	233, yel							Triacetate, 187, yel, Conc H_2SO_4 → red
37	**2-Bromo-9,10-phenanthraquinone**	233 4, red-yel, ac a						*mono* 163 4, or	
38	**1-Bromo-9,10-phenanthraquinone**	233-4, yel						*mono* 213d	
39	**Chrysoquinone** (Chrysenequinone)	239 5, red						*mono* 161, or	Conc H_2SO_4 → bl
40	**1,2,8-Trihydroxy-9,10-anthraquinone** (2-Hydroxychrysazin)	239 40, red, ac a							Triacetate, 224, yel 2-Me eth, 220 or, chl-me al, 2,8-Di-Me eth, 193, br-yel, chl-me al, 1,2,8-Tri-Me eth, 157, yel, me al
41	**1-Amino-9,10-anthraquinone**	251, or-red							N-Acetyl, 218, or-red, N-Benzoyl, 255, grn, N-*p*-Toluenesulfonyl, 228 9
42	**3-Amino-9,10-phenanthraquinone**	254, dk red-br, al						*mono* 247d, red-br	
43	**1,2,4-Trihydroxy-9,10-anthraquinone**	259, dk red, abs al							2-Me eth 232 3, red, bz, 2,4-Di-Me eth 186-9, or, 2-Acetate, 179 80, or, al Triacetate, 198-200 (sinters 193), pa yel
44	**Acenaphthenequinone**	261 (cor), yel, ac a		*mono* 192-3, ac a, *di* 271, al		*mono* 247, or-red, ac a	*mono* 179, or-red, al, *di* 219, dk yel, al	*mono* 230, dil al, 220d	

* Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE XI. ORGANIC DERIVATIVES OF QUINONES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Semi-carbazone	2 4-Dinitro-phenyl hydrazone	*p*-Nitro-phenyl-hydrazone	Phenyl-hydrazone	Oxime	Miscellaneous
45	**1,3-Dihydroxy-4-methyl-9,10-anthraquinone** (4-Methylpur-puroxanthin)	265 6, or , bz							Di-Me eth , 162, yel , chl , Diacetate, 181-2, yel , ac a
46	**2-Bromo-1,4-dihydroxy-9,10-anthraquinone** (2-Bromo-quinizarin)	265 8, br - red							Diacetate, 226-9, yel
47	**3-Bromo-9,10-phenanthraquinone**	268 dk - yel , ac a		*mono* 242d			*mono* 177, red	*mono* 198, *di* 212d , grn	
48	**Aceanthrenequinone** (3,4-Benzacenaphthenequinone)	270, red, bz					*mono* 203, or , bz	*mono* 251d , yel , ac a	subl
49	**1,2,5-Trihydroxy-9,10-anthra-quinone** (Hydroxyanthrarufin)	273 4, red, ac a							2-Me eth , 229, yel , al , 1 2-Di-Me eth , 231, or , al , 1,2,5-Tri-Me eth , 203 4, yel , al , Triacetate, 228 9, yel al
50	**1,5-Dihydroxy-9,10-anthra-quinone** (Anthrarufin)	280 (subl), pa yel	379-81						Diacetate, 245d , pa yel , ac a
51	**Chloranilic acid** (2 5-Dichloro-3,6-dihydroxy-1,4-benzo-quinone)	283 4, red, w (+2H_2O)							Di-Me eth , 141 2, red, Di-Et eth , 107, red, Di-acetate, 182 5, yel
52	**9,10-Anthraquinone**	286	382, 376 8 (cor)					*mono* 224, pa yel , (rapid htng)	Diacetate, 260, col , ac a
53	**Chloranil** (2,3,5,6-Tetrachloro-1,4-benzoquinone)	290, yel , ac a , (slow htng , sealed tube)	subl						SO_2—Tetrachlorohydro-quinone, In w -alkali sol → alkali salts of chloranilic acid
54	**Alizarin** (1,2-Dihydroxy-9,10-anthraquinone)	290, or , al	430						2-Benzoate, 214 6, al , 2-*p*-Bromobenzoate, 195, yel , Diacetate, 184, yel , al , Di-Me eth , 215
55	**2-Amino-9,10-phenanthraquinone**	>300, dk vlt , w , sinters at 205-10							N-Acetyl, 324, dk red-vlt , $PhNO_2$, N-Benzoyl, 297-8, br -red, $PhNO_2$
56	**3-Aminoalizarin** (3-Amino-1,2-dihydroxy-9,10-anthraquinone)	>300, dk red, ac a							N-Acetyl, 238-40, yel -br , Monobenzoyl, 275, dk yel , Dibenzoyl, 252, yel
57	**1,4-Diamino-5,8-dihydroxy-9,10-anthraquinone** (5,8-Diamino-quinizarin)	>300, br - vlt , $PhNO_2$							N,N'-Dibenzoyl, 284-5, br -vlt , xyl , N,N'-Di-phenyl, 258-60, dk bl , bz -lgr , 1,4-Di-Me eth , 250d , vlt -blk , ac a
58	**Dianthraquinone** (9,9'-Di-anthranyl-10,10'-quinone)	>300, yel							Conc H_2SO_4 → vlt -red, CrO_3 → Anthraquinone, Zn dust + ac a → di-anthranol, 230 (enol), 250 (keto)

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XI. ORGANIC DERIVATIVES OF QUINONES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Semi carbazone	2 4-Dinitro-phenyl-hydrazone	*p*-Nitro-phenyl-hydrazone	Phenyl-hydrazone	Oxime	Miscellaneous
59	**2-Amino-9,10-anthraquinone**	306, 303 6, red, al							N-Acetyl, 262, yel , N,N-Diacetyl, 258, yel , ac a N-Benzoyl, 227 8, yel , ac a
60	**2-Hydroxy-9,10-anthraquinone**	305, yel , al	306						Acetate, 159 60, al , Benzoate, 202 4, ac a
61	**1,2,3-Trihydroxy-9,10-anthra-quinone** (Anthragallol)	313 4d , br -or (290, subl)							Triacetate, 181 2, yel , al 188 9, pyr 2,3-Di-*p*-toluenesulfonate 196 8, yel , pyr , Tri-Me eth , 167 9, grn -yel , bz -pet , Triacetate, 181-2, yel , ac a , Tribenzoate, 213 5, pa yel , al bz
62	**1,2,6-Trihydroxy-9,10-anthra-quinone** (Flavopurpurin)	>330, (>160, subl)							2,6-Di-Me eth , 239, yel , 1,2,6-Tri-Me eth , 225-6, yel Diacetate 238 Tri acetate 202 3
63	**1,2,7-Trihydroxy-9,10-anthra-quinone** (Anthrapurpurin)	369, or , al							2-Acetate, 296-8 yel , al , 2,7-Diacetate, 192 3, yel , al -ac a Triacetate, 223, pa yel , ac a Tri-Me eth , 201, yel , al

*Derivative data given in order m p , crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLES XII, XIII AND XIV

The derivatives of three classes of compounds (carboxylic acids, acyl halides and acid anhydrides) are essentially the same as those of carboxylic acids, and are prepared either directly from the acid or *via* the acyl halide All of them appear therefore under the same title

Hydrolysis of acid halide or acid anhydride to the corresponding carboxylic acid

$$RCOCl + H_2O \longrightarrow \underset{\text{Acid}}{RCOOH} + HCl$$

$$(RCO)_2O + H_2O \xrightarrow{NaOH} 2RCOONa \xrightarrow{H^+} \underset{\text{Acid}}{RCOOH}$$

From the acyl halide in water
For directions and examples see Wild, p 180
From the acyl halide with aqueous sodium hydroxide
See Vogel, p 369, Wild, p 180
From the acid anhydride with water
See Vogel, p 376, Wild, p 184, A C D Rivett and N V Sidgwick, *J Chem Soc*, **97**, 1677 (1910)
From the acid anhydride with aqueous sodium hydroxide
See Linstead, pp 16 7 Wild, p 184

Amide *

$$RCOOH \xrightarrow{SOCl_2} \underset{\substack{\text{Acid}\\\text{chloride}}}{RCOCl} \xrightarrow{NH_3} RCONH_2 + NH_4Cl$$

$$RCOOH + NH_3 \longrightarrow RCONH_2$$

$$(RCO)_2O + NH_3 \longrightarrow \underset{\text{Amide}}{RCONH_2}$$

Acid chloride is prepared from the acid and thionyl chloride Amide is formed on addition of aqueous ammonia
For directions and examples see Cheronis, p 440, Shriner, p 200, Vogel, p 361, Wild, p 181
From the acid chloride in benzene with aqueous ammonia
See D Swern, J M Stutzman and E T Roe, *J Amer Chem Soc*, **71**, 3017 (1942)
By passing gaseous ammonia through a benzene or ether solution of the acyl chloride
See Linstead, p 14, Wild, p 182
From the neat acid with gaseous ammonia
See J A Mitchell and E E Reid, *J Amer Chem Soc*, **53**, 1879 (1931)
From the acid anhydride with aqueous ammonia
See Wild, p 184, 185

Anilide *

$$RCOOH \xrightarrow{SOCl_2} RCOCl \xrightarrow{C_6H_5NH_2} RCONHC_6H_5 + C_6H_5NH_3^+Cl^-$$

$$RCOOH + C_6H_5NH_2 \longrightarrow RCONHC_6H_5 + H_2O$$

$$(RCO)_2O + C_6H_5NH_2 \longrightarrow \underset{\text{Anilide}}{RCONHC_6H_5} + C_6H_5NH_3^+RCOO^-$$

From the acid chloride (prepared from the acid and thionyl chloride) and aniline in benzene or in ether
For directions and examples see Cheronis, p 445, Linstead, p 14, Shriner, pp 98, 200–1, Vogel, pp 361, 369, 458, Wild, p 182, P W Robertson, *J Chem Soc*, **115**, 1210 (1919)
From the acid chloride with aniline in aqueous sodium hydroxide
See Wild, pp 181, 219
From the acid and aniline at high temperatures
See Vogel, p 362

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

From the sodium salt of the acid with aniline and concentrated hydrochloric acid
See Shriner, p 201, Wild, p 154
From the acid anhydride with aniline without solvent
See Linstead, p 17, Vogel, p 377, Wild, p 185
From the acid anhydride with aniline in benzene
See Linstead, p 15, Wild, p 185

p-Toluidide *

$$RCOOH \xrightarrow{SOCl_2} RCOCl \xrightarrow{p\text{-}CH_3C_6H_4NH_2} RCONHC_6H_4CH_3\text{-}p + p\text{-}CH_3C_6H_4NH_3^+Cl^-$$

$$RCOOH + p\text{-}CH_3C_6H_4NH_2 \longrightarrow RCONHC_6H_4CH_3\text{-}p + H_2O$$

$$(RCO)_2O + p\text{-}CH_3C_6H_4NH_2 \longrightarrow RCONHC_6H_4CH_3\text{-}p + p\text{-}CH_3C_6H_4NH_3^+RCOO^-$$

From the acid chloride with *p*-toluidine in ether or benzene
For directions and examples see Cheronis, pp 441, 444, 458, Linstead, p 14, Shriner, pp 200-1, Vogel, p 361
From the acid and *p*-toluidine at high temperatures
See Cheronis, pp 441, 442-3, Vogel, p 362
From the sodium salt of the acid, *p*-toluidine and concentrated hydrochloric acid
See Shriner, p 201, Wild, p 154
From the acid anhydride with *p*-toluidine without solvent
See Cheronis, p 459, Linstead, p 17
From the acid anhydride with *p*-toluidine in benzene
See Wild, p 185

1- and 2-Naphthylamide *

$$RCOOH \xrightarrow{SOCl_2} RCOCl \xrightarrow{1\text{- or }2\ C_{10}H_7NH_2} \underset{\text{Naphthylamide (1 or 2-)}}{RCONHC_{10}H_7} + C_{10}H_7NH_3^+Cl^-$$

From the acid chloride with the naphthylamine
For directions and examples see Cheronis, p 446, P W Robertson, *J Chem Soc*, **115**, 1210 (1919)

p-Nitrobenzyl ester *

$$RCOONa + p\text{-}NO_2C_6H_4CH_2X \rightarrow \underset{p\text{-Nitrobenzyl ester}}{RCOOCH_2C_6H_4NO_2\text{-}p} + NaX \quad (X = Cl, Br, I)$$

From an aqueous solution of the sodium salt of the acid, with the *p*-nitrobenzyl halide in ethanol
For directions and examples see Cheronis, pp 447, 448, Shriner, p 200, Vogel, p 362, Wild, pp 144 5
From an aqueous solution of the sodium salt of the acid with *p*-nitrobenzyl bromide in acetone
See F F Blicke and F D Smith, *J Amer Chem Soc*, **51**, 1947 (1929)
From the sodium or the potassium salt of the acid and *p*-nitrobenzyl bromide in 1 2 water-ethanol
See E E Reid, *J Amer Chem Soc*, **39**, 124 (1917)
From the sodium or the potassium salt of the acid and *p*-nitrobenzyl chloride or iodide in 1 2 water-ethanol
See J A Lyman and E E Reid, *J Amer Chem Soc*, **39**, 701 (1917)

p-Bromophenacyl ester *

$$RCOONa + \underset{\text{bromide}}{\underset{p\text{-Bromophenacyl}}{p\text{-}BrC_6H_4COCH_2Br}} \longrightarrow RCOOCH_2COC_6H_4Br\text{-}p + NaCl$$

$$RCOOH + \underset{\text{phenone}}{\underset{p\text{ Bromodiazoaceto-}}{p\text{-}BrC_6H_4\,COCHN_2}} \xrightarrow{CuCl_2} \underset{p\text{-Bromophenacyl ester}}{RCOOCH_2COC_6H_4Br\text{-}p} + N_2$$

From the sodium salt of the acid and *p*-bromophenacyl bromide in aqueous ethanol

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

For directions and examples see Cheronis, pp 447, 448, Linstead, p 14, Shriner, p 200, Vogel, p 362, Wild, p 146

From the sodium salt of the acid (neutralization with sodium carbonate) with *p*-bromophenacyl halide in 1 2 water-ethanol

See W L Judefind and E E Reid, *J Amer Chem Soc*, **41**, 1043 (1920)

From the sodium salt of the acid (neutralization with sodium hydroxide) with *p*-bromophenacyl bromide in 95% ethanol

See R M Hann, E E Reid and G S Jamieson, *J Amer Chem Soc*, **52**, 818 (1930), C G Moses and E E Reid, *J Amer Chem Soc*, **54**, 2101 (1930)

From the acid and *p*-bromodiazoacetophenone in dioxane in the presence of catalytic amounts of cupric chloride

See J L E Erickson, J M Dechary and M R Kesling, *J Amer Chem Soc*, **73**, 5301 (1951)

p-Phenylphenacyl ester *

$$RCOONa + \underset{\text{p Phenylphenacyl bromide}}{p\text{-}C_6H_5C_6H_4COCH_2Br} \longrightarrow RCOOCH_2COC_6H_4C_6H_5\text{-}p + NaBr$$

$$RCOOH + \underset{\substack{\text{p Phenyldiazoaceto}\\\text{phenone}}}{p\text{-}C_6H_5C_6H_4COCHN_2} \xrightarrow{CuCl_2} \underset{\text{p Phenylphenacyl ester}}{RCOOCH_2COC_6H_4C_6H_5\text{-}p} + N_2$$

From the sodium salt of the acid (neutralization with sodium carbonate) and *p*-phenylphenacyl bromide in aqueous alcohol

For directions and examples see Linstead, p 14, Vogel, p 363, N L Drake and J Bronitsky, *J Amer Chem Soc*, **52**, 3715 (1930)

From the sodium salt of the acid (neutralization with sodium hydroxide) and *p*-phenylphenacyl bromide in aqueous alcohol

See Shriner, p 200, N L Drake and J P Sweeney, *J Amer Chem Soc*, **54**, 2059 (1932)

For dibasic acids from the acid, ethylamine and *p*-phenylphenacyl bromide in aqueous ethanol

See Wild, p 147, N L Drake and J P Sweeney, *J Amer Chem Soc*, **54**, 2059 (1932)

From the acid and *p*-phenyldiazoacetophenone in dioxane in the presence of catalytic amounts of cupric chloride

See J L E Erickson, J M Dechary and M R Kesling, *J Amer Chem Soc*, **73**, 5301 (1951)

Methyl ester

$$RCOOH + CH_3OH \xrightarrow{H_2SO_4} RCOOCH_3 + H_2O$$

$$RCOOH + CH_2N_2 \longrightarrow \underset{\text{Methyl ester}}{RCOOCH_3} + N_2$$

From the acid with methanol and a catalytic amount of sulfuric acid

For directions and examples see Linstead, p 16, Vogel, p 383

From the acid and diazomethane in ether

See B Eistert, in *Newer Methods of Preparative Organic Chemistry*, Interscience, New York, 1948, p 513

Ethyl ester

$$RCOOH + C_2H_5OH \longrightarrow RCOOC_2H_5 + H_2O$$

$$RCOOAg + C_2H_5I \longrightarrow RCOOC_2H_5 + AgI$$

$$RCOOH \xrightarrow{SOCl_2} RCOCl \xrightarrow{C_2H_5OH} \underset{\text{Ethyl ester}}{RCOOC_2H_5} + HCl$$

From the acid and ethanol in the presence of a catalytic amount of sulfuric acid

For directions and examples see Vogel, pp 383, 385, 386, 387

From the silver salt of the acid with ethyl iodide

See Vogel, p 388

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

From the acid chloride and ethanol.

See: Vogel, p. 389.

NOTE: The same methods can be used for the formation of other esters.

*S-Benzylthiuronium salt.**

$$\underset{}{RCOONa} + \underset{\text{S-Benzylthiuronium chloride}}{[C_6H_5CH_2SC(NH_2)_2]^+Cl^-} \rightarrow \underset{\text{S-Benzylthiuronium salt}}{[C_6H_5CH_2SC(NH_2)_2]^+RCOO^-} + NaCl$$

From the sodium or the potassium salt of the acid and S-benzylthiuronium chloride in water.

For directions and examples see: Linstead, p. 15; Vogel, p. 36; Wild, p. 149; S. Veibel and H. Lillelund, *Bull. Soc. Chim.* [5], **5**, 1153 (1938), S. Veibel and K. Ottung, *Bull. Soc. Chim.* **6**, 1434 (1939).

From the sodium or the potassium salt of the acid in water or in aqueous ethanol with an ethanolic solution of S-benzylthiuronium chloride.

See: Cheronis, p. 449; Shriner, p. 202; J. J. Donleavy, *J. Amer. Chem. Soc.*, **58**, 1004 (1936).

Phenylhydrazide.

$$RCOOH + H_2NNHC_6H_5 \rightarrow \underset{\text{Phenylhydrazide}}{RCONHNHC_6H_5} + H_2O$$

From the acid with phenylhydrazine without solvent.

For directions and examples see: Shriner, p. 201; Wild, p. 152; G. H. Stempel and G. S. Schaffel, *J. Amer. Chem. Soc.*, **64**, 470 (1942).

From the acid with phenylhydrazine in benzene.

See: Shriner, p. 201; Wild, p. 152.

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	*p*-Toluidide	Anilide	*p*-Bromophenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
1	**Thioacetic acid**	93			$1\ 074_4^{10}$	130	76		108			
2	**Formic acid**	100 7	8 4	1 37137	1 22026	53	50	140 135				*p* Nitrobenzyl ester, 31
3	**Acetic acid** (Ethanoic acid)	118 2	16 6	1 36976 1 3721	1 04926	153 147	114	86 0	82			*p*-Nitrobenzyl ester, 78
4	**Difluoroacetic acid**	134 5							52			
5	**Acrylic acid**	141, 140	13	1 4224	$1\ 0621_4^{16}$	141	104 5, w		84-5, pet eth			
6	**Propionic acid** (Propanoic acid)	141	−20 8	1 3868	0 99336	126, 123	106	63 4	81			*p*-Nitrobenzyl ester 31
7	**Propiolic acid**	144d	18		$1\ 1391_4^{15}$		87		61 2			
8	**Isobutyric acid** (Isobutanoic acid)	154 7	−46 1	1 3920	0 94791	108 5 9 5	105	76 8	128 129			
9	**Methacrylic acid**	161	16	1 429	1 015				102 6			*p*-Bromoanilide, 116
10	***n*-Butyric acid** (*n*-Butanoic acid)	162 5 164	−5 5 −8	1 3983 1 3979	0 95790	75	96 97	63	115 6			*p* Nitrobenzyl ester, 35
11	**Pyruvic acid** (α-Oxopropionic acid)	165d 80^{23}	13 6	1 4138	$1\ 2668_4^{15}$	109 130	104, subl		124 5, 145			2,4-Dinitrophenylhydrazone 218, yel, al
12	**Vinylacetic acid** (3-Butenoic acid)	169 163	−35	1 4221	1 0094		58		73			
13	**Isocrotonic acid** (*cis*-(β)-Crotonic acid *cis*-2-Butenoic acid)	169	15	1 4456	1 0265	132	101 2	81	101 2			
14	***d l*-2-Methylbutanoic acid** (Ethylmethylacetic acid)	176 7 174		1 4052	$0\ 938_{20}^{20}$	92 5 3 0	110	55	112			
15	**Isovaleric acid** (3-Methylbutanoic acid)	176 5	−30 0	1 4043	0 92623	106 7	109 5 (cor)	68 0	135 137			
16	***n*-Amylpropiolic acid** (1-Heptyne-1-carboxylic acid)	180 220d	f p 2 5			68, bz			91			Nitrile, b p 194 6 *o*-Toluidide, 60, pet eth
17	**3,3-Dimethylbutanoic acid** (*tert*-Butylacetic acid)	184, 96^{26}	6 7	1 4096	0 9124	134	132, et ac - pet eth		132	b p 126		
18	***d l*-α-Chloropropionic acid**	186				124	92		80			
19	**Cyclopropanecarboxylic acid**	186, 182 4	17, 18-9	1 43901	1 0885				125		b p 134, n_D^{20} 1 41902, D_4^{15} 0 96078	
20	***n*-Pentanoic acid** (*n*-Valeric acid)	186 4	−34 5	1 4086	0 93922	74	63	75	106			
21	**2,2-Dimethylbutanoic acid** (Dimethylethylacetic acid)	187, 190	−15 0	1 4141, 1 4145	0 9276	83 0 5	92, 90-1		103			*p*-Phenylphenacyl ester, 86
22	**Allylacetic acid** (4-Pentenoic acid)	188 9		1 4341 1 4283	$0\ 9843_4^{18}$				94, b p 230		b p 144 6	
23	**Cyclopropylacetic acid**	190^{750}		$1\ 4320^{25}$								*p*-Phenylphenacyl ester, 83
24	***d l*-2,3-Dimethylbutanoic acid** (Isopropylmethylacetic acid)	191 7	−1 5	1 4146	0 9275	112 6	78 4		132			*p*-Phenylphenacyl ester, 74
25	**Dichloroacetic acid**	194	5-6	1 4659	1 5634	153	118	99	98, subl			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	*p*-Toluidide	Anilide	*p*-Bromophenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
26	**Cyclobutanecarboxylic acid**	195	1 4403[25]	1 0599					152 3	b p 136 0 – 5	b p 159 62	
27	**2-Ethylbutanoic acid** (Diethylacetic acid)	195	–31 8	1 4132	0 9239	116 2	127 5		112 107			
28	***d l*-2-Methylpentanoic acid** (Methyl-*n*-propylacetic acid)	195 6		1 4136	0 9230	81	95		79 6			
29	***d,l*-3-Methylpentanoic acid**	197 5	–41 6	1 4159	0 9262	74 8	87, 88		124 9			
30	**4-Methylpentanoic acid** (Isocaproic acid, Isobutylacetic acid)	199 1[752]	–33	1 4144	0 9225	63 0	112 0, 110 5 111 5	77 3	120 1			
31	**Methoxyacetic acid** (Glycolic acid methyl ether)	204, 203		1 41677	1 1768		58, pet eth		96 5 7 0, 92–4			
32	**2-Ethyl-2-methylbutanoic acid** (Diethylmethylacetic acid)	204		1 4256					78			
33	**Hexanoic acid** (*n*-Caproic acid)	205 35	–3 9, f p –1 5– –2	1 41635	0 93568	74 5	94 5	72 0	100, 101		b p 166–7	
34	**Ethoxyacetic acid** (Glycolic acid ethyl ether)	206 7		1 41937	1 1021	32, eth	95 92	104 8	80–2			
35	**5-Methylhexanoic acid**	207[752]		1 4220			75		103			
36	**2-Ethylpentanoic acid** (Ethyl-*n*-propylacetic acid)	209				129	94		104 5			
37	**2-Methylhexanoic acid** (*n*-Butylmethylacetic acid)	209 6		1 4189[25]		85	98		73 70–2 5			
38	**α-Chloroisovaleric acid**	20–2									b p 178 9	Nitrile b p 154 5 Chloride, b p 149
39	**α-Bromobutanoic acid**	217d				92	98		112, 108			
40	**4-Methylhexanoic acid**	217 8[754]		1 4211	0 9194		76 5		98			
41	**2,2-Dimethylhexanoic acid**	218							89			
42	**4-Ethyl-4-methylbutanoic acid** (*active*-Amylacetic acid)	221			0 9149					b p 158 64	b p 173 9	$[\alpha]_D^5$ +7 6 in me al
43	**2-Chloro-*n*-valeric acid** (2-Chloropentanoic acid)	222								b p 160	b p 185–6	Nitrile, b p 160
44	***n*-Heptanoic acid** (*n*-Heptoic acid)	223 0	–7 46	1 4234	0 91808	81	70, 65	72 0	96, 96 5			
45	**2-Ethylhexanoic acid** (α-Ethylcaproic acid)	228							102			*p*-Phenylphenacyl ester, 53 4, 49 5 50
46	**Cyclohexylacetic acid**	237							172			
47	***n*-Caprylic acid** (*n*-Octanoic acid)	237, 239 3	16 3	1 4268	0 90884	70	57	67 4	110, 106		b p 207 8[754]	
48	**Pelargonic acid** (*n*-Nonanoic acid)	254 4	12 3	1 43446[15] He, yel	0 90552	84	57	68 5	99			
49	***d*-Citronellic acid** (2,6-Dimethyl-1-octene-8-carboxylic acid)	257			0 9308				84 5		b p 113 5[12], $[\alpha]_D^{26}$ +0 3	$[\alpha]_D$ +21, Nitrile, b p 230, D^{20} 0 8645
50	**2-Phenylpropionic acid**	265							92			
51	**4-Acetylbutanoic acid** (γ-Acetobutyric acid)	275d, 195–200[65]	13–4			123, w			114, chl			Semicarbazone 175d (+1 H_2O), w, Oxime, 104 5 bz

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

a) Liquids 2) (Reduced pressure b.p. only) (Listed in order of increasing amide m.p.)*

No	Name	Amide	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	*p*-Toluidide	Anilide	*p*-Bromophenacyl ester	Methyl ester	Ethyl ester	Miscellaneous
1	**3-Ethoxypropionic acid**	51	120[17]		1 4216							
2	**3-Heptynoic acid**	67	102[2]	14	1 4635[25]							
3	**2-Heptynoic acid**	68 9, al	135[20]		1 4619	0 978				b p 91-3[19], n_D^{20} 1 4455, D_4^{20} 0 937		
4	*trans*-**Oleic acid**	75-6	216[5], 250 (superheated steam)	*α* 13 36, *β* 16 25	1 4597		42 5	41	40, 46			
5	**2-Fluoropropionic acid**	76	60[8]									
6	**2-Azidoisovaleric acid** (2-Triazoisovaleric acid)	78 9, bz	82[0 1]			$1\ 0638_{33}^{33}$					b p 82[16], D_{20}^{20} 1 0295	
7	***d,l*-Lactic acid**	78 5 9 0 (cor), bz -al (3 1)	122[15]	18			107	58 5-9 0, w	112 8	144 8	154	
8	***d l*-2-Azidopropionic acid** (*d,l*-2-Triazopropionic acid)	80, bz	121 5[20]								b p 70[16] n_D^{25} 1 428 57, D_{23}^{23} 1 065	Explodes on heating
9	**2-Ethyl-3-Hexenoic acid**	80	132[19]									
10	**4-Phenoxybutanoic acid**	80	197[18]									
11	**2-Methoxypropionic acid**	81	89[10]									
12	***l*-Citronellic acid** (2,6-Dimethyl-1-octen-8-carboxylic acid)	84-5	117 9[0 6]		1 4563[24]	$0\ 9274_{25}^{25}$	93-4	76		b p 86[1 1]		$[\alpha]_D^{24}$ -6 6
13	**2-Ethyl-4-methylpentanoic acid** (Ethylisobutylacetic acid)	89	115[20]									
14	**2-Octynoic acid**	90	133[10]		1 4595			60				
15	**6-Methyloctanoic acid**	91	149[23]		1 4337							
17	**3-Methylhexanoic acid**	98	112[16]		1 4222							
18	**2,3-Dimethylpentanoic acid**	102	92[15]									
19	**2-Cyanopropionic acid**	105, 81	142-5[11]								b p 192-3	
20	**7-Methyloctanoic acid**	106	105[2]									
21	**1-Chlorocyclohexane carboxylic acid**	110, me al -w	138-40[13]									Ethylamide, 53
22	**2-Cyanobutanoic acid**	113	153-5[15]								b p 207-9	
23	**Methylneopentylacetic acid**	123	108[14]									
24	**2-Isopropylbutanoic acid** (2-Ethyl-3-methylbutanoic acid)	135	105[15]									
25	**5-Cyclopentylpentanoic acid**	136	123[4 5]									
26	**2-Methylcyclopentanecarboxylic acid**	148	107[9]		1 4504[22]							
27	**3,4,4-Trimethylpentanoic acid**	167	98[4]		1 4320[21]							
28	*cis*-**4-Methylcyclohexanecarboxylic acid**	175	130[13]									
29	**Cyclopentanecarboxylic acid**	179	123[27]									

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point °C	*p*-Toluidide	Anilide	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
1	**β-Bromobutyric acid** (β-Bromobutanoic acid)	20	122[16]					92 3		b p 183 4	
2	***trans*-β-Ethyl-α-methylacrylic acid**	24	112[12] *cis* 94[10]				91, *cis* 46	80			n_D^{20} 1 4578 *cis* n_D^{25} 1 4485
3	***d l*-α-Azidobutyric acid** (*d l*-α-Triazobutyric acid)	24	81[0 2]					38 9, bz - pet eth		b p 64[7], D_{20}^{20} 1 038	
4	**Undecylenic acid** (10-Undecen-1-oic acid 10-Hendecen-1-oic acid)	24 5	275					87			Cu salt, 232-4, Pb salt, 80
5	**2-Ethoxybenzoic acid** (Salicylic acid ethyl ether)	24 5 5 5	300d					132			
6	***d l*-α-Bromopropionic acid**	25 7	203 5	125	99, 100			123	b p 145-50	b p 159-60d	
7	***n*-Undecylic acid** (*n*-Undecanoic acid, *n*-Hendecanoic acid)	28 5, α 13 4, β 16 3	280, 284	80	71		68 2	103			
8	**α-Chloroisobutyric acid** (α-Chloroisobutanoic acid)	31	118[50]		69 70, al				b p 133 5	b p 148 9	
9	**α-Azidoisobutyric acid** (α-Azidoisobutanoic acid α-Triazoisobutyric acid)	31	75[0 2]					93-4		b p 71[16], D_{20}^{20} 1 0344	D_{33}^{33} 1 1433
10	**Cyclohexanecarboxylic acid** (Hexahydrobenzoic acid)	31, 30 1	233		146 (cor)			185 6			
11	**α-Ketobutyric acid** (2 Oxobutanoic acid)	31	78[25]					117			n_D^{20} 1 3975, *p*-Nitrophenylhydrazone, 194
12	**Fluoroacetic acid**	31-2	167-9					108			
13	**Capric acid** (*n*-Decanoic acid)	31 5	268 70	78	70		67, al , 66	108, 100 1, 98, 99	b p 224	b p 243-5	n_D^{40} 1 42855
14	**Bromochloroacetic acid**	31 5	215 sl d					126, 117		b p 174d	Phenyl ester, 46 5, b p 266
15	**2-Hexenoic acid**	32	-		110						
16	***n*-Butylmethylglycolic acid**	33						58			
17	***cis*-13-Docosenoic acid** (Erucic acid)	33-4	264[15]	75-8	55		62 5, 61 0	84			D 0 860[55]
18	**Levulinic acid** (γ-Ketovaleric acid, β-Acetylpropionic acid)	33-5 deliq	245-6	108 9, w	102, w	61	84	107-8d			Oxime, 96
19	**Pivalic acid** (Trimethylacetic acid)	35 5	163-4	119-20	132-3, 128 (cor)		75 6	155 7, 153-4, et ac -pet eth			
20	***d,l*-α-Methylhydrocinnamic acid** (α-Benzylpropionic acid)	36 5	272	130, *d* 115-6				107 8, *d* 113-4			
21	**1-Cyclohexenylcarboxylic acid**	38	107[3]					128			
22	***n*-Hexylmethylglycolic acid**	40						59			
23	**5-Acetyl-*n*-valeric acid** (δ-Acetylpentanoic acid)	40 2, 31-2	250 3[280]								Semicarbazone, 144-6, ac a
24	***d, l*-α-Campholytic acid** (1,5,5-Trimethylcyclopenten-4-carboxylic acid)	40 5	162-5[45], *l* 240-3					103, w	b p 200		Nitrile, b p 200-5
25	**β-Chloropropionic acid**	41, w , 39, lgr	204						b p 155-7, D^0 1 198	b p 162, D_4^{20} 1 1086, n_D^{20} 1 42537	Nitrile, b p 175-6, $D^{18\,5}$ 1 1443
26	***d,l*-α-Ethylphenylacetic acid** (*d,l*-α-Phenylbutanoic acid)	42	270					85-7, 83			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point °C	*p* Toluidide	Anilide	*p* Nitro benzyl ester	*p*-Bromo phenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
27	**α-Ethylpimelic acid**	43	223[17]		145						
28	**Tridecylic acid** (*n*-Tridecanoic acid)	43, 41 6	312, 177[10]	88	80		75 0	100			
29	**Lauric acid** (*n*-Dodecanoic acid)	44, 42	299	87	78		76	100, 99			
30	***d,l*-α-Bromoisovaleric acid**	44	230d	124	116			133, bz	b p 174	b p 186	
31	**Elaidic acid** (*trans*-Oleic acid)	44 5, 51	234[15]				65	93-4, 89 90			*p*-Phenylphenacyl ester, 73 5, *p*-Chlorophenacyl ester, 56
32	**4-Cyanobutanoic acid** (γ-Cyanobutyric acid)	45						69 70, sealed tube		b p 245	
33	**Dimethylneopentylacetic acid**	45	230[732]					71			
34	***trans*-2-Methyl-2-butenoic acid** (Angelic acid)	45 6	185 (cor)		126, bz			127-8			Isobutyl ester, b p 177 2-Naphthylamide, 135, bz , Heating 2 hours in sealed tube → tiglic acid, 64-5
35	**Dibromoacetic acid**	48	232-5					156			
36	**α-Bromoisobutyric acid** (α-Bromoisobutanoic acid)	48 9	198 200	92 5, al	83, al -w			148			*o*-Toluidide, 63
37	***tert*-Butylpropiolic acid**	48-9	110[10]						b p 66[13], D^0 0 9209	b p 75[15], D^0 0 9209	
38	**Hydrocinnamic acid** (β-Phenylpropionic acid)	48 7, 40	279-80 (cor)	135	98, 96	36 3	104	105, 82			*p*-Phenylphenacyl ester, 95
39	**β-Cyanopropionic acid**	48-50						97, sealed tube	b p 215, n_D^{20} 1 42427, D^{20} 1 0792	b p 220[754] D^{20} 1 0353	..
40	**Benzylpyruvic acid**	49 50 (+½ H_2O), w						180			Semicarbazone, 175d , Oxime, 65, Phenylhydrazone, 144-5
41	**Bromoacetic acid**	50	208		131	88		91	b p 144d	b p 168-9	
42	**2-Pentynoic acid** (Ethylpropiolic acid)	50	100[10]					146			
43	**γ-Phenylbutyric acid**	52	290					84			
44	***n*-Pentadecylic acid** (*n*-Pentadecanoic acid)	52 3	212[16]		78	39 5-40 (cor)	77 2	102 5			
45	**β-Campholenic acid**	53 5	245					86		222 5	Nitrile, 225, D^{20} 0 9093
46	**Myristic acid** (Tetradecanoic acid)	53 9	202[16]	93	84		81	103			
47	**Trichloroacetic acid**	57 8	197 5	113	97, 94	80		141	b p 153 8	b p 168	Phenylhydrazide, 123
48	**α-Acetoxypropionic acid** (O-Acetyllactic acid)	57 60, 39-40	167-70[78]								Nitrile, b p 172-3
49	**β-Acetylglutaric acid**	58						*mono* 141-2, al -eth	89		
50	***sec*-*n*-Amylmalonic acid** (2-Ethylbutane-1,1-dicarboxylic acid, *sec*-*n*-Pentylmalonic acid)	58, bz			*di* 219-20					*di* b p 243 5	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	*p*-Toluidide	Anilide	*p* Nitrobenzyl ester	*p*-Bromophenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
51	*trans*-**Brassidic acid**	59 7	256[10]		78		94 2	94			
52	**5-Phenylpentanoic acid**	60			90			109			
53	**β-Cyclohexylacrylic acid**	60	154[11]					159			
54	**β-Chloroisocrotonic acid**	61	195 (subl)		108			110	b p 142	b p 161	
55	**Margaric acid** (*n*-Heptadecanoic acid)	61 2	231[16]			48 5 9 0 (cor)	82 6	108, 106			
56	**Chloroacetic acid**	α 61 3, β 56 2 γ 52 5	189	162	136 7		104	121	b p 130	b p 145 6	
57	**β-Bromopropionic acid**	62 5						111	b p 80[27], D[17] 1 4897	b p 70[12], D[15] 1 2609	2-Naphthylamide, 174
58	**Palmitic acid** (Hexadecanoic acid)	62 7	222[16]	98	90 6, al	42 5	86, 82	106 7, 105 3, al			
59	*cis*-**2-Methyl-2-butenoic acid** (Tiglic acid)	64 5 5 0	198 5 (cor)	70 0 1 5	77, pet eth	64	68	75 6, bz			
60	**Cyanoacetic acid**	66			198-9			119-20	b p 200	b p 207	Nitrile, 29-30, b p 218 9
61	**Benzoylformic acid**	66						91			Nitrile, 32-3, b p 206-8, 2,4-Dinitrophenylhydrazone, 196-7d (cor), Phenylhydrazone, 64
62	**Acetoxyacetic acid**	66-8, bz	145[12]		89-90, w					b p 179, D[17] 1 0993	
63	**2,3-Dibromopropionic acid**	67, stab , 51, unst	160[20]					130			
64	**3,3-Dimethylacrylic acid**	67	106[20]					108			
65	**2-Furylacetic acid**	67			85						
66	**3,3,4,4-Tetramethylpentanoic acid**	67						138			
67	**4-Ketocyclohexanecarboxylic acid** (4-Oxocyclohexanecarboxylic acid)	67-8, bz - pet eth							b p 140[20]	b p 158[40]	Semicarbazone, 200d , Oxime, 147, eth
68	*d,l*-**2-Phenyllactic acid**	68 (+½ H_2O), w 94 (anh), *d* 116-7, w , *l* 115 6, bz						101 2, dichloroethylene, *l* 62 5 3 5, bz			*d,l*-Et eth , 60-2, lgr , *d*-Quinine salt, 216d , al , *l*-l-Menthyl ester, 55 5-6 0
69	*d*-**Chaulmoogric acid** (*d*-ω-Cyclopentyltridecanoic acid)	68 5	247-8[20]	100	89			106, al	22	b p 230[20], D_4^{15} 0 9064	$[\alpha]_D$ +62 in chl
70	**Stearic acid** (Octadecanoic acid)	70-1, 69 6		102	95 5, al		92	109, 108 4, al			
71	*trans*-**Crotonic acid** (*trans*-2-Butenoic acid)	72, w	189 (cor)	132, bz	118, w , 115	67 4	95 6	159-60, bz	b p 121	b p 138, D_4^{20} 0 9175, n_D^{20} 1 42524	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	*p*-Toluidide	Anilide	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
72	**γ-Bromocrotonic acid**	74, lgr						101	b p 87[15], D_4^{19} 1 490 n_D^{19} 1 498	b p 97-8[15], D_4^{16} 1 402, n_D^{19} 1 490	
73	**Caproylacetic acid**	74d						100	b p 118[19], D_4^0 0 9916	b p 127[19], D^0 0 9721	Nitrile, b p 127-8[14], D^{15} 0 9914
74	**3-Ketocyclohexanecarboxylic acid** (3-Oxocyclohexane-carboxylic acid)	75 6, bz	195-7[20]							b p 138[18]	Semicarbazone, 183-4, al, Oxime, 170d, w, Phenylhydrazone, 125, yel
75	**2-Thienylacetic acid**	76						148			
76	***sec*-Butylmalonic acid** (Isopentane-1,1-dicarboxylic acid)	76						*di* 242	*di* b p 217 8[748]	*di* b p 245-50[762]	
77	**Phenylacetic acid**	76 5, subl	256 5 (cor)	135-6	117-8	65	89	156			
78	**Eicosanoic acid** (Arachidic acid)	77, 75	204[1]	96	92		89	108 9			
79	**Glycolic acid** (Hydroxyacetic acid)	78 9, 80		143, w	97, w	106 8	138	120, al - et ac			On prolonged heating at 100° → anh, 128 30
80	**α-Hydroxyisobutyric acid** (2-Hydroxyisobutanoic acid Dimethylglycolic acid)	79	212	132-3, w	136, w	80 5	98, acet				
81	**α-Methylcinnamic acid**	81, 74						128			
82	**2-Ketocyclohexanecarboxylic acid** (2-Oxocyclohexane-carboxylic acid)	81-2, eth								b p 107-8[12], 159-60[100]	Alcoholic sol + $FeCl_3$ → blue color
83	***n*-Docosanoic acid** (Behenic acid)	81-2			101 2			111	54	50	
84	**β-Iodopropionic acid**	82, 85						101 142			
85	**α-Benzoylpropionic acid**	82-3, bz - pet eth			137-8, al			145-6			Phenylhydrazone, 100 4, br, bz
86	**Iodoacetic acid**	83						95			
87	**γ-Chlorocrotonic acid**	83	117 8[13]					130-2, w		b p 191-3[750]	Nitrile, b p 73[15], D^0 1 1495
88	**Lignoceric acid** (Tetracosanoic acid)	84					91				*p*-Chlorophenacyl ester, 100
89	**β-Methyladipic acid**	85, 91	223[18]		200						
90	**α-Benzoylbutyric acid** (α-Benzoylbutanoic acid)	85-7						148-9		b p 168-71[19]	Nitrile, b p 134-5[3]
91	***d,l*-α-Bromophenylacetic acid**	86, 84						148, 144			Nitrile, 29, b p 242d
92	**(4-Methoxyphenyl)acetic acid**	87, 84						189			
93	**Dineopentylacetic acid**	88						140			
94	**Dibenzylacetic acid**	89		175, abs al	155, abs al			128-9, bz			
95	**(2-Tolyl)acetic acid**	90, 88						161			
96	**α-Thienylglyoxylic acid**	91						88			
97	**Δ[5]-Campholytic acid** (4,5,5-Trimethylcyclopentene-1-carboxylic acid)	91						90, lgr			
98	**Citraconic acid** (Methylmaleic acid)	92d, 92-3, 91d, eth -lgr		*mono* 170-1, yel, eth	*mono* 153, *di* 175 5, al	*di* 70 6		*di* 185-7d	*di* b p 210-1	*di* b p 231	

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	*p*-Toluidide	Anilide	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
99	**2-Bromobenzoylformic acid**	93-101						136-7, w			Nitrile, 62-4, yel, Oxime, 162-4d
100	**β-Chlorocrotonic acid**	94	206-11 sl d		123-4			100 1	b p 64 7^{14}, D_4^{22} 1 555, n_D^{20} 1 463	b p 180, 184, D_4^{20} 1 1062, n_D^{20} 1 459	1-Naphthylamide, 169-70
101	**Phenyl-*n*-propylglycolic acid**	94						132			
102	**(2-Chlorophenyl)acetic acid**	95, w		170	138 5			175, w			Nitrile, 25, b p 251, *o*-Toluidide, 174
103	**(4-Tolyl)acetic acid**	95, 91	159^{15}					185			
104	***o*-Chlorohydrocinnamic acid**	96 5, w						119, bz	b p 255		Nitrile, b p 267-8
105	**2-Hydroxy-3-phenylpropionic acid**	97, 96						112			
106	**1,2,3,4-Tetrahydro-2-naphthoic acid**	97						139			
107	**Glutaric acid** (1,3-Propanedicarboxylic acid)	98	302 4	*dl* 218	*dl* 223 4	*dl* 69	*dl* 136 8	*dl* 175-6			
108	**3-Phenoxypropionic acid**	98						119			
109	**α-Crotonic acid**	99	212					112	161	176	Nitrile, b p 136
110	**Phenoxyacetic acid**	98-9, 99 100	285d		99, al		148 5	101 5			
111	**2-Benzofurylacetic acid**	99						164			
112	**1-Naphthylglycolic acid**	99 124-5						135			
113	**Citric acid**	100 (+1 H_2O), 153 (anh)		*tri* 189, al	*tri* 192	*tri* 102	*tri* 148	*tri* 210-5d, w			
114	**2-Methoxybenzoic acid** (*o*-Anisic acid Salicylic acid methyl ether)	100 1	200				113	129			
115	***l*-Malic acid** (Hydroxysuccinic acid)	100-1		*dl* 206-7	*dl* 197	*mono* 87 2, *dl* 124 5	*dl* 179	*dl* 156-7, *d,l* 162 3			
116	**Oxalic acid**	101 (+2 H_2O) (rapid htng), 189 5 (anh) subl at 150-60		*mono* 169, *dl* 268	*mono* 148 9, *dl* 254, 246, bz	*dl* 204		*mono* 219, *dl* 419d			
117	**Acetylpyruvic acid** (2,4-Diketo-*n*-valeric acid, 2,4-Dioxopentanoic acid)	101, bz						131-2d, al	63-4		
118	***n*-Butylmalonic acid** (Pentane-1,1-dicarboxylic acid)	101			*dl* 193			*dl* 200		*dl* b p 235-40	Mononitrile, 122 5-6 5, w, subl
119	**α-Cyanohydrocinnamic acid** (Benzylcyanoacetic acid)	101-2						130		b p $176-85^{21}$	
120	**2-Chloro-6-methylbenzoic acid**	102, w						167			Nitrile, 82-3, pet eth
121	**Aleuritic acid** (9,10,16-Trihydroxypalmitic acid)	102, w							63-4		Hydrazide, 139-40, Azide, 50d, al

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	*p*-Toluidide	Anilide	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
122	**(2-Bromophenyl)acetic acid**	103 4, 109						186 7			Nitrile, b p 145 7^{14}
123	**Benzylacetic acid**	103 4d			107 8			113			Nitrile, 80 1, 1-Menthyl ester, 41
124	**Pimelic acid**	104–5, subl	223^{15}	*di* 206, al	*mono* 108 9 *di* 155 6, me al -w		*di* 136 6	*di* 175			
125	**2-Toluic acid** (2-Methylbenzoic acid)	104 5, 107 8	259^{751}	144	125	90 7	57	142 8 (cor)			
126	**Allylmalonic acid**	105, eth				46, al				*di* b p 222-3	Mononitrile, b p 223, Dinitrile, b p 217 8
127	**(4-Chlorophenyl)acetic acid**	105–6, 104		190	164 5, al			175, al		32, b p 260	*o*-Toluidide, 190, bz Nitrile, 30, b p 265–7
128	**Δ^2-Cyclogeranic acid** (1,5,5-Trimethylcyclohexene-6-carboxylic acid)	106, lgr	138^{11}					120 1, bz - pet eth		b p 101 2^{10}	
129	***d*-Campholic acid** (*d*-1,2,2,3-Tetramethylcyclopentane-1-carboxylic acid)	106, *d l* 109	255		91			80, *d l* 90	b p 208	b p 220	Nitrile, 73, Anhydride, 56, *d l* 66
130	**Atropic acid** (1-Phenylacrylic acid)	106–7, w			134			121 2, w		b p 124^{16}, n_D^{16} 1 52605	
131	***l*-Campholic acid**	106–7	250					78–9	b p 211	b p 228	Anhydride, 57 8
132	**Azelaic acid** (Heptane-1,7-dicarboxylic acid)	106 5	>360 sl d , 237^{15}	*di* 201 2	*mono* 107–8, dil al , *di* 186 7	*di* 43 8	*di* 130 6	*mono* 93–5, *di* 175			
133	**Methylneopentylglycolic acid**	109						116			
134	***trans*-4-Methylcyclohexanecarboxylic acid**	111						226			
135	***cis*-α-Chloroallocinnamic acid**	111			138 9, al -w			134, bz	b p 153 4^{28}	b p 157 8^{10}, D_4^{25} 1 1569 n_D^{25} 1 5525	
136	**Ethylmalonic acid**	111			150	75		*di* 214			
137	**3-Toluic acid** (3-Methylbenzoic acid)	111 3, 110–1	263, subl	118	126	86 6	108	94, 97			
138	**O-Benzoyllactic acid** (Lactic acid benzoate)	112						124		b p 288	Nitrile, b p 269–70, 1-Naphthylamide, 155, 2-Naphthylamide, 177
139	**2,4,6-Triethylbenzoic acid**	113						156			
140	**2-Phenylbenzoic acid**	113						177			
141	**(1-Naphthyl)glyoxylic acid**	113						151			
142	**Bromomalonic acid**	113d		*di* 217, ac a				*di* 181, al	*di* b p 215–25	*di* b p 233–5d	Dinitrile, 65–6
143	**(4-Bromophenyl)acetic acid**	114, subl						192 4		30	Nitrile, 46 7
144	**2-Acetylbenzoic acid** (Acetophenone-*o*-carboxylic acid)	114–5						116 5, w			Oxime, 159, 2,4-Dinitrophenylhydrazone, 186

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	*p*-Toluidide	Anilide	*p*-Nitro benzyl ester	*p*-Bromo-phenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
145	**Pyrotartaric acid** (Methyl-succinic acid)	115		164	*mono* 159, et ac 123, chl *dl* 200			*dl* 225			
146	**2-Phenoxypropionic acid**	115-6, 112-3		115	117 118 9			132 3, 130			
147	**3-Benzoylpropionic acid**	116			150, 145			145-6, w		18 9	Semicarbazone, 181d
148	**Benzylmalonic acid**	117d, 121			*dl* 217	*dl* 119 5		*dl* 225			Dinitrile, 91, 79
149	***d l*-Tropic acid** (3 Hydroxy-2 phenylpropionic acid)	117 8 *d* 130						169			
150	**Cuminic acid** (4 Isopropyl benzoic acid)	117-8, al						133		b p 263 4	Nitrile, b p 243-4[734]
151	***d l*-Mandelic acid** (α-Hydroxy-phenylacetic acid)	118, *d* 133 *l* 134		172, al	151 2, al	123 4		133 4 (cor)			
152	***l*-Arabonic acid**	118 9, al		200	204			136, me al			*o*-Toluidide, 172
153	**α-Chlorodiphenylacetic acid**	118-9d, bz -lgr			88			115		43 4	Anhydride, 219
154	***d l*-Citramalic acid** (*d l*-2-Hydroxy-2-methylsuccinic acid)	119						*mono* 140 1	*dl* b p 112[15]		Me eth, 90 2 Et eth, 81 3
155	**Anilinomalonic acid**	119d, al -lgr			*mono* 157d, w *dl* 162, 246 7, ac a			*dl* 156	*dl* 68	*dl* 45, al	
156	**4-Chloromandelic acid**	119 22, 112 3						122 3			Nitrile, 43 Me eth 85-8, bz pet eth
157	**(3-Nitrophenyl)acetic acid**	120						110			
158	***cis*-2-Bromoallocinnamic acid**	120						129	b p 111°6, D_4^{20} 1 4726	b p 173 4[30], D_4^{25} 1 3713	
159	**3-Furoic acid** (3 Furancar-boxylic acid)	121						169			
160	**1-Cyclopentenylcarboxylic acid**	121		122	126						
161	**Cetylmalonic acid** (Heptade-cane-1,1-dicarboxylic acid)	121 5 2 0, ac a						*mono* 130 50d, lgr -al	*dl* 44, eth	*dl* 22	
162	***cis*-1,3-Cyclopentanedicar-boxylic acid**	122 *trans* 161						226			
163	***d l-trans*-Camphenic acid** (*d l-trans*-Camphene-camphoric acid)	122 3, ac a			*dl* 165, ac a			*dl* 231 2, ac a			
164	**Benzoic acid**	122.4, at 100, subl	249	158	160, boil 50% al	89	119 0	130	b p 199 6	b p 212 6	
165	**3,3,3-Trichlorolactic acid**	124			164			96			
166	**3-Nitrosalicylic acid**	125 (hyd)						145			
167	**Diethylmalonic acid**	125				*dl* 91		*mono* 146, *dl* 224			
168	**1,14-Tetradecanedicarboxylic acid**	126			163						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	*p*-Toluidide	Anilide	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
169	**2,4-Dimethylbenzoic acid**	127 (anh) 90 (hyd)			141			179-81			
170	*cis*-**2-Chloroallocinnamic acid**	127						112			
171	**2-Benzoylbenzoic acid** (Benzophenone-2-carboxylic acid)	128, 91 (+1 H_2O), w			195	100 4		165 (cor)	52		
172	**1,10-Decanedicarboxylic acid**	128						185			
173	**2-Thenoic acid** (2-Thiophenecarboxylic acid)	129						180			
174	**4-Bromopyromucic acid** (4-Bromofuran-2-carboxylic acid)	129						155-6		29 b p 235 6	
175	**Maleic acid** (*cis*-Butenedioic acid)	130 (+30% Fumaric a), 137 (pure)		*di* 142, eth	*mono* 198, 187, yel , al , *di* 187, al	*di* 91 (cor)	168 70, 190	*mono* 172 3, w 153 sl d , *di* 260, 181, me al			Heated at 160 → anh , 60, b p 202
176	**Tribromoacetic acid**	131, 135	245d					122			
177	**(1-Naphthyl)acetic acid** (1-Naphthaleneacetic acid)	131, 135			155, al , 159 6			180 1, al			
178	*trans*-α-**Bromocinnamic acid**	131-2						119	23	b p 294-6	
179	**2,5-Dimethylbenzoic acid**	132			140			186			
180	*cis*-β-**Chloroallocinnamic acid**	132		142	134 5			76	34	b p 265 sl d	
181	*trans*-**Cinnamic acid**	133	300	168	153, 109	116 8	145 6	147 8			Nitrile, 20-1, b p 255 6
182	**Chloromalonic acid**	133			*di* 118, w			*di* 170	*di* b p 206-8[772]	*di* b p 222	Di-*p*-bromoanilide 239
183	**Sebacic acid** (Decanedioic acid, Octane-1,8-dicarboxylic acid)	33, subl	243[15]	*di* 201	*mono* 122 3, *di* 201 2	*di* 73 5, 72 6	*di* 147	*mono* 170, *di* 210, 208			Phenylhydrazide, 194
184	**2-Furoic acid** (2-Furancarboxylic acid, Pyromucic acid)	133-4, 132	230-2	170 5, al	123 5, al	133 5	138 5	142 3		34, b p 195	
185	**Malonic acid** (Propanedioic acid)	134 8- 9		*mono* 156d , *di* 252-3, al	*mono* 132, *di* 230, 227-8, al	*di* 85 5		*mono* 106 10, *di* 170, w -al		*di* b p 199	Phenylhydrazide, 194
186	**O-Acetylsalicylic acid** (Aspirin)	135, rapid htng	140d		136	90 5		138			Phenacyl ester, 105
187	β-**Campholytic acid** (1,5,5-Trimethylcyclopentene-2-carboxylic acid)	135	247-9, 255-6	114	104, al - w			130	b p 203 4	b p 214	
188	**2-Anilinoisovaleric acid**	135, w						102 3		b p 275-80	
189	**Acetone-1,3-dicarboxylic acid**	135d , et ac			*di* 155, al						Oxime, 53 4 w Acids or alkalis → acetone b p 56 + CO_2
190	*d l-cis*-**Camphenic acid** (*d l cis*-Camphenecamphoric acid)	135-7			*di* 212			*di* 225			
191	**Phenylpropiolic acid**	136-7, subl		142	128, 126, 125	83		99-100, 109			Melts under w at 80

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	*p*-Toluidide	Anilide	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
192	***trans*-Glutaconic acid**	136–8			*mono* 167, *di* 228						Acetic anhydride → anh 88
193	**3-Ethoxybenzoic acid**	137						139 0– 5			
194	**Methylmalonic acid**	137, 138d		*mono* 145d, *di* 228, 214				217, 206			
195	***trans*-α-Chlorocinnamic acid**	137–8		116, al	118, al			121 2	33	b p 209[75], D_4^{25} 1 1719, n_D^{25} 1 5705	
196	**3-Thenoic acid** (3-Thiophenecarboxylic acid)	138					130	180			
197	***cis*-Cyclobutane-1,2-dicarboxylic acid**	138						*di* 228, w	*di* b p 225	*di* b p 238–42[720]	Anhydride, 75 71–3
198	**2-Pyridinecarboxylic acid** (Picolinic acid)	138						107			
199	**(3-Chloromethyl)benzoic acid**	138, w						124		b p 168 9[25]	Nitrile 67 al b p 258 60
200	**5-Chloro-2-nitrobenzoic acid**	139, w			164, eth			154, eth	48 5, me al		Methylamide, 134, al -w, Dimethylamide, 104 5
201	**Anhydrocamphoronic acid**	139			202 3				α 138, β 45		
202	**Butane-1,1,4-tricarboxylic acid**	139 40, bz -et ac			*mono* 177					*tri* b p 175 6[18], D^{15} 1 0726	
203	***meso*-Tartaric acid**	140			*mono* 193–4, pa yel, w	93		*di* 187, 189 90, dil me al			Diphenylhydrazide 245
204	**3-Nitrobenzoic acid**	140		162	154	141	132	143	78 5, 70	47, 40–1	
205	**3-Bromo-4-toluic acid** (2-Bromo-4-methylbenzoic acid)	140						137, subl			Nitrile, 47
206	**2-Chloro-4-nitrobenzoic acid**	140–2			168			172, al	73–5		
207	**(2-Nitrophenyl)acetic acid**	141, 138						161			
208	**Furanacrylic acid** (β-(2-Furyl)-acrylic acid)	141	286					168 9			
209	**2-Anilinobutyric acid**	141			92, al			123, w		26, b p 278	Nitrile, 39
210	**(2-Naphthyl)acetic acid** (2-Naphthaleneacetic acid)	141–2, 143						200, 205			
211	**4-Chloro-2-nitrobenzoic acid**	142, w						172, al	41 3		Nitrile, 98
212	***trans*-β-Chlorocinnamic acid**	142		122–5	128			118	29	b p 293	
213	**2-Chlorobenzoic acid**	142, 140		131	114, 118, pet eth	106	106	142, 202	b p 234	b p 243	
214	**(2-Bromophenoxy)acetic acid**	142 5, al						151, al		b p 160 70[16]	

*Derivative data given in order m p, crystal color, solvent from which crystallized



TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point °C	*p*-Toluidide	Anilide	*p*-Nitro benzyl ester	*p*-Bromo phenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
215	**Suberic acid** (Octanedioic acid, Hexane-1,6-dicarboxylic acid)	144, 139 41		*di* 218, 219	*mono* 128 9, *di* 186–7	*di* 85	*di* 144 2	*mono* 125 7, *di* 216–7		*di* b p 282 6	
216	**Asaronic acid** (2,4,5-Trimethoxybenzoic acid)	144, bz - pet eth	*ca* 300		154 5			184 5	97 5, yel	72, yel	Nitrile, 112–4, al
217	**(2-Chlorophenoxy)acetic acid**	145 6, w			121			149 5	b p 186 8	32	
218	**2-Nitrobenzoic acid**	146			155	112	107	176	b p 275, 269, D_4^{20} 1 286	30, b p 148 50[10]	
219	**Phthalonic acid**	146			*mono* 176 *di* 208			α 179d β 155d			Phenylhydrazone, 171 2
220	**(2-Hydroxyphenyl)acetic acid**	147 149, 141						118			
221	**2-Anilinovaleric acid** (2-Anilinopentanoic acid)	147–8, al -w						99, eth - pet eth			Nitrile, 51, pet eth
222	**Diphenylacetic acid**	148		172 3	180			167 5 8 0			
223	**Diglycolic acid**	148, 142		*mono* 148, w	*mono* 118, *di* 152, eth al (2 1)			*mono* 135			
224	**Oxanilic acid**	148 9			*di* 154			228			
225	**(4-Hydroxyphenyl)acetic acid**	148 50, 148, w						175			Benzoate of amide, 167 9
226	**2-Bromobenzoic acid**	150			141	110	102	155	b p 243 4	b p 254–5	
227	**Benzilic acid** (α-Hydroxydiphenylacetic acid)	150		189–90	174 5	99 5	152	153, chl , 154 5	74–5	34	Acetate, 98, ac a
228	**Citric acid** (2-Hydroxypropane-1,2,3-tricarboxylic acid)	153 (slow htng)		*tri* 189 al	*tri* 192, al -w	*tri* 102	*tri* 148	*tri* 210 5d			Triphenyl ester, 124
229	**(4-Nitrophenyl)acetic acid**	153			198		207	198			
230	**2,5-Dichlorobenzoic acid**	153						155			
231	**Phenylmalonic acid**	153						233			
232	**Adipic acid** (Butane 1,4-dicarboxylic acid)	153 4 (cor)	216[15]	241	*mono* 151 3 w *di* 240 1 al	106	154 5, 152 6	*mono* 125 30, w , *di* 220	3, b p 162[10]	*di* 8, b p 112[10], f p 0	Diphenyl ester, 105–6, al -w
233	**(4-Bromophenoxy)acetic acid**	153–4 al								54, al	Phenyl ester, 73, al
234	**Phenylpyruvic acid**	154									Oxime, 159
235	**3-Bromobenzoic acid**	155			136	105	120	155	31 2	b p 254–5	
236	**2,4,6-Trimethylbenzoic acid**	155, 153						188			
237	**2-Chloro-4-methylbenzoic acid**	155–6						182			Nitrile, 61–2, subl
238	**(4-Chlorophenoxy)acetic acid**	155 6, w , 158			125		136	133	b p 177 80	49	
239	**3-(1-Naphthyl)propionic acid**	156						104			
240	**Tartronic acid** (Hydroxymalonic acid)	156 8d						*di* 198, dil al , 195–6d			
241	**Benzoylpyruvic acid**	156 8d (+1 H_2O), al -w						138d	59, 62	46	1-Oxime, 98–100d (+1 H_2O)

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	*p*-Toluidide	Anilide	*p*-Nitro benzyl ester	*p*-Bromo phenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
242	**Cyclobutane-1,1-dicarboxylic acid**	157, w 158			*di* 214 5			*di* 275 7		b p 218 ¹² *di* b p 222 6	Dihydrazide 109 10 al -w
243	**3-Chlorobenzoic acid**	158 155			122 5 al	107	116	134	21 b p 231	b p 245	
244	**Salicylic acid** (2 Hydroxy-benzoic acid)	158 3, subl at 76		156	136	97 8	140	142 139	−8 6 b p 223 3	1 3 b p 234 231 5	
245	**1-Naphthoic acid**	161 2 (cor)			162 3 164		135 5	202 205			
246	**2-Iodobenzoic acid**	162			141	111	143	110	184		
247	**2-Anilinopropionic acid**	162, w			127, al			144		b p 272	Nitrile, 92, al N-Acetyl, 143, w
248	**4-Dibenzothienylacetic acid**	162						206			
249	**Alloxanic acid**	162 3d , eth						191, w	171, et ac	115, acet - chl	Phenylamide 99, eth
250	**5-Chloro-3-nitrosalicylic acid** (5-Chloro-2-hydroxy-3-nitro benzoic acid)	163						199		91, al	
251	**2-Benzofurylacetic acid**	163						210			
252	**Cholanic acid**	164, ac a						175		93-4, 80% al	$[\alpha]_D^{14}$ +21 74 in chl , Propyl ester 56-7, Butyl ester, 53
253	**4-Nitrophthalic acid**	165		*mono* 172	192			200d			
254	**Itaconic acid** (Methylene-succinic acid)	165			*mono* 151 5, eth	*di* 90 6	*di* 117 4	*di* 191 2 8, al			
255	**5-Bromosalicylic acid** (5-Bromo-2-hydroxybenzoic acid)	165			222			232	61, b p 264 6	50	
256	**6-Chloro-3-nitrobenzoic acid**	165, w						178, w	73, me al	28 9	Nitrile, 105-6
257	**3,4-Dimethylbenzoic acid**	166, 164			104, 108			130			
258	**Tricarballylic acid** (Propane-1,2,3-tricarboxylic acid)	166			*tri* 252, $PhNO_2$		*tri* 138 2	*tri* 205 7d			
259	**Mesitylenic acid** (3,5-Dimethyl-benzoic acid)	166						133			
260	***d,l*-Phenylsuccinic acid**	167-8, 84 (anh), *d l* 173 4		*mono* (α) 175, *mono* (β) 168-9	*mono* (α) 175, *mono* (β) 171, *di* 222			*mono* (α) 158 9 *mono* (β) 145, *di* 211			
261	**Mesitylacetic acid**	168						210			
262	**3-Chloro-4-hydroxybenzoic acid**	169 70, w , 164-5						180 2	106 7	77 8	Nitrile, 155
263	***d*-Tartaric acid**	169 71			*mono* 180d , 194 (cor), ac a , *di* 263 4d , al	*di* 163	*di* 204	*mono* 171-2, *di* 196d , al			Phenylhydrazide, 240

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	*p*-Toluidide	Anilide	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
264	**Azobenzene-3-carboxylic acid**	170 1, or , al						198-9, or , al	58, me al		
265	**2,2-Diphenylpropionic acid**	171 175						149			
266	**8-Chloro-1-naphthoic acid**	171 2, al -w						207 5, red, al		50	
267	**4-Bromo-2,5-dimethylbenzoic acid**	171 5 2 5, lgr						209-10			Nitrile, 103-4
268	**5-Chlorosalicylic acid** (5-Chloro-2-hydroxybenzoic acid)	172 w						226-7	50, b p 249d	25	Nitrile, 165-7, Phenyl ester, 81-3, Me eth , 81-2, Et ester, 118
269	**4-Chloro-2-methylbenzoic acid**	172						183		b p 258	Nitrile, 67
270	**2,4-Dibromobenzoic acid**	174						198			
271	**3-Aldehydeobenzoic acid** (3 Formylbenzoic acid)	175						190d	53	b p 278	Nitrile, 79-81, eth , Semicarbazone, 265, Phenylhydrazone, 164
272	**3-Thianaphthenecarboxylic acid**	175			173			198			
273	**Apiolic acid** (2,5-Dimethoxy 3,4-methylenedioxybenzoic acid)	175, w							71-2, w		Nitrile, 135 5, al -w
274	**Allomucic acid** (2,3 4,5-Tetrahydroxyadipic acid)	176d , w						175 6, w , *di* 209d , w		*di* 139-41 al	Polyphenylhydrazide, 218d , al
275	**8-Bromo-1-naphthoic acid**	178, bz			151, al			179-80	33, pet eth	52, pet eth	
276	**3-Phenanthrylacetic acid**	178						176			
277	**Acetylenedicarboxylic acid**	179						*di* 294d			
278	**4-Toluic acid** (4-Methylbenzoic acid)	179 80, subl 182	275 (cor)	160, 165	144 5, 148, 140	104 5	153	160, 158			
279	**6-Bromo-3-nitrobenzoic acid**	180			166, al			197-8	82	66	Nitrile, 117, subl
280	**5-Bromo-2,4-dimethylbenzoic acid**	180 1						197 5-8 5			Nitrile, 88-9
281	**Veratric acid** (3 4 Di methoxybenzoic acid)	181 (anh)			154			164			
282	***N*-Benzoylanthranilic acid** (2 Benzamidobenzoic acid)	181			279			218-9	100	98	Nitrile, 156
283	**4-Chloro-3-nitrobenzoic acid**	181-2			131			156, al	83, me al	59, yel	Nitrile, 100-1
284	**3,5-Dinitrosalicylic acid** (3,5-Dinitro-2-hydroxybenzoic acid)	182 (anh) 174 (+1H_2O)						181			
285	**4-Fluorobenzoic acid**	182 182 6						154, 154 5			Nitrile, 35
286	**4-Chloropicolinic acid** (4-Chloropyridine-2-carboxylic acid)	182d						158, 152-4	57-8		Phenyl ester, 68, pet eth
287	**2,4-Dinitrobenzoic acid**	183				142	158	203			
288	**2-Naphthoic acid**	184, 185 5		192, al	171, bz , 173			192-3, al , 195			
289	**3-Bromosalicylic acid** (3-Bromo-2-hydroxybenzoic acid)	184						165			Nitrile, 49-50
290	**2-Anilinoisobutyric acid** (2-Anilinoisobutanoic acid)	184 5, w			155, al			136			Nitrile, 93-4, al
291	**4-Anisic acid** (4-Methoxybenzoic acid)	184 6, 184 2 (cor)	275-80	186	169-71	132	152	167, 162-3, w			

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	*p*-Toluidide	Anilide	*p*-Nitro benzyl ester	*p*-Bromo phenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
292	**(2-Carboxyphenyl)acetic acid** (Homophthalic acid)	185, 180						228			
293	**Acetylanthranilic acid**	185, ac a			167 8, al			177, al			Nitrile, 133, w, *N*-Methylamide, 172 al
294	**Succinic acid** (Butanedioic acid, Ethane-1,2-dicarboxylic acid)	185, 182 8	235d	*mono* 179 80, *di* 254 5–5 5, 260	*mono* 148 5, *di* 230, al	*di* 88	*di* 211 0	*mono* 157 *di* 260d, w			
295	**5-Bromopyromucic acid** (5-Bromofuran-2-carboxylic acid)	186, w						144 5		b p 234	Hydrazide 135 5 6 0, Azide, 66 7
296	**Hippuric acid**	187			208	136	151	183			
297	**3-Iodobenzoic acid**	187				121	128	186			
298	**5-Bromo-2-toluic acid** (4-Bromo-2-methylbenzoic acid)	187, subl						180			Nitrile, 70
299	**2-Cyanobenzoic acid** (Phthalic acid mononitrile)	187, 192						173	151	70	
300	**3-Nitroanisic acid** (4-Methoxy-3-nitrobenzoic acid)	187			163						
301	**Fluorene-2-acetic acid**	187						266			
302	**Coumarin-3-carboxylic acid**	187d, w			250			236	116–7	94	Nitrile, 182
303	*d*-**Camphoric acid** (1,2,2-Trimethylcyclopentane-1,3-dicarboxylic acid)	187 5–8 0, *l* 187, *d,l* 202, 208		(*α*) 212–4, (*β*) 190–6	*mono* (*α*) 204, 209 10, *mono* (*β*) 196, *di* 226, *di*, *l* 226	65 5		*mono* (*α*-amide-*β*-acid) 176, *mono* (*β*-amide-*α*-acid) 182–3, *di* 192–3	(*α*) 77 (*β*) 86 *di* b p 263 4	(*α*) 47 8 (*β*) 57 *di* b p 285 6	
304	**3-Bromophthalic acid**	188								*mono* 127 8	Anhydride, 132–4
305	**4-Bromo-3,5-dinitrobenzoic acid**	188, al						188, pa yel, al -w	125 me al -w	118, al -w	
306	**Butane-1,2,3,4-tetracarboxylic acid** (low melting form)	189, w			187 (rapid htng), al -w			*di* 181d, dil H_2SO_4 *tetra* 310d, w	*tetra* 75–6, w	*di* 168 w	Heating → monoanh of high melting form
307	**Anthroxanic acid**	190, 196d						211–2, w	70	64–5	
308	**α-Chrysenic acid** (*o*-2-Naphthylbenzoic acid)	190						169 70	63		
309	*l*-**Ascorbic acid**	190d, *d,l* 168–9									$[\alpha]_D^{23}$ +48 in me al, Diphenylhydrazone, 178d, red, Di-*p*-nitrophenyl hydrazone 262d al Di 2 4 dinitro phenylhydrazone, 282d, br -red

*Derivative data given in order m p., crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	*p*-Toluidide	Amide	*p*-Nitro benzyl ester	*p*-Bromo phenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
310	**Chlorofumaric acid**	191 2, ac a			186, al	*di* 138 5			*di* b p 224	*di* b p 250 sl d	Ethyl ester amide, 102
311	***N*-Methylacetylanthranilic acid**	192 3					155				*N*-Methylamide, 171 2 *N*-Ethyl-amide, 140
312	**Coumarilic acid** (Coumarone-2-carboxylic acid)	192 3, w	310 5 sl d		159			159		27	Nitrile, 36, Phenyl ester, 101
313	**Dimethylmalonic acid**	193, subl				83 6		*di* 269			
314	***trans*-Aconitic acid**	194 5d (cor), *cis* 125 → *trans* on heat-ing			*di* 189, *cis*, *mono* 170d , al		*tri* 186	*tri* 250 → br , 260 → sinters			Heat → Itaconic acid, 165
315	**Benzylidenemalonic acid**	195 6d						*di* 189 90	*di* 44	85, *di* 32	Mononitrile, 183 Dinitrile, 87
316	**4-Ethoxybenzoic acid**	198 195 6			169, 170 172			202			
317	***trans*-3-Nitrocinnamic acid**	199 *cis* 138				174	178, 173	196			
318	**Chrysodiphenic acid** (2-Phenyl-naphthalene-1,2'-dicarboxylic acid)	199						1-*mono* 275, 2'-*mono* 220	1-*mono* 171 5, me al , 2'-*mono* 124, *di* 90		
319	**3,4-Dihydroxybenzoic acid** (Protocatechuic acid)	199-200d			166	188		212	134 5 w		
320	**3-Hydroxybenzoic acid**	200, subl		163 dil al	156 7, w 155	106 8	176, 176 1-4	170 167 w			
321	**Phthalic acid** (Benzene-1,2-dicarboxylic acid)	200 6, 191 (sealed tube), 230 (rapid htng)		*mono* 150 (slow htng), 160 5 (rapid htng), *di* 201	*mono* 170 *di* 253-5	*di* 155 5	*di* 152 8	*mono* 149, *di* 220			
322	**3,4-Dichlorobenzoic acid**	201 2, 208 9						133			
323	**(4-Chloromethyl)benzoic acid**	203						173			Nitrile, 79 80, al , b p 263
324	**5-Bromo-2-nitro-4-toluic acid** (2-Bromo-4-methyl-5 nitro-benzoic acid)	203, 200						191		61	Nitrile, 132
325	**4-Bromo-3-nitrobenzoic acid**	203 4			156, or -yel , al			156	104	74	Nitrile, 120
326	***d,l*-Tartaric acid**	203-4 (+1 H_2O) 205 6 (anh)			*di* 235-6	*di* 147 6		*di* 226, w -me al			
327	***cis*-Apocamphoric acid**	204, w , *trans* 190-1, w			*mono* 212						Anhydride, 178, al
328	**3,5-Dinitrobenzoic acid**	204-5			234	157	159	183			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	*p*-Toluidide	Anilide	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
329	**Mesaconic acid** (Methylfumaric acid)	204 5 (cor), subl		*mono* (α) 196, *di* 212, al	*mono* (α) 202, *mono* (β) 163, *di* 185 7	*di* 134 (cor)		*mono* (α) 222, *mono* (β) 174, *di* 176 5			
330	**5-Bromo-3-nitro-4-toluic acid** (6-Bromo-4-methyl-2-nitrobenzoic acid)	206						171			Nitrile, 130, subl
331	**Anthracene-9-carboxylic acid** (*meso*-Anthroic acid)	207, pa yel , al							111, yel		Nitrile, 170-2, lgr
332	**Vanillic acid**	207, 210				140d				44, b p 293	
333	*trans*-**2-Coumaric acid** (*trans*-2 Hydroxycinnamic acid)	207 8d , subl , w				152 5		209d			Acetate, 154 5, 146, bz
334	**Oxamic acid**	210			148-9			419d			
335	**Pentamethylbenzoic acid**	210						206			
336	**4-Coumaric acid** (4-Hydroxycinnamic acid)	210 3, 206 (anh)						194	137 126		Acetate, 200 5
337	*trans*-**2-Chlorocinnamic acid**	212, yel , al			176			168	10 5, b p 278-9	b p 162[12]	Nitrile, 40
338	**2,4-Dihydroxybenzoic acid** (β-Resorcylic acid)	213d (rapid htng), 216d , 217			126-7	188 9		222			Loses H_2O of crystallization at 100 Easy loss of CO, gives m p varying from 194 to 236
339	**2-Bromo-3,5-dinitrobenzoic acid**	213						216, pa yel , al -w	109, me al -w	74, al	
340	**4-Dibenzofurylacetic acid**	214						212			
341	**Mucic acid**	214d (varies with htng rate) 223 255				310	225	*mono* 192d , *di* 220			
342	**3-Chloroanisic acid** (3-Chloro-4-methoxybenzoic acid)	214 5						193	94 5		
343	**4-Hydroxybenzoic acid**	215, 213-4 210		203-4, al	196 7, yel , w	180 2	191 5 (cor), 184	162 (+1 H_2O), w			
344	**Piperic acid**	216				145					
345	**3-Chloro-2-naphthoic acid**	216 7, me al -w						237	58, me al	50	
346	**3-Nitrophthalic acid**	218		*di* 226	*di* 234	189		*di* 201d			
347	**Acenaphthene-5-carboxylic acid**	219, bz						198			Nitrile, 110-1
348	**4-Cyanobenzoic acid** (Terephthalic acid mononitrile)	219, 214			179	189		223	62	54	
349	**4-Phenylbenzoic acid**	221						223			
350	**3-Hydroxy-2-naphthoic acid**	222 3 (cor)		221-3	243-4, ac a , 249 (cor)			217 8 (cor), yel , al			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	*p* Toluidide	Anilide	*p* Nitro benzyl ester	*p*-Bromo phenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
351	**4-Hydroxy-2-naphthoic acid**	225 6		206				217 8			
352	**5-Bromo-3-nitro-2-toluic acid** (4-Bromo-2-methyl 6 nitro-benzoic acid)	226						235			Nitrile, 106-7, subl
353	**9-Fluorenecarboxylic acid**	227 230, 225						251			
354	**Biphenyl-2,2'-dicarboxylic acid** (2 2 Diphenic acid)	227 233 229			*mono* 176, *di* 229-30, al	*di* 187, 182 6		*mono* 193, 190 1, *di* 212, w			
355	**Methyliminodiacetic acid**	227d						*mono* 169, *di* 169			
356	**2,4,6-Trinitrobenzoic acid**	228						264d			
357	**Piperonylic acid**	229, 228						169, al			
358	**5-Nitrosalicylic acid**	229 30			224			225			
359	**4-Chloro-3-hydroxy-2-naphthoic acid**	231, yel						225	116, yel		
360	**1-Phenanthroic acid**	232						284			
361	**3-Pyridylacrylic acid**	233						148			
362	**4-Bromo-3-hydroxy-2-naphthoic acid**	233-5d, yel, al-ac a			161-2						Acetate, 183
363	**4-Chloro-1-hydroxy-2-naphthoic acid**	234, al		143-4	180-1				120-1	92-3	*o*-Toluidide, 148-9, *m*-Toluidide, 188-9
364	**3-Chloro-2-nitrobenzoic acid**	235 w			186						
365	**Benzophenone-2,4-dicarboxylic acid**	235, w						*di* >288	*di* 107		
366	**5-Bromo-2-hydroxy-3-toluic acid** (5 Bromo-2-hydroxy 3-methylbenzoic acid)	236			125, al -w			75-8	109	75	
367	**2-Thianaphthenecarboxylic acid**	236						177			
368	**Butane-1,2,3,4-tetracarboxylic acid** (high melting form)	236-7 (slow htng)			*di* 168, acet (slow htng)			*di* 169d	*tetra* 63-4, lgr		Di-imide, 320d, w
369	**7-Bromo-1-naphthoic acid**	237 (cor), 60% al			202, al -w			247, 50% al	55 (cor), 60% me al	46	
370	**3-Pyridinecarboxylic acid**	237 8 235, 232		150	85, 132, bz - lgr, 265, w			128, 122			
371	***trans*-2-Nitrocinnamic acid**	240, *cis* 146-7				132	141	185			
372	**2-Chloroquinoline-3-carboxylic acid**	240						200-1			
373	**4-Nitrobenzoic acid**	241		204, 192	211, 204	168	137	201, 198	96	57	
374	**Azobenzene-4-carboxylic acid**	241, red, al						224-5, red	123-4, or, me al	86-7, or - red, al	Nitrile, 120-1, br, bz, Propyl ester, 64, red, lgr
375	**4-Chlorobenzoic acid**	243, 240			194, al	129 5, al	126	179, 170	44	b p 238	
376	**7-Chloro-1-naphthoic acid**	243, 60% al			185, al - w			237, 50% al	54, 60% al		
377	**3-Chlorocinchonic acid** (2-Chloroquinoline-4-carboxylic acid)	244, al			202, al			334-5, al - w, 276-8 (after fusion)	89-90, acet	64 5	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point °C	*p*-Toluidide	Anilide	*p*-Nitro benzyl ester	*p*-Bromo-phenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
378	**5-Chloro-1-naphthoic acid**	245, 241-2 subl						239		42	Nitrile, 145
379	**Azobenzene-2,2'-dicarboxylic acid**	245, dk yel, al						*mono* 215d, red-br, et ac, *di* 294d, red-br, ac a	*di* 101, red, me al	*di* 85, pa red, al	
380	**Anthracene-1-carboxylic acid** (α-Anthroic acid)	245, yel, al, 252						260, al	108, ac a		Nitrile, 126, yel, Phenyl ester, 207-9, yel
381	**2-Amino-9,10-anthraquinone-1-carboxylic acid**	250 2, or - red						300, or, $PhNO_2$			
382	**4-Bromobenzoic acid**	251-3			197	180		189-90, w			*p*-Phenylphenacyl ester, 193
383	**9-Phenanthroic acid**	251, 253						233			
384	**4-Bromocinnamic acid**	251 3			183				80		
385	**Cinchoninic acid** (Quinoline-4-carboxylic acid)	253 4 (+1 or $2H_2O$)						181	24	13, b p 173^{15}	Nitrile, 102
386	**Gallic acid** (3,4,5-Trihydroxy-benzoic acid)	253-4d, 222-40d			207	141	134	189			
387	**1-Acenaphthoic acid**	256						228			
388	**2-Phenanthroic acid**	260						243			
389	**Cinchomeronic acid** (Pyridine-3,4-dicarboxylic acid)	260d, w			*di* 199-206			3-*mono* 200d, 4-*mono* 170d, w, *di* 163-5d	3-*mono* 182 4-*mono* 154-72, *di* 141	4-*mono* 131-3, bz, *di* b p 172^{21}	Imide, 229-30, subl
390	**5-Bromo-1-naphthoic acid**	261, 256						241		48-9	Nitrile, 147, subl
391	**Chelidonic acid** (γ-Pyrone-2,6-dicarboxylic acid)	262						245	*di* 122 5	227, *di* 63	*p*-Phenylphenacyl ester, 195-8d
392	**4-Iodobenzoic acid**	270, 265			210	141	146	217			
393	**5-Chloro-2-naphthoic acid**	270, al			202 5			186-7	81	45	Nitrile, 144
394	**3-Phenanthroic acid**	270						234			
395	**Quinoline-3-carboxylic acid**	272						198			
396	**1-Chloroanthraquinone-2-carboxylic acid**	272, pa yel, al			248 9, pa yel, bz-ac a			317, yel	161 5, yel, acet, 155	142, yel, al	Benzyl ester, 135-6, yel, al
397	**Anthracene-2-carboxylic acid** (β-Anthroic acid)	281, yel, al						293-5, yel, al		134-5	
398	*trans*-**4-Nitrocinnamic acid**	285				186	191	204, 217			
399	**Fumaric acid** (*trans*-Butanedioic acid)	286-7, (sealed tube), >200, subl, 293-5			*mono* 233 0-4 5, *di* 313 4, ac a	150 8		270, 300 2 subl, *di* 266d	*di* 102, b p 192	*mono* 66, *di* b p 218	At 230 → maleic anh 56
400	**Muconic acid**	289d (slow htng), 306 (rapid htng)						*di* 240d			*trans-trans* 296-8, *cis-cis* 195

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE XII. ORGANIC DERIVATIVES OF CARBOXYLIC ACIDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	*p* Toluidide	Anilide	*p*-Nitro benzyl ester	*p*-Bromo phenacyl ester	Amide	Methyl ester	Ethyl ester	Miscellaneous
401	**9,10-Anthraquinone-2-carboxylic acid**	290–2, yel, ac a			258 60			280, ac a -bz	170	147	
402	**9,10-Anthraquinone-1-carboxylic acid**	293 4, pa yel, ac a			288 9, pa yel, $PhNO_2$			280 pa yel, al	189, pa yel, me al	169, yel, al	Nitrile, 247, yel, ac a
403	**Bromoterephthalic acid** (2-Bromobenzene-1,4-dicarboxylic acid)	299						*di* 270	1-*mono* 145, 4-*mono* 164 *di* 54		
404	**Terephthalic acid** (Benzene-1,4-dicarboxylic acid)	300, subl without melting			*di* 334 7, $PhNO_2$	*di* 263 5	*di* 225	*di* >225			
405	**Chloroterephthalic acid** (2-Chlorobenzene-1,4-di-carboxylic acid)	>300, w						*di* >300	*di* 60		
406	**4-Pyridinecarboxylic acid** (Isonicotinic acid)	324						156			
407	**9,10-Anthraquinone-2,3-dicarboxylic acid**	240–2, yel, ac a						*mono* >340, br, ac a			Anhydride, 290
408	**Isophthalic acid** (Benzene-1,3-dicarboxylic acid)	348, subl				202 5	179 1	*mono* 280, *di* 280			Ba salt (+6 H_2O) very soluble—differentiates from Terephthalic acid
409	**Benzophenone-4,4′-dicarboxylic acid**	subl <360						*di* >300	*di* 224 231		Dinitrile, 204–5
410	**Trimesic acid** (Benzene-1,3,5-tricarboxylic acid)	380 (cor)			*tri* 118–20d, ac a		*tri* 197 (sealed tube)	365d (cor)	*tri* 143–4, me al	*tri* 132 3, al 133 after sintering at 127	

*Derivative data given in order m p, crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLES XII, XIII AND XIV

The derivatives of three classes of compounds (carboxylic acids, acyl halides and acid anhydrides) are essentially the same as those of carboxylic acids, and are prepared either directly from the acid or *via* the acyl halide All of them appear therefore under the same title

Hydrolysis of acid halide or acid anhydride to the corresponding carboxylic acid

$$RCOCl + H_2O \longrightarrow \underset{\text{Acid}}{RCOOH} + HCl$$

$$(RCO)_2O + H_2O \xrightarrow{NaOH} 2RCOONa \xrightarrow{H^+} \underset{\text{Acid}}{RCOOH}$$

From the acyl halide in water
For directions and examples see Wild, p 180
From the acyl halide with aqueous sodium hydroxide
See Vogel, p 369, Wild, p 180
From the acid anhydride with water
See Vogel, p 376, Wild, p 184, A C D Rivett and N V Sidgwick, *J Chem Soc*, **97**, 1677 (1910)
From the acid anhydride with aqueous sodium hydroxide
See Linstead, pp 16 7 Wild, p 184

Amide *

$$RCOOH \xrightarrow{SOCl_2} \underset{\substack{\text{Acid}\\\text{chloride}}}{RCOCl} \xrightarrow{NH_3} RCONH_2 + NH_4Cl$$

$$RCOOH + NH_3 \longrightarrow RCONH_2$$

$$(RCO)_2O + NH_3 \longrightarrow \underset{\text{Amide}}{RCONH_2}$$

Acid chloride is prepared from the acid and thionyl chloride Amide is formed on addition of aqueous ammonia
For directions and examples see Cheronis, p 440, Shriner, p 200, Vogel, p 361, Wild, p 181
From the acid chloride in benzene with aqueous ammonia
See D Swern, J M Stutzman and E T Roe, *J Amer Chem Soc*, **71**, 3017 (1942)
By passing gaseous ammonia through a benzene or ether solution of the acyl chloride
See Linstead, p 14, Wild, p 182
From the neat acid with gaseous ammonia
See J A Mitchell and E E Reid, *J Amer Chem Soc*, **53**, 1879 (1931)
From the acid anhydride with aqueous ammonia
See Wild, p 184, 185

Anilide *

$$RCOOH \xrightarrow{SOCl_2} RCOCl \xrightarrow{C_6H_5NH_2} RCONHC_6H_5 + C_6H_5NH_3^+Cl^-$$

$$RCOOH + C_6H_5NH_2 \longrightarrow RCONHC_6H_5 + H_2O$$

$$(RCO)_2O + C_6H_5NH_2 \longrightarrow \underset{\text{Anilide}}{RCONHC_6H_5} + C_6H_5NH_3^+RCOO^-$$

From the acid chloride (prepared from the acid and thionyl chloride) and aniline in benzene or in ether
For directions and examples see Cheronis, p 445, Linstead, p 14, Shriner, pp 98, 200–1, Vogel, pp 361, 369, 458, Wild, p 182, P W Robertson, *J Chem Soc*, **115**, 1210 (1919)
From the acid chloride with aniline in aqueous sodium hydroxide
See Wild, pp 181, 219
From the acid and aniline at high temperatures
See Vogel, p 362

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

From the sodium salt of the acid with aniline and concentrated hydrochloric acid
See Shriner, p 201, Wild, p 154
From the acid anhydride with aniline without solvent
See Linstead, p 17, Vogel, p 377, Wild, p 185
From the acid anhydride with aniline in benzene
See Linstead, p 15, Wild, p 185

p-Toluidide *

$$RCOOH \xrightarrow{SOCl_2} RCOCl \xrightarrow{p\text{-}CH_3C_6H_4NH_2} RCONHC_6H_4CH_3\text{-}p + p\text{-}CH_3C_6H_4NH_3^+Cl^-$$

$$RCOOH + p\text{-}CH_3C_6H_4NH_2 \longrightarrow RCONHC_6H_4CH_3\text{-}p + H_2O$$

$$(RCO)_2O + p\text{-}CH_3C_6H_4NH_2 \longrightarrow RCONHC_6H_4CH_3\text{-}p + p\text{-}CH_3C_6H_4NH_3^+RCOO^-$$

From the acid chloride with *p*-toluidine in ether or benzene
For directions and examples see Cheronis, pp 441, 444, 458, Linstead, p 14, Shriner, pp 200-1, Vogel, p 361
From the acid and *p*-toluidine at high temperatures
See Cheronis, pp 441, 442-3, Vogel, p 362
From the sodium salt of the acid, *p*-toluidine and concentrated hydrochloric acid
See Shriner, p 201, Wild, p 154
From the acid anhydride with *p*-toluidine without solvent
See Cheronis, p 459, Linstead, p 17
From the acid anhydride with *p*-toluidine in benzene
See Wild, p 185

1- and 2-Naphthylamide *

$$RCOOH \xrightarrow{SOCl_2} RCOCl \xrightarrow{1\text{- or }2\ C_{10}H_7NH_2} \underset{\text{Naphthylamide (1 or 2-)}}{RCONHC_{10}H_7} + C_{10}H_7NH_3^+Cl^-$$

From the acid chloride with the naphthylamine
For directions and examples see Cheronis, p 446, P W Robertson, *J Chem Soc*, **115**, 1210 (1919)

p-Nitrobenzyl ester *

$$RCOONa + p\text{-}NO_2C_6H_4CH_2X \rightarrow \underset{p\text{-Nitrobenzyl ester}}{RCOOCH_2C_6H_4NO_2\text{-}p} + NaX \quad (X = Cl, Br, I)$$

From an aqueous solution of the sodium salt of the acid, with the *p*-nitrobenzyl halide in ethanol
For directions and examples see Cheronis, pp 447, 448, Shriner, p 200, Vogel, p 362, Wild, pp 144 5
From an aqueous solution of the sodium salt of the acid with *p*-nitrobenzyl bromide in acetone
See F F Blicke and F D Smith, *J Amer Chem Soc*, **51**, 1947 (1929)
From the sodium or the potassium salt of the acid and *p*-nitrobenzyl bromide in 1 2 water-ethanol
See E E Reid, *J Amer Chem Soc*, **39**, 124 (1917)
From the sodium or the potassium salt of the acid and *p*-nitrobenzyl chloride or iodide in 1 2 water-ethanol
See J A Lyman and E E Reid, *J Amer Chem Soc*, **39**, 701 (1917)

p-Bromophenacyl ester *

$$RCOONa + \underset{\text{bromide}}{\underset{p\text{-Bromophenacyl}}{p\text{-}BrC_6H_4COCH_2Br}} \longrightarrow RCOOCH_2COC_6H_4Br\text{-}p + NaCl$$

$$RCOOH + \underset{\text{phenone}}{\underset{p\text{ Bromodiazoaceto-}}{p\text{-}BrC_6H_4\,COCHN_2}} \xrightarrow{CuCl_2} \underset{p\text{-Bromophenacyl ester}}{RCOOCH_2COC_6H_4Br\text{-}p} + N_2$$

From the sodium salt of the acid and *p*-bromophenacyl bromide in aqueous ethanol

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

For directions and examples see Cheronis, pp 447, 448, Linstead, p 14, Shriner, p 200, Vogel, p 362, Wild, p 146

From the sodium salt of the acid (neutralization with sodium carbonate) with *p*-bromophenacyl halide in 1 2 water-ethanol

See W L Judefind and E E Reid, *J Amer Chem Soc*, **41**, 1043 (1920)

From the sodium salt of the acid (neutralization with sodium hydroxide) with *p*-bromophenacyl bromide in 95% ethanol

See R M Hann, E E Reid and G S Jamieson, *J Amer Chem Soc*, **52**, 818 (1930), C G Moses and E E Reid, *J Amer Chem Soc*, **54**, 2101 (1930)

From the acid and *p*-bromodiazoacetophenone in dioxane in the presence of catalytic amounts of cupric chloride

See J L E Erickson, J M Dechary and M R Kesling, *J Amer Chem Soc*, **73**, 5301 (1951)

p-Phenylphenacyl ester *

$$RCOONa + \underset{\text{p Phenylphenacyl bromide}}{p\text{-}C_6H_5C_6H_4COCH_2Br} \longrightarrow RCOOCH_2COC_6H_4C_6H_5\text{-}p + NaBr$$

$$RCOOH + \underset{\substack{\text{p Phenyldiazoaceto}\\\text{phenone}}}{p\text{-}C_6H_5C_6H_4COCHN_2} \xrightarrow{CuCl_2} \underset{\text{p Phenylphenacyl ester}}{RCOOCH_2COC_6H_4C_6H_5\text{-}p} + N_2$$

From the sodium salt of the acid (neutralization with sodium carbonate) and *p*-phenylphenacyl bromide in aqueous alcohol

For directions and examples see Linstead, p 14, Vogel, p 363, N L Drake and J Bronitsky, *J Amer Chem Soc*, **52**, 3715 (1930)

From the sodium salt of the acid (neutralization with sodium hydroxide) and *p*-phenylphenacyl bromide in aqueous alcohol

See Shriner, p 200, N L Drake and J P Sweeney, *J Amer Chem Soc*, **54**, 2059 (1932)

For dibasic acids from the acid, ethylamine and *p*-phenylphenacyl bromide in aqueous ethanol

See Wild, p 147, N L Drake and J P Sweeney, *J Amer Chem Soc*, **54**, 2059 (1932)

From the acid and *p*-phenyldiazoacetophenone in dioxane in the presence of catalytic amounts of cupric chloride

See J L E Erickson, J M Dechary and M R Kesling, *J Amer Chem Soc*, **73**, 5301 (1951)

Methyl ester

$$RCOOH + CH_3OH \xrightarrow{H_2SO_4} RCOOCH_3 + H_2O$$

$$RCOOH + CH_2N_2 \longrightarrow \underset{\text{Methyl ester}}{RCOOCH_3} + N_2$$

From the acid with methanol and a catalytic amount of sulfuric acid

For directions and examples see Linstead, p 16, Vogel, p 383

From the acid and diazomethane in ether

See B Eistert, in *Newer Methods of Preparative Organic Chemistry*, Interscience, New York, 1948, p 513

Ethyl ester

$$RCOOH + C_2H_5OH \longrightarrow RCOOC_2H_5 + H_2O$$

$$RCOOAg + C_2H_5I \longrightarrow RCOOC_2H_5 + AgI$$

$$RCOOH \xrightarrow{SOCl_2} RCOCl \xrightarrow{C_2H_5OH} \underset{\text{Ethyl ester}}{RCOOC_2H_5} + HCl$$

From the acid and ethanol in the presence of a catalytic amount of sulfuric acid

For directions and examples see Vogel, pp 383, 385, 386, 387

From the silver salt of the acid with ethyl iodide

See Vogel, p 388

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

From the acid chloride and ethanol.

See: Vogel, p. 389.

NOTE: The same methods can be used for the formation of other esters.

*S-Benzylthiuronium salt.**

$$\underset{}{RCOONa} + \underset{\text{S-Benzylthiuronium chloride}}{[C_6H_5CH_2SC(NH_2)_2]^+Cl^-} \rightarrow \underset{\text{S-Benzylthiuronium salt}}{[C_6H_5CH_2SC(NH_2)_2]^+RCOO^-} + NaCl$$

From the sodium or the potassium salt of the acid and S-benzylthiuronium chloride in water.

For directions and examples see: Linstead, p. 15; Vogel, p. 36; Wild, p. 149; S. Veibel and H. Lillelund, *Bull. Soc. Chim.* [5], **5**, 1153 (1938), S. Veibel and K. Ottung, *Bull. Soc. Chim.* **6**, 1434 (1939).

From the sodium or the potassium salt of the acid in water or in aqueous ethanol with an ethanolic solution of S-benzylthiuronium chloride.

See: Cheronis, p. 449; Shriner, p. 202; J. J. Donleavy, *J. Amer. Chem. Soc.*, **58**, 1004 (1936).

Phenylhydrazide.

$$RCOOH + H_2NNHC_6H_5 \rightarrow \underset{\text{Phenylhydrazide}}{RCONHNHC_6H_5} + H_2O$$

From the acid with phenylhydrazine without solvent.

For directions and examples see: Shriner, p. 201; Wild, p. 152; G. H. Stempel and G. S. Schaffel, *J. Amer. Chem. Soc.*, **64**, 470 (1942).

From the acid with phenylhydrazine in benzene.

See: Shriner, p. 201; Wild, p. 152.

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

TABLE XIII. ORGANIC DERIVATIVES OF ACYL HALIDES

I. Acyl Fluorides (Listed in order of increasing b.p.)*

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acid		Amide	Anilide	*p*-Toluidide	2-Naphthyl amide	Miscellaneous
						B p , °C	M p , °C					
1	**Acetyl fluoride**	20-1			1 002[15]	118		82	114	147	134	
2	**Propionyl fluoride**	44 6				141		81	106	126		
3	**Fluoroacetyl fluoride**	50 5-51				167 9	31-2	108				
4	**Trichloroacetyl fluoride**	66 8				197	57 8	141	97	113		
5	***n*-Butyryl fluoride**	67				162 5		115	96	75	125	
6	**Chloroacetyl fluoride**	73 5					63	120	137	162	117 8	
7	**Phthaloyl difluoride**	224 6	42-3				206	220(*dt*)	253(*dt*)	201(*dt*)		
8	**Phenylacetyl fluoride**	88-9[17]	.				76	156	118	136	159	

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIII. ORGANIC DERIVATIVES OF ACYL HALIDES

II. Acyl Chlorides a) Liquids 1) (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	Melting point °C	n_D	Density g/ml	Acid		Amide	Anilide	*p*-Toluidide	2 Naphthyl amide	Miscellaneous
						B p , °C	M p , °C					
1	**Acetyl chloride**	51-2		1 3897^{20}	1 105$_4^{20}$	118		82	114	147	134	
2	**Oxalyl chloride**	64	−12	1 434^{13}	1 488$_4^{13\ 4}$		101 (dih-yd)	419d	246	268		
3	**Fluoroacetyl chloride**	72-3				167 9	31-2	108				
4	**Acrylyl chloride**	76		1 4343^{20}	1 114$_4^{20}$	140		85	105	141		
5	**Propionyl chloride**	80		1 4051^{20}	1 065$_4^{20}$	141		81	106	126		
6	**Isobutyryl chloride**	92		1 4079^{20}	1 017$_4^{20}$	154 5		128	105	107		
7	**Methacrylyl chloride**	95-6		1 4435		160 5	15-6	102-6				
8	**Vinylacetyl chloride**	98				163		72-3	58			
9	***n*-Butyryl chloride**	101-2		1 4121^{20}	1 028$_4^{20}$	162 5		115	96	75		
10	**Pivalyl chloride**	105-6					35	154	129	120		
11	**Dichloroacetyl chloride**	108				194		98	118	153		
12	**Chloroacetyl chloride**	108-10		1 454^{20}	1 3997$_4^{18}$	189	63	120	137	162		
13	**DL-α-Chloropropionyl chloride**	110-11		1 440^{20}	1 285$_4^{20}$	185-6		80	92	124		
14	**Methoxyacetyl chloride**	113				204		97	58			
15	**DL-Ethylmethylacetyl chloride**	115-6				176		112	110	93		
16	**Isovaleryl chloride**	115		1 4136$^{24\ 3}$	0 985$_4^{24\ 3}$	176		135	109 10	107	138 5	
17	**Acetylglycyl chloride**	115-8					206	137				Hydrazide 115 Me ester 58 9
18	**Trichloroacetyl chloride**	118		1 470^{20}	1 620$_4^{20}$	197	57 8	141	97	113		
19	**Cyclopropane carbonyl chloride**	120			1 152$_0^{20}$	186	18	125				
20	**Ethoxyacetyl chloride**	123-4				207		80 2				
21	***trans*-Crotonyl chloride**	126		1 46^{18}	1 08$_4^{20}$		72	161	118	132		
22	***n*-Pentanoyl chloride** (*n*-Valeryl chloride)	126		1 420^{20}	1 0004$_4^{20}$	186		106	63	74	112	
23	**Allylacetyl chloride**	128			1 074^{16}	188 9		94				
24	**Bromoacetyl chloride**	133-5			1 908°	208	50	91	131		134	
25	**Cyclobutane carbonyl chloride**	137 142 3				195		153				
26	**β-Methoxypropionyl chloride**	138		1 424		107^{10}		50 5				
27	**Diethylacetyl chloride**	140		1 4234		190		107				
28	**β-Chloropropionyl chloride**	144		1 455	1 331^{13}		42		119	121		
29	**Isocaproyl chloride** (4-Methylpentanoyl chloride)	147			0 9725$_4^{20}$	199		121	112	63		
30	**α-Acetoxypropionyl chloride** (O-Acetyl lactoyl chloride)	150 part d		1 4241^{17}	1 192		57 60, 40					
31	**DL-α-Bromobutyryl chloride**	150-2				217d	−4	112	98	92		
32	***n*-Hexanoyl chloride** (*n*-Caproyl chloride)	153		1 426^{20}	0 975$_4^{20}$	205		100	95	75	107	
34	**Furoyl chloride**	173 4					133-4	142-3	124	107		
35	***n*-Heptanoyl chloride** (Enanthoyl chloride)	175		1 4345^{15}	0 963$_4^{20}$	223		96	70 (65)	81	101	
36	**Hexahydrobenzoyl chloride** (Cyclohexane carboxylic acid chloride)	183 4		1 4766^{15}, 1 4711^{20}	1 096$_4^{15}$		29 30	185	143 4			
37	**3-Fluorobenzoyl chloride**	189, 204					124	130				
38	**Succinyl dichloride**	190d	20	1 473^{15}	1 395$_4^{15}$		186	260 (*di*)	230 (*di*)	255 (*di*)		
39	**4-Fluorobenzoyl chloride**	193	9				183	154 5				

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIII. ORGANIC DERIVATIVES OF ACYL HALIDES

II. Acyl Chlorides a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acid		Amide	Anilide	*p*-Toluidide	2-Naphthyl amide	Miscellaneous
						B p , °C	M p , °C					
40	***n*-Octanoyl chloride** (*n*-Capryloyl chloride)	196			$0\ 949_4^{20}$	239	16	110, 106	57	70	103	
41	**Benzoyl chloride**	197	−1	$1\ 558^{15}$	$1\ 212_4^{20}$		122	130	163	158		
42	**Diethyl malonyl dichloride**	197		$1\ 5537^{20}$	$1\ 2187_{15}^{15}$		125	224 (*dt*)				
43	**2-Fluorobenzoyl chloride**	206	4				126 5	116				
44	**Phenylacetyl chloride**	210		$1\ 533^{20}$	$1\ 1685_4^{20}$		76	156	118	136	159	
45	***n*-Nonanoyl chloride** (Pelargonyl chloride)	215			$0\ 946_4^{15}$	255	12	99	57	84	103	
46	**Glutaryl dichloride**	218		$1\ 473^{20}$	$1\ 324_4^{20}$	302	97 8	175 6 (*dt*)	224			
47	**4-Chlorobenzoyl chloride**	222	16	$1\ 579_4^{20}$	$1\ 362_4^{20}$		240	179 170	194			
48	**Hydrocinnamoyl chloride** (*β*-Phenylpropionyl chloride)	225 d			$1\ 135_{21}^{21}$		48	105	98, pet eth	135		
49	**3-Chlorobenzoyl chloride**	225					158	134	122			
50	**Phenoxyacetyl chloride**	225-6					98-9	101 5	101			
51	**4-Methylbenzoyl chloride** (4-Toluyl chloride)	225 6	−3 9	$1\ 545^{20}$	$1\ 1686_4^{20}$		179-80	160	145	160 165		
52	***n*-Decanoyl chloride**	232				268 70	31	108 98	70	78	104	
53	**2-Chlorobenzoyl chloride**	233					142	142	118	131		
54	**3-Methoxybenzoyl chloride**	242 4					110, 105					Benzylamine salt of acid, 112
55	**3-Bromobenzoyl chloride**	243, 239					155	155	136			Hydrazide, 151
56	**2-Bromobenzoyl chloride**	245	11				150	155 6	141			Hydrazide, 153
57	**2-Methoxybenzoyl chloride**	254						129	131			Phenyl ester, 59
58	**4-Methoxybenzoyl chloride** (Anisoyl chloride)	262 3 sl d	22	$1\ 58^{20}$	$1\ 261_4^{20}$		184	162 3	169, 163	186		Anisidide, 202
59	**Phthaloyl dichloride**	276	15 6	$1\ 569^{20}$	$1\ 406_4^{20}$		200 6	220 (*dt*)	253 5 (*dt*)	201 (*dt*)		
60	**3-Nitrobenzoyl chloride**	278	35				140	143	154	162		
61	**1-Naphthoyl chloride**	297 5	20				161	202				Piperidide, 85 7

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIII. ORGANIC DERIVATIVES OF ACYL HALIDES

II. Acyl Chlorides a) Liquids

2) (Reduced pressure b.p. only) (Listed in order of increasing m.p. of the corresponding amides)*

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acid		Amide	Anilide	*p*-Toluidide	2-Naphthyl amide	Miscellaneous
						B p °C	M p , °C					
1	**β-Ethoxypropionyl chloride**	78[52]				120[17]		51				
2	**Azidoacetyl chloride**	50[20]					16	58				
3	**Oleyl chloride**	163[2]					16	75 6	41	42 5		
4	**γ-Phenoxybutyryl chloride**	155[20]					64-5 60	80				
5	**γ-Phenylbutyryl chloride**	140-2[12]				290	52	84 5				
6	**ω-Undecenoyl chloride** (ω-Undecylenoyl chloride, ω-Hendecenoyl chloride)	128[14]				275	24 5	87				
7	**Benzoylformyl chloride**	125[9]					64-6	91				2,4-Dinitrophenyl-hydrazone of acid, 196 7, yel
8	**Iodoacetyl chloride**	49-52[15]			2 25[25]		83	95	143-4			
9	**β-Iodopropionyl chloride**	81[15]					82, 85	101, 142				
10	**Palmitoyl chloride**	194[17]	11-2				63	106-7	90	98	109	
11	**Myristoyl chloride**	174[16]	1-3				54, 58	107	84	93	108	
12	**Phenylpropiolyl chloride**	115-6[17]					136-7	108-9, 99 100	126	142		
13	**Dodecanoyl chloride** (Lauroyl chloride)	145[18]	-17	1 446[20]		299	44	110 102	78	87	106	
14	**α-Phenoxybutyryl chloride**	128-31[38]				258	82 3 99	111 123	93-4			Phenyl ester, 48-9
15	**Cyanoacetyl chloride**	57[0 5]					66	119 20	198-9			
16	**Nicotinyl chloride**	90[15]					235	122	85			
17	**Dibenzylacetyl chloride**	202[18]					89	129	155			
18	**α-Phenoxypropionyl chloride**	115[20]					115 6 112 3	132	117	115	117	
19	**DL-α-Bromoisovaleryl chloride**	59[15]					44	133	116	124	145	
20	**3-Ethoxybenzoyl chloride**	135-40[16]	27 8				137	139				
21	**α-Bromoisobutyryl chloride**	52[30]		1 475[23]			48 9	148	83	92 5	135	
22	**4-Isopropylbenzoyl chloride**	121[10]					256-8	153				
23	**Benzilic acid chloride** (α-Hydroxydiphenylacetyl chloride)	193 5[27]					150	154 5	175	190		Me ester 74-5
24	**1-Naphthoxyacetyl chloride**	194[10]					190	155	144			4-Phenetidide, 145 6
25	**Hexahydrophenylacetyl chloride** (Cyclohexylacetyl chloride)	98 100[23]				244-6	33	171-2				
26	**Azelayl dichloride**	166[18] 140[9]					106 5	175 (*dl*)	186-7 (*dl*)	191 (*dl*)		
27	**2-Nitrobenzoyl chloride**	148[9]	20				146	176	155			
28	**Mesaconyl dichloride** (Methylfumaryl dichloride)	64-5[14]					240 5	177 (*dl*)	186 (*dl*)	212		
29	**1-Naphthylacetyl chloride**	188[23]					131	180 1 154				
30	**2,4,6-Trimethylbenzoyl chloride**	155-6[18]		1 5263[25]	1 0967$_4^{25}$		152	188				
31	**3-Formylbenzoyl chloride**	130[20]					175	190				Me ester, 53, Semicarbazone of acid, 265
32	**4-Ethoxybenzoyl chloride**	160[20]					198	202	170			
33	**Sebacoyl dichloride**	182[16]		1 4684	1 1212$_4^{20}$		134 5	210 (*dl*)	198 (*dl*)			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIII. ORGANIC DERIVATIVES OF ACYL HALIDES

II. Acyl Chlorides a) Liquids

2) (Reduced pressure b.p. only) (Listed in order of increasing m.p. of the corresponding amides)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acid		Amide	Anilide	*p*-Toluidide	2-Naphthyl amide	Miscellaneous
						B p , °C	M p , °C					
34	**Adipyl dichloride**	130–2[18]					153	220 (*di*)	240–1	241		Di-N-methyl-amide, 152–3
35	**Benzylmalonyl dichloride**	141[15]					117d	225 (*di*)	217 (*di*)			
36	**Phenylmalonyl dichloride**	122[15]					152–3	233				Di-Me ester, 51
37	*trans*-**Aconityl trichloride** (1,2,3-Propylenetricarboxylic acid trichloride)	155–7[20]					194–5	260 (*tri*) (sinters)				
38	**Fumaryl dichloride**	63[13]		1 5004[18]	1 408$_4^{20}$		300–2	266 (*di*)	314 (*di*)			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIII. ORGANIC DERIVATIVES OF ACYL HALIDES

II. Acyl Chlorides b) Solids (Listed in order of increasing m.p.)*

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acid		Amide	Anilide	*p*-Toluidide	2 Naphthyl amide	Miscellaneous
						B p , °C	M p °C					
1	**Salicyloyl chloride**	92^{15}	19–20				158	142	136	156	189	
2	**Stearoyl chloride**	$202–3^{6}$	23				70 1	109	95	102	112	
3	**2-Iodobenzoyl chloride**		35–40, 30–1				162	184				
4	***trans*-Cinnamoyl chloride**	258	35 6	$1\ 6202^{37}$	$1\ 1632^{37}$		133	147 8	151	168		
5	**4-Bromobenzoyl chloride**	245–7	42				251 3	189–90	197			Hydrazide, 164
6	**Isophthaloyl dichloride**	276	43–4	$1\ 570^{47}$	$1\ 388^{47}_{4}$		345–7	280 (*dt*)				Di-Me ester, 68 Dihydrazide, 220
7	**2-Naphthoyl chloride**	304–6	43				184–5	192				Piperidide, 88–90
8	**2,4-Dinitrobenzoyl chloride**		46				183	203				Me ester, 70
9	**4-Formylbenzoyl chloride**	258	48				256					Me ester, 63, Phenylhydrazone of acid, 226
10	**4-Nitrophenylacetyl chloride**		48				153	198	198			
11	**2-Naphthoxyacetyl chloride**		54				156	147	145			4-Phenetidide, 164–5, Et ester, 48–9
12	**Diphenylacetyl chloride**		56–7				148	168	180	173	191 2	
13	***trans*-2-Nitrocinnamoyl chloride**		64 5				240	185				Me ester, 73
14	**3,5-Dinitrobenzoyl chloride**		68 9, 74				204 5	183	234			Me ester, 108, Et ester, 93
15	**4-Nitrobenzoyl chloride**	$150–2^{15}$	75				241	201	211	204		
16	**3-Nitrophthaloyl dichloride**		77				218	201 (*dt*)	234 (*dt*)	226 (*dt*)		
17	**Benzylidene malonyl dichloride**		77				195–6	189 (*dt*)				Di Me ester 45
18	**Fluorene-9-carboxylic acid chloride**		77				230–2	251				Me ester, 63
19	**Terephthaloyl dichloride**		83–4					>250 (*dt*)	334–7 (*dt*)			Di-1-naphthylamide, 334
20	**4-Iodobenzoyl chloride**		83 77–8				270 265	218	210			
21	**Diphenylcarbamyl chloride** (Diphenylaminoformyl chloride)		86					189				Me ester, 86, Et ester, 72, lgr
22	**2,2′-Diphenic acid dichloride**		94				228 9	212				
23	**α,α-Diphenylpropionyl chloride**		95–6				173–4	149				Benzyl ester, 71 2
24	**Phenanthrene-2-carboxylic acid chloride**		101				259 60	242 3	217–8			
25	**Phenanthrene-9-carboxylic acid chloride**		102				252	232 226	218			
26	**Diphenyl-4-carbonyl chloride** (4-Phenylbenzoyl chloride)		114–5				228	223				Me ester, 117–8, Et ester, 46
27	**Phenanthrene-3-carboxylic acid chloride**		116–7				269	233 227	216–7			
28	***trans*-4-Nitrocinnamoyl chloride**		124				286	217				Me ester, 161
29	**Fluorenone-4-carboxylic acid chloride**		128, yel				227, yel	230, 225				Oxime of acid, 263, Me ester, 132, Et ester, 103
30	**Fluorenone-1-carboxylic acid chloride**		140, yel					229–30				Oxime of acid 230 Me ester, 86 9, Et ester, 84 6

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIII. ORGANIC DERIVATIVES OF ACYL HALIDES
II. Acyl Chlorides b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acid		Amide	Anilide	*p*-Toluidide	2-Naphthyl amide	Miscellaneous
						B p , °C	M p , °C					
31	**Azobenzene-4,4'-dicarboxylic acid dichloride**		144–5, red				330d					Di-Me ester, 242, Di-Et ester, 146
32	**9, 10-Anthraquinone-2-carboxylic acid chloride**		147				290, yel	280	258–60			Me ester, 170
33	**Di-(1-naphthyl) acetyl chloride**		167–9				228 5					
34	**9, 10-Anthraquinone-2,6-dicarboxylic acid dichloride**		197–8				>400	>370				
35	**9,10-Anthraquinone-1,4-dicarboxylic acid dichloride**		203–5				>300					
36	**9,10-Anthraquinone-1,5-dicarboxylic acid dichloride**		260–3				>390					Di-Me ester, 236, Di-Et ester, 155, yel

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIII. ORGANIC DERIVATIVES OF ACYL HALIDES

III. Acyl Bromides a) Liquids 1) (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point °C	Melting point °C	n_D	Density g/ml	Acid		Amide	Anilide	*p* Toluidide	2-Naphthyl amide	Miscellaneous
						B p , °C	M p °C					
1	**Oxalyl dibromide**	64					101 (hyd)	419d (*d*ı)	254 (*d*ı)	268 (*d*ı)		
2	**Acetyl bromide**	81		1 4538[16]	1 6625$^{16}_{4}$	118		82	114	147	132	
3	**Propionyl bromide**	103				141		81	106	126		
4	**Chloroacetyl bromide**	127					63	120	137	162	117–8	
5	***n*-Butyryl bromide**	128				162 5		115	96	75	125	
6	**Isovaleryl bromide**	138–40				176		135		107	138 5	
7	**Trichloroacetyl bromide**	143			1 90$^{15}_{15}$	197	57–8	162 5	95–7	113		4-Nitroanilide, 146–7
8	**Bromoacetyl bromide**	150			2 425	208	50	91	131		134	
9	**DL-α-Bromopropionyl bromide**	154–5			2 061$^{16}_{4}$	204	25 7	123	99, 110			
10	**α-Bromoisobutyryl bromide**	162–4				198–200	48 9	148	83	92 5	135	
11	**DL-α-Bromobutyryl bromide**	172 4				127[25]	–4	112, 108				
12	***n*-Hexanoyl bromide** (*n*-Caproyl bromide)	175–6				?05		100	95	75	107	
13	**DL-α-Bromoisovaleryl bromide**	184–94					44	133	116	124	145	
14	**Benzoyl bromide**	218–9			1 570[15]		122	130	163	158		

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIII. ORGANIC DERIVATIVES OF ACYL HALIDES

III. Acyl Bromides a) Liquids

2) (Reduced pressure b.p. only) (Listed in order of increasing m.p. of the corresponding amides)*

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acid		Amide	Anilide	p-Toluidide	2 Naphthyl amide	Miscellaneous
						B p , °C	M p , °C					
1	**3-Methylbenzoyl bromide**	137[52]					111	94 97	126	118		
2	***n*-Pentanoyl bromide** (*n*-Valeryl bromide)	64[66]				186 5		106	63	74		
3	**3-Chlorobenzoyl bromide**	145[40]					158, 155	134	122			
4	**2-Chlorobenzoyl bromide**	144[37]					140	142	114, 118	131		
5	**2-Methylbenzoyl bromide**	135[37]					104 5	143	125	144		
6	**2-Bromobenzoyl bromide**	167[18]					150	155	141			
7	**Phenylacetyl bromide**	150–5[50]					76	156	117–8	135–6	159	
8	**4-Methylbenzoyl bromide**	147[42]					179–80	160	145 148	160, 165		
9	**4-Methoxybenzoyl bromide**	185[27]					184–6	167, 163	169–71	186		
10	**4-Chlorobenzoyl bromide**	142[27]					240	179, 170	194			
11	**4-Bromobenzoyl bromide**	136[18]					251	189	197			
12	**Succinyl dibromide**	105–6[13]					186	260 (*d*)	230 (*d*)	255 (*d*)		

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIII. ORGANIC DERIVATIVES OF ACYL HALIDES

III. Acyl Bromides b) Solids (Listed in order of increasing m.p.)*

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acid		Amide	Anilide	*p*-Toluidide	2-Naphthyl amide	Miscellaneous
						B p , °C	M p , °C					
1	**3-Nitrobenzoyl bromide**		43				140	143	154	162		
2	***trans*-Cinnamoyl bromide**		48				133	148	151, 153	168		
3	**4-Iodobenzoyl bromide**		55				270, 265	217	210			
4	**3,5-Dinitrobenzoyl bromide**		60				204–5	183	234			
5	**4-Nitrobenzoyl bromide**		64				241	201, 198	211	203		
6	**Phthaloyl dibromide**		80				206	220 (*d*)	253 (*d*)	201 (*d*)		

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIII. ORGANIC DERIVATIVES OF ACYL HALIDES

IV. Acyl Iodides. Liquids 1) (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acid		Amide	Anilide	*p*-Toluidide	2-Naphthyl amide	Miscellaneous
						B p , °C	M p , °C					
1	**Acetyl iodide**	108			1 98[17]	118		82	114	147	134	
2	**Propionyl iodide**	127				141		81	106 103	126		
3	***n*-Butyryl iodide**	146–8				162 5		115	96	75	125	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIII. ORGANIC DERIVATIVES OF ACYL HALIDES

IV. Acyl Iodides. Liquids

2) (Reduced pressure b.p. only) (Listed in order of increasing m.p. of the corresponding amides)*

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acid		Amide	Anilide	*p*-Toluidide	2-Naphthyl amide	Miscellaneous
						B p , °C	M p , °C					
1	**Dichloroacetyl iodide**	55[15]		1 5754		194		98	118	153		
2	**Chloroacetyl iodide**	37[4]		1 5903			63	120	137, 134	162	117-8	
3	**Benzoyl iodide**	109[10]					122	130	163	158		
4	**Trichloroacetyl iodide**	74[30]		1 5711		197	57-8	141	97 94	113		

*Derivative data given in order m p , crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLES XII, XIII AND XIV

The derivatives of three classes of compounds (carboxylic acids, acyl halides and acid anhydrides) are essentially the same as those of carboxylic acids, and are prepared either directly from the acid or *via* the acyl halide All of them appear therefore under the same title

Hydrolysis of acid halide or acid anhydride to the corresponding carboxylic acid

$$RCOCl + H_2O \longrightarrow \underset{\text{Acid}}{RCOOH} + HCl$$

$$(RCO)_2O + H_2O \xrightarrow{NaOH} 2RCOONa \xrightarrow{H^+} \underset{\text{Acid}}{RCOOH}$$

From the acyl halide in water
For directions and examples see Wild, p 180
From the acyl halide with aqueous sodium hydroxide
See Vogel, p 369, Wild, p 180
From the acid anhydride with water
See Vogel, p 376, Wild, p 184, A C D Rivett and N V Sidgwick, *J Chem Soc*, **97**, 1677 (1910)
From the acid anhydride with aqueous sodium hydroxide
See Linstead, pp 16 7 Wild, p 184

Amide *

$$RCOOH \xrightarrow{SOCl_2} \underset{\substack{\text{Acid}\\\text{chloride}}}{RCOCl} \xrightarrow{NH_3} RCONH_2 + NH_4Cl$$

$$RCOOH + NH_3 \longrightarrow RCONH_2$$

$$(RCO)_2O + NH_3 \longrightarrow \underset{\text{Amide}}{RCONH_2}$$

Acid chloride is prepared from the acid and thionyl chloride Amide is formed on addition of aqueous ammonia
For directions and examples see Cheronis, p 440, Shriner, p 200, Vogel, p 361, Wild, p 181
From the acid chloride in benzene with aqueous ammonia
See D Swern, J M Stutzman and E T Roe, *J Amer Chem Soc*, **71**, 3017 (1942)
By passing gaseous ammonia through a benzene or ether solution of the acyl chloride
See Linstead, p 14, Wild, p 182
From the neat acid with gaseous ammonia
See J A Mitchell and E E Reid, *J Amer Chem Soc*, **53**, 1879 (1931)
From the acid anhydride with aqueous ammonia
See Wild, p 184, 185

Anilide *

$$RCOOH \xrightarrow{SOCl_2} RCOCl \xrightarrow{C_6H_5NH_2} RCONHC_6H_5 + C_6H_5NH_3^+Cl^-$$

$$RCOOH + C_6H_5NH_2 \longrightarrow RCONHC_6H_5 + H_2O$$

$$(RCO)_2O + C_6H_5NH_2 \longrightarrow \underset{\text{Anilide}}{RCONHC_6H_5} + C_6H_5NH_3^+RCOO^-$$

From the acid chloride (prepared from the acid and thionyl chloride) and aniline in benzene or in ether
For directions and examples see Cheronis, p 445, Linstead, p 14, Shriner, pp 98, 200–1, Vogel, pp 361, 369, 458, Wild, p 182, P W Robertson, *J Chem Soc*, **115**, 1210 (1919)
From the acid chloride with aniline in aqueous sodium hydroxide
See Wild, pp 181, 219
From the acid and aniline at high temperatures
See Vogel, p 362

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

From the sodium salt of the acid with aniline and concentrated hydrochloric acid
See Shriner, p 201, Wild, p 154
From the acid anhydride with aniline without solvent
See Linstead, p 17, Vogel, p 377, Wild, p 185
From the acid anhydride with aniline in benzene
See Linstead, p 15, Wild, p 185

p-Toluidide *

$$RCOOH \xrightarrow{SOCl_2} RCOCl \xrightarrow{p\text{-}CH_3C_6H_4NH_2} RCONHC_6H_4CH_3\text{-}p + p\text{-}CH_3C_6H_4NH_3^+Cl^-$$

$$RCOOH + p\text{-}CH_3C_6H_4NH_2 \longrightarrow RCONHC_6H_4CH_3\text{-}p + H_2O$$

$$(RCO)_2O + p\text{-}CH_3C_6H_4NH_2 \longrightarrow RCONHC_6H_4CH_3\text{-}p + p\text{-}CH_3C_6H_4NH_3^+RCOO^-$$

From the acid chloride with *p*-toluidine in ether or benzene
For directions and examples see Cheronis, pp 441, 444, 458, Linstead, p 14, Shriner, pp 200-1, Vogel, p 361
From the acid and *p*-toluidine at high temperatures
See Cheronis, pp 441, 442-3, Vogel, p 362
From the sodium salt of the acid, *p*-toluidine and concentrated hydrochloric acid
See Shriner, p 201, Wild, p 154
From the acid anhydride with *p*-toluidine without solvent
See Cheronis, p 459, Linstead, p 17
From the acid anhydride with *p*-toluidine in benzene
See Wild, p 185

1- and 2-Naphthylamide *

$$RCOOH \xrightarrow{SOCl_2} RCOCl \xrightarrow{1\text{- or }2\ C_{10}H_7NH_2} \underset{\text{Naphthylamide (1 or 2-)}}{RCONHC_{10}H_7} + C_{10}H_7NH_3^+Cl^-$$

From the acid chloride with the naphthylamine
For directions and examples see Cheronis, p 446, P W Robertson, *J Chem Soc*, **115**, 1210 (1919)

p-Nitrobenzyl ester *

$$RCOONa + p\text{-}NO_2C_6H_4CH_2X \rightarrow \underset{p\text{-Nitrobenzyl ester}}{RCOOCH_2C_6H_4NO_2\text{-}p} + NaX \quad (X = Cl, Br, I)$$

From an aqueous solution of the sodium salt of the acid, with the *p*-nitrobenzyl halide in ethanol
For directions and examples see Cheronis, pp 447, 448, Shriner, p 200, Vogel, p 362, Wild, pp 144 5
From an aqueous solution of the sodium salt of the acid with *p*-nitrobenzyl bromide in acetone
See F F Blicke and F D Smith, *J Amer Chem Soc*, **51**, 1947 (1929)
From the sodium or the potassium salt of the acid and *p*-nitrobenzyl bromide in 1 2 water-ethanol
See E E Reid, *J Amer Chem Soc*, **39**, 124 (1917)
From the sodium or the potassium salt of the acid and *p*-nitrobenzyl chloride or iodide in 1 2 water-ethanol
See J A Lyman and E E Reid, *J Amer Chem Soc*, **39**, 701 (1917)

p-Bromophenacyl ester *

$$RCOONa + \underset{\text{bromide}}{\underset{p\text{-Bromophenacyl}}{p\text{-}BrC_6H_4COCH_2Br}} \longrightarrow RCOOCH_2COC_6H_4Br\text{-}p + NaCl$$

$$RCOOH + \underset{\text{phenone}}{\underset{p\text{ Bromodiazoaceto-}}{p\text{-}BrC_6H_4\,COCHN_2}} \xrightarrow{CuCl_2} \underset{p\text{-Bromophenacyl ester}}{RCOOCH_2COC_6H_4Br\text{-}p} + N_2$$

From the sodium salt of the acid and *p*-bromophenacyl bromide in aqueous ethanol

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

For directions and examples see Cheronis, pp 447, 448, Linstead, p 14, Shriner, p 200, Vogel, p 362, Wild, p 146

From the sodium salt of the acid (neutralization with sodium carbonate) with *p*-bromophenacyl halide in 1 2 water-ethanol

See W L Judefind and E E Reid, *J Amer Chem Soc*, **41**, 1043 (1920)

From the sodium salt of the acid (neutralization with sodium hydroxide) with *p*-bromophenacyl bromide in 95% ethanol

See R M Hann, E E Reid and G S Jamieson, *J Amer Chem Soc*, **52**, 818 (1930), C G Moses and E E Reid, *J Amer Chem Soc*, **54**, 2101 (1930)

From the acid and *p*-bromodiazoacetophenone in dioxane in the presence of catalytic amounts of cupric chloride

See J L E Erickson, J M Dechary and M R Kesling, *J Amer Chem Soc*, **73**, 5301 (1951)

p-Phenylphenacyl ester *

$$RCOONa + \underset{\text{p Phenylphenacyl bromide}}{p\text{-}C_6H_5C_6H_4COCH_2Br} \longrightarrow RCOOCH_2COC_6H_4C_6H_5\text{-}p + NaBr$$

$$RCOOH + \underset{\substack{\text{p Phenyldiazoaceto}\\\text{phenone}}}{p\text{-}C_6H_5C_6H_4COCHN_2} \xrightarrow{CuCl_2} \underset{\text{p Phenylphenacyl ester}}{RCOOCH_2COC_6H_4C_6H_5\text{-}p} + N_2$$

From the sodium salt of the acid (neutralization with sodium carbonate) and *p*-phenylphenacyl bromide in aqueous alcohol

For directions and examples see Linstead, p 14, Vogel, p 363, N L Drake and J Bronitsky, *J Amer Chem Soc*, **52**, 3715 (1930)

From the sodium salt of the acid (neutralization with sodium hydroxide) and *p*-phenylphenacyl bromide in aqueous alcohol

See Shriner, p 200, N L Drake and J P Sweeney, *J Amer Chem Soc*, **54**, 2059 (1932)

For dibasic acids from the acid, ethylamine and *p*-phenylphenacyl bromide in aqueous ethanol

See Wild, p 147, N L Drake and J P Sweeney, *J Amer Chem Soc*, **54**, 2059 (1932)

From the acid and *p*-phenyldiazoacetophenone in dioxane in the presence of catalytic amounts of cupric chloride

See J L E Erickson, J M Dechary and M R Kesling, *J Amer Chem Soc*, **73**, 5301 (1951)

Methyl ester

$$RCOOH + CH_3OH \xrightarrow{H_2SO_4} RCOOCH_3 + H_2O$$

$$RCOOH + CH_2N_2 \longrightarrow \underset{\text{Methyl ester}}{RCOOCH_3} + N_2$$

From the acid with methanol and a catalytic amount of sulfuric acid

For directions and examples see Linstead, p 16, Vogel, p 383

From the acid and diazomethane in ether

See B Eistert, in *Newer Methods of Preparative Organic Chemistry*, Interscience, New York, 1948, p 513

Ethyl ester

$$RCOOH + C_2H_5OH \longrightarrow RCOOC_2H_5 + H_2O$$

$$RCOOAg + C_2H_5I \longrightarrow RCOOC_2H_5 + AgI$$

$$RCOOH \xrightarrow{SOCl_2} RCOCl \xrightarrow{C_2H_5OH} \underset{\text{Ethyl ester}}{RCOOC_2H_5} + HCl$$

From the acid and ethanol in the presence of a catalytic amount of sulfuric acid

For directions and examples see Vogel, pp 383, 385, 386, 387

From the silver salt of the acid with ethyl iodide

See Vogel, p 388

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

From the acid chloride and ethanol.

See: Vogel, p. 389.

NOTE: The same methods can be used for the formation of other esters.

*S-Benzylthiuronium salt.**

$$\underset{}{RCOONa} + \underset{\text{S-Benzylthiuronium chloride}}{[C_6H_5CH_2SC(NH_2)_2]^+Cl^-} \rightarrow \underset{\text{S-Benzylthiuronium salt}}{[C_6H_5CH_2SC(NH_2)_2]^+RCOO^-} + NaCl$$

From the sodium or the potassium salt of the acid and S-benzylthiuronium chloride in water.

For directions and examples see: Linstead, p. 15; Vogel, p. 36; Wild, p. 149; S. Veibel and H. Lillelund, *Bull. Soc. Chim.* [5], **5**, 1153 (1938), S. Veibel and K. Ottung, *Bull. Soc. Chim.* **6**, 1434 (1939).

From the sodium or the potassium salt of the acid in water or in aqueous ethanol with an ethanolic solution of S-benzylthiuronium chloride.

See: Cheronis, p. 449; Shriner, p. 202; J. J. Donleavy, *J. Amer. Chem. Soc.*, **58**, 1004 (1936).

Phenylhydrazide.

$$RCOOH + H_2NNHC_6H_5 \rightarrow \underset{\text{Phenylhydrazide}}{RCONHNHC_6H_5} + H_2O$$

From the acid with phenylhydrazine without solvent.

For directions and examples see: Shriner, p. 201; Wild, p. 152; G. H. Stempel and G. S. Schaffel, *J. Amer. Chem. Soc.*, **64**, 470 (1942).

From the acid with phenylhydrazine in benzene.

See: Shriner, p. 201; Wild, p. 152.

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

TABLE XIV. ORGANIC DERIVATIVES OF ACID ANHYDRIDES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)*

No	Acid anhydride	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acid		Amide	Anilide	*p*-Toluidide	2-Naphthylamide	Miscellaneous
						B P	M P					
1	**Trifluoroacetic**	39		$1\ 269^{25}$	$1\ 490_4^{25}$	72		75	88			
2	**Perfluoropropionic**	72		$1\ 273^{25}$	$1\ 571_4^{25}$	96		95				
3	**Perfluoro-*n*-butyric**	108		$1\ 285^{20}$	$1\ 665^{20}$	120		105	93			
4	**Acetic**	140	−73	$1\ 3904^{20}$	$1\ 0811^{20}$	118	16	82	114	153		
5	***n*-Propionic**	167	−45	$1\ 404^{20}$	$1\ 017^{15}$	141		81	106	126 (124)		
6	**Perfluoro-*n*-caproic** (Perfluoro-*n*-hexanoic)	176		$1\ 295^{20}$	$1\ 769_4^{25}$	157		117				
7	**Isobutyric**	182			$0\ 957^{17}$	154		128	105	107		
8	**Pivalic** (Trimethylacetic)	190				164	35	154	129	120		
9	***n*-Butyric**	198			$0\ 978^{15}$	162		115	96	75 (73)	125	
10	**Citraconic** (Methylmaleic)	214	7–8	$1\ 471^{21.5}$	$1\ 238_4^{25}$		92d	185–7 (*di*)	175 (*di*)			
11	**Isovaleric**	215				176		135 (137)		107	138	
12	**Dichloroacetic**	216d				194		98	118	153		
13	**Valeric** (Pentanoic)	218			$0\ 922_4^{17}$	186		106	63	74	112	
14	**Crotonic**	248		$1\ 4745^{20}$	$1\ 0397_4^{20}$	189	72	161 (158)	118 (115)	132		
15	**Caproic** (*n*-Hexanoic)	254–7 (245)		$1\ 4297^{20}$	$0\ 92_4^{20}$	205		100	95 (92)	75 (73)	107	
16	***n*-Heptanoic**	258		$1\ 4335^{15}$	$0\ 9175_4^{20}$	223		96	70 (65)	81	101	
17	**α-Methylglutaric**	272–5					79		175 6 (*di*) *mono* (2 forms) 114 or 100	174 5 (*di*) *mono* (2 forms) 126 or 98–9	227–8 (*di*), 115–9 (*mono*)	
18	**Caprylic** (*n*-Octanoic)	280–5	−1	$1\ 436^{17}$	$0\ 9065_4^{17}$	239	16	110 (106)	57 (55)	70	103	
19	***cis*-Hexahydroisophthalic**	304					187 9		298–9 (*di*)			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIV. ORGANIC DERIVATIVES OF ACID ANHYDRIDES

a) Liquids 2) (Reduced pressure b.p. only) (Listed in order of increasing m.p. of the corresponding amide derivative)*

No.	Acid anhydride	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acid		Amide	Anilide	*p*-Toluidide	2-Naphthyl-amide	Miscellaneous
						B.P.	M.P.					
1	**DL-α-Bromobutyric**.....	148–52[10]	.....	.....	.....	127[25]	−4	112	.....	.....	.....	4-Nitrophenyl ester, 48-9; 2-Naphthyl ester, 54
2	**DL-α-Bromopropionic**.....	120[5] (123–4[10])	.....	.....	.....	204	26	123	.....	.....	.....	.....

* Derivative data given in order: m.p., crystal color, solvent from which crystallized.

TABLE XIV. ORGANIC DERIVATIVES OF ACID ANHYDRIDES

b) Solids (Listed in order of increasing m.p.)*

No	Acid anhydride	Melting point, °C	Boiling point, °C	Acid		Amide	Anilide	*p*-Toluidide	2 Naphthylamide	Miscellaneous
				B P	M P					
1	**Oleic**	22			16	76	41	43	169	
2	**Capric** (*n*-Decanoic)	24		268 70	31	108, 98	70	78	104	D_D^{20} 0 8596, n_D^{20} 1 4234
3	**β-Ethyl-β-methylglutaric**	25	185[20]		87		105 (*mono*)			1-Naphthylamide, 126
4	**Hexahydrobenzoic**	25	280-3	232	29-30	185-6				
5	**α,α-Dimethylsuccinic** (*unsym* - Dimethylsuccinic)	29	220		141					α-Me ester, 41 β Me ester, 52, Anil, 87
6	***cis*-Hexahydrophthalic**	32	145[18]		192					Conc HCl at 180 → *trans* form, 221
7	**DL-Methylsuccinic**	37	244-8		115 (112)	225 (*dl*)	123, chl (*mono*), 159 et, ac, (*mono*)	164 (*mono*)	155 (*mono*)	Anil, 109-10
8	***n*-Undecanoic** (*n*-Hendecanoic)	37		284	30	103, 99	71	80		
9	**2-Methylbenzoic** (*o*-Toluic)	39			104 5	143	125	144		
10	**β-Methylglutaric**	41	276-8		87		200 (*dl*) 121 (117) (*mono*)	*mono* 135	143 (*mono*)	
11	**Bromoacetic**	41-2		208	50	91	131		134	
12	**Lauric** (*n*-Dodecanoic)	42		299	44 (42)	110, 100	78	87	106	
13	**Benzoic**	42	360		122	130	163	158		
14	***trans*-α,β-Dimethylsuccinic**	43			198 (208)	238 (*dl*) 165 7 (*mono*)				Imide, 78
15	**Iodoacetic**	46			83	95	143 4			
16	**Chloroacetic**	46		189	63	121	134	162	117-8	
17	***n*-Tridecanoic**	50		312	44	100	80	88		
18	**DL-Phenylsuccinic**	54	204-6[22]		168	209 10 (*dl*) 158-9 (α) 144 5 (β-)	222 (*dl*) 175 (α-) 170-1 (β-)	175 (α-) 168 9 (β-)		Imide, 90
19	**Myristic** (*n*-Tetradecanoic)	54		202[16]	54	107,103	84	93	108	D_4^{70} 0 8502, n_D^{70} 1 4335
20	**Glutaric**	56		200[20]	97	*dl* 175 6	224	218		
21	**Maleic**	56, 52-4	198		130	181 (172) (*mono*) 266 (*dl*)	173-5 (*mono*) 187 (*dl*)	*dl* 142		
22	**Suberic** (*dimer*) (Octanedioic)	56-7			144 (141)	127 (*mono*) 217 (*dl*)	128 (*mono*) 186 (*dl*)	*dl* 218		
23	**α-Bromoisobutyric**	63-5		198-200	48-9	148	83	92	135	1-Naphthylamide, 116
24	**Palmitic** (*n*-Hexadecanoic)	64		222[16]	63	106 7	90	98	109	D_4^{70} 0 847, n_D^{70} 1 4357
25	**Margaric** (*n*-Heptadecanoic)	67		231[16]	61	108				
26	**Itaconic** (Methylenesuccinic)	67-8			165	*dl* 192	190, 185			
27	**Sebacic** (*dimer*) (Decanedioic)	68		243[15]	133	210 (*dl*) 170 (*mono*)	201 (*dl*), 122 (*mono*)	201		
28	**Stearic** (*n*-Octadecanoic)	70			70	109	95	102	112	
29	**3-Methylbenzoic** (*m*-Toluic)	71			111 3	94	126	118		Hydrazide, 97
30	**Phenylacetic**	72			76-7	156	118	136	159	
31	**2-Bromobenzoic**	75-6			150	155 6				Hydrazide, 153
32	**Arachidic** (*n*-Eicosanoic)	77-8			77	108-9	92	96	112	
33	**2-Chlorobenzoic**	79			142, 140	142	114, 118	131		
34	***cis*-α-Methylglutaconic**	85			118		148 (*mono*)			
35	***cis*-β-Methylglutaconic**	86			147-9		143 (*mono*)			Mono-Et ester, 73
36	***cis*-α,β-Dimethylsuccinic**	87			129,122	148 9 (*mono*) 244 (*dl*)	222 (*dl*)			Imide, 111, 101, Anil, 146
37	**3,5-Dichlorophthalic**	89			164					Imide, 208, N-Phenylimide, 150
38	**4-Methylphthalic**	92	295		152	188 (*dl*)				Imide, 196
39	**3-Chlorobenzoic**	95			158, 155	134	122			
40	**4-Methylbenzoic** (*p*-Toluic)	95			179 80	160	145	160		
41	**Diphenylacetic**	98			148	167-8	180			Me ester, 60

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIV. ORGANIC DERIVATIVES OF ACID ANHYDRIDES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Acid anhydride	Melting point, °C	Boiling point, °C	Acid		Amide	Anilide	*p*-Toluidide	2-Naphthylamide	Miscellaneous
				B P	M P					
42	**4-Chlorophthalic**	99			157					Imide, 210-11, Di-Me ester, 37, Anil, 174
43	**Anisic** (4-Methoxybenzoic)	99			184-6	167, 163	169 71	186		
44	**DL-Benzylsuccinic**	102			161					Imide, 97 8, Dihydrazide, 146
45	**β-Phenylglutaric**	105			140		171 (168) (*mono*)	154 (*mono*)		Imide, 174, Di-Me ester, 86-7
46	**4-Ethoxybenzoic**	108			198	202	170			Hydrazide, 124
47	**α-Benzylcinnamic**	108-9			158					Me ester, b p 278, Et ester, 38-9
48	**3,5-Dinitrobenzoic**	109			204-5	183	234			
49	**4-Bromophthalic**	113 109			173-5, 166					Di-Me ester, 40
50	**3-Methylphthalic**	114-5, 110			157					Imide, 189-90
51	**4-Nitrophthalic**	119			165	200d	192	*mono* 172		
52	**Succinic**	120	261		186	157 (*mono*), 260 (*di*)	148 (*mono*) 230 (*di*)	180 (*mono*) 255 (*di*)		
53	**Nicotinic** (3-Pyridine-carboxylic)	123			237 8	128	85	150		
54	**3-Chlorophthalic**	124 5			186					Imide, 118 20 (sealed tube)
55	**4-Iodophthalic**	125-6			182, 185					Imide, 224-4
56	**3,4-Dimethylphthalic**	126			201					Imide, 240-1, Methylimide, 98 9
57	**3-Bromophthalic**	132-4			188, 178					Mono-Et ester, 127 8
58	**Phthalic**	132			206, 200	149 (*mono*) 220 (*di*)	170 (*mono*) 253-5 (*di*)	*mono* 160		
59	**3-Iodobenzoic**	134			187	187				Me ester, 54-5
60	**2-Naphthoic** (β-Naphthoic)	135			184	192-3	171-2	192		
61	**2-Nitrobenzoic**	135			146	176	155			
62	**Cinnamic**	136			133	148	151, 153	168		
63	*trans*-**DL-Hexahydrophthalic acid**	140			221	*mono* 196				Mono-Me ester, 96, Di-Me ester, 33
64	**Homophthalic** (2-Carboxy-phenylacetic)	141			180-1	230 (2-), 185 (α-)	231			α-Me ester 96 8 2-Me ester, 143 5, α-Et ester, 107 8, Imide, 233
65	**1-Naphthoic** (α-Naphthoic)	146			162	202	163			Piperidide, 85-7
66	**3-Bromobenzoic**	148-9			155	155				Hydrazide, 151
67	**3-Iodophthalic**	159 61			206					Di-Me, ester, 89, Di-Et ester, 70, Imide, 238
68	**2,4-Dinitrobenzoic**	160			183	203				
69	**3-Nitrobenzoic**	160, 163			140	143	154	162		
70	**3-Nitrophthalic**	162			218	201 (*di*)	234 (*di*)	226 (*di*)		
71	**3,5-Dinitrophthalic**	163-4, 161			226					Et ester, 187, Di-Et ester, 73
72	**4,5-Dichlorophthalic**	188	313		200, 188					Mono-Et ester, 133 4
73	**4-Nitrobenzoic**	189			241	201, 198	211, 204	204, 192		
74	**4-Chlorobenzoic**	194			240	179, 170	194			
75	**3,6-Dichlorophthalic**	194-5	339		194-5					Mono-Et ester, 130 1 Di-Et ester, 60, Imide, 242, Anil, 191
76	**3,4-Di-iodophthalic**	198			212-3					Anil, 270
77	**β-Phenylglutaconic**	206			154-5	138 (*mono*)	174 (*mono*)	184 (*mono*)		Mono-Et ester, 78, Imide, 256-7
78	**4,5-Dimethylphthalic**	208			123,196					Methylimide, 150, Ethylimide, 89

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIV. ORGANIC DERIVATIVES OF ACID ANHYDRIDES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Acid anhydride	Melting point, °C	Boiling point, °C	Acid		Amide	Anilide	*p*-Toluidide	2-Naphthylamide	Miscellaneous
				BP	MP					
79	**2,2'-Diphenic**	217			229	191 (*mono*) 212 (*di*)	176 (*mono*) 230 (*di*)			H_2SO_4 at 100-120 → Fluorenone-4-carboxylic acid, 227
80	**4-Bromobenzoic**	218			251	189	197			
81	**D-Camphoric**	221			188	177 (*mono*) 193 (*di*)	209 (204) (*mono*), 226 (*di*)	α 212-4, β 190-6		
82	**4-Iodobenzoic**	228			270, 267	217 8				Me ester, 114
83	**Tetrachlorophthalic**	256, 249			250 d					Mono-Me ester, 142, Mono-Et ester, 94 5, Imide, 338-9, 2-Naphthylimide, 287, Anil, 268-9
84	**1,8-Naphthalenedicarboxylic**	274			274		250 82 (*di*)			Heat with aq NH_3 → 1,8-Naphthalimide, 300 N-Phenylimide, 202 Di-Me ester, 102 3
85	**Tetrabromophthalic**	280			266					Mono-Me ester, 267, Imide, > 380, yel , Anil, 279-80, *p*-Tolil, 280, 2-Naphthylimide, 306-8
86	**Tetraiodophthalic**	318, 325, yel			324 7					Mono-Me ester, 298

*Derivative data given in order m p , crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLE XV

Hydrolysis of amide or imide to the corresponding carboxylic acid and amine *

$$RCONHR' + H_2O + HCl \rightarrow \underset{\text{Acid}}{RCOOH} + NH_3R'^+Cl^- \xrightarrow{OH^-} NH_2R'$$

Amine

$$RCONHR' + NaOH \rightarrow RCOONa \xrightarrow{H^+} \underset{\text{Acid}}{RCOOH} + \underset{\text{Amine}}{NH_2R'}$$

From the amide with aqueous hydrochloric acid

For directions and examples see Cheronis, pp 607, 608, Vogel, pp 404, 808

From the amide with 85% or 100% phosphoric acid

See Cheronis, p 609, G Berger and S C J Olivier, *Rec Trav chim*, **46**, 600 (1927), W M Dehn and K E Jackson, *J Amer Chem Soc*, **55**, 4284 (1933)

From the amide with 70% sulfuric acid

See Wild, p 193

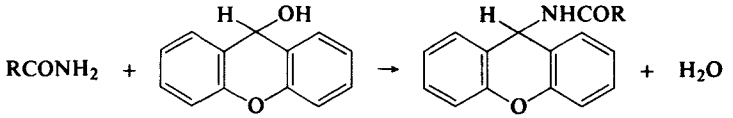
From the amide with aqueous sodium hydroxide

See Cheronis, p 609, Vogel, pp 404, 799, Wild, p 193

NOTE For directions and examples for preparation of derivatives of carboxylic acids formed on hydrolysis of amides and imides see explanations and references to Tables XII, XIII and XIV, p 186, 187, 188, 189

For directions and examples for preparation of derivatives of amines formed on hydrolysis of amides and imides see explanations and references to Table XVIII, p 291, 292, 293, 294

N-Xanthylamides *



N-Xanthylamide

From the amide with xanthydrol in glacial acetic acid

For directions and examples see Cheronis, p 610, Linstead, p 66, Shriner, p 222, Vogel, p 405, Wild, p 195, R F Phillips and B M Pitt, *J Amer Chem Soc*, **65**, 1355 (1943), W Andriani, *Rec Trav chim*, **35**, 180 (1916)

From the amide with xanthydrol in ethanol-water-acetic acid mixture

See Shriner, p 222, Wild, p 195, R F Phillips and B M Pitt, *J Amer Chem Soc*, **65**, 1355 (1943)

Hg salt (Hg derivative) *

$$RCONH_2 + HgO \rightarrow \underset{\text{Mercuric salt}}{(RCONH)_2Hg} + H_2O$$

From the amide with mercuric oxide in methanol or ethanol

For directions and examples see Cheronis, pp 610, 611, Wild, p 197, J W Williams, W T Rainey and R S Leopold, *J Amer Chem Soc*, **64**, 1738 (1942)

From the amide with mercuric oxide in water

See Vogel, p 405

From the amide with yellow mercuric oxide without solvent

See Cheronis, p 611, Wild, p 196, J W Williams, W T Rainey and R S Leopold, *J Amer Chem Soc*, **64**, 1738 (1942)

Oxalate

$$RCONH_2 + (COOH)_2 \rightarrow \underset{\text{Amide oxalate}}{RCONH_2 \cdot (COOH)_2}$$

From the amide with anhydrous oxalic acid in the presence of ethyl acetate

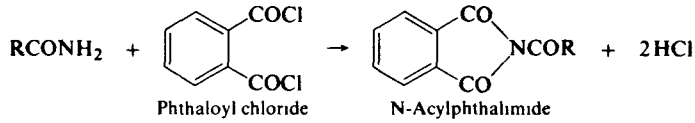
*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

EXPLANATIONS AND REFERENCES TO TABLE XV (Continued)

For directions and examples see: Cheronis, p. 611; Wild, p. 196; C. A. MacKenzie and W. T. Rawles, *Ind. Eng. Chem., Anal. Ed.*, **12**, 737 (1940).

N-Acylphthalimide (Phthalimide derivative).



From the amide with phthaloyl chloride in toluene or without solvent.

For directions and examples see: Cheronis, p. 611; T. W. Evans and W. M. Dehn, *J. Amer. Chem. Soc.*, **51**, 3651 (1929).

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

a) Liquids (Listed in order of increasing b.p.)*

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Derived acid				Derived amine				Miscellaneous
						M P , °C	B P , °C	*p*-Nitro benzyl ester	*p*-Bromo-phenacyl ester	M P , °C	B P , °C	Acet-amide	Benz-amide	
1	**N,N-Dimethylformamide**	153, 76[39]	−61	1 42938[22 4]	0 9484[22 4]	8 4	100 7	31	140, 135		7		41	
2	**N,N-Diethylformamide**	176–8, 68[15]			0 908[16]	8 4	100 7	31	140, 135		56		42	
3	**N-Methylformamide**	180–5, 131[90]	−3 8, −5 4	1 4310[25]	1 011[19]	8 4	100 7	31	140, 135		−6	28	80	
4	**Formamide**	193, 195d	2 55			8 4	100 7	31	140, 135		NH_3			Xanthyl deriv , 184, Oxalate, 107 4 7 7
5	**N-Ethylformamide**	197 9			0 952[21]	8 4	100 7	31	140, 135		16 5, 19		71	
6	**N-Formylpiperidine** (Form-N-piperidide)	222				8 4	100 7	31	140, 135		106		48	
7	**N-Acetylpiperidine** (Aceto-N-piperidide)	226				166	118 2	78	86 0		106		48	
8	**N-Methylformanilide**	243-4, 249–51, 128–9[15]	12 5		1 0928[23]	8 4	100 7	31	140, 135		196	102	63	
9	**N-Ethylformanilide**	258[728], 123[11]			1 0549	8 4	100 7	31	140, 135		205	54	60	
10	**N-Propylformanilide**	267[731] (cor)			1 044[16]	8 4	100 7	31	140, 135		222	47		
11	**N-Isobutylformanilide**	274[731] (cor)				8 4	100 7	31	140, 135		227			
12	**N-Isoamylformanilide**	285–6[728]			1 004[16]	8 4	100 7	31	140, 135		254 5 (cor)			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point °C	Xanthyl amide	Derived acid				Derived amine				Miscellaneous
				M P °C	B P °C	*p* Nitro benzyl ester	*p* Bromo phenacyl ester	M P, °C	B P °C	Acet amide	Benz amide	
1	***n*-Butyranilide**	35		−5 5 −8	162 5 164		63		184	114	160	
2	**Oleanilide**	41		*α* 13 36 *β* 16 25	250 (super heated steam) 216[5]		40 46		184	114	160	
3	**N-Benzpiperidide** (*N*-Benzoyl piperidine)	48		122 4	249	89	119 0		106		48	
4	**Ethyl urethane** (Ethyl carbamate)	49 48	169						NH_3			
5	**Formanilide**	50 47		8 4	100 7	31	140 135		184	114	160	B p 271 Benzyl chloride → benzyl form anilide 48
6	**Malonic acid monoamide** (Malonamic acid)	50		134 8 9		*di* 85 5			NH_3			
7	**N-Propylacetanilide**	50		16 6	118 2	78	86 0			47		
8	**Difluoroacetamide**	52			134 5				NH_3			
9	**N-Benzyl-*n*-caproamide**	53		−3 9	203 35		72		184 5	60	105	
10	**Phenyl urethane** (Phenyl carbamate)	53							184	114	160	
11	***Methyl urethane*** (Methyl carbamate)	54 52	193						NH_3			
12	**N-Ethylacetanilide**	54		16 6	118 2	78	86 0		205	54	60	B p 249
13	***n* Butyl urethane** (*n* Butyl carbamate)	54							NH_3			
14	**N-Benzylisovaleramide**	54		−30	176 5	68 0	135 137		184 5	60	105	
15	**Acetoacetamide**	54							NH_3			
16	**Isobutyl urethane** (Isobutyl carbamate)	55	148						NH_3			
17	**N-Methyl-2-acetotoluidide**	56		16 6	118 2	78	86 0		208	56	66	
18	**Carprylanilide**	57 55		16 3	237 239 3		67 4		184	114	160	
19	**Pelargonanilide**	57		12 3	254 4		68 5		184	114	160	
20	**N-Benzylacetanilide**	58		16 6	118 2	78	86 0	37	298	58	107	
21	**Methoxyacetanilide**	58			204 203				184	114	160	
22	***d l*-Lactanilide**	59		18	122[15]		112 8		184	114	160	
23	**N-Ethylbenzanilide**	60		122 4	249	89	119 0		205	54	60	
24	***n*-Propyl urethane** (*n* Propyl carbamate)	60							NH_3			
25	**N-Benzylformamide**	60		8 4	100 7	31	140 135		184 5	60	105	
26	**N-Benzylacetamide**	61		16 6	118 2	78	86 0		184 5	60	105	
27	**Propiolamide**	61–2		18	144d				NH_3			
28	***n*-Valeranilide** (*n*-Pentananilide)	63		−34 5	186 4		75		184	114	160	
29	**Isoamyl urethane** (Isoamyl carbamate)	64	145						NH_3			
30	**Erucanilide**	65, 55		33 4	264[15]		62 5		184	114	160	
31	**3-Acetotoluidide** (N Acetyl-*m* toluidine)	66 65		16 6	118 2	78	86 0		203	65	125	
32	**N-Methyl-3-acetotoluidide**	66		16 6	118 2	78	86 0		206 7	66	125	
33	**Ethyl oxanilate**	66 7							184	114	160	
34	**Benzindole**	68		122 4	249	89	119	52	253	157 8	68	
35	**Heptananilide**	70, 65		−7 46	223		72		184	114	160	
36	**Capranilide** (*n*-Decananilide)	70		31 3	268 7		60		184	114	160	
37	***n*-Undecananilide** (*n* Hendecananilide)	71		28 5 *α* 13 4 *β* 16 3	280, 284		68 2		184	114	160	

*Derivative data given in order m p , crystal color solvent from which crystallized

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No.	Name	Melting point, °C	Xanthylamide	Derived acid				Derived amine				Miscellaneous
				M.P., °C	B.P., °C	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	M.P., °C	B.P., °C	Acetamide	Benzamide	
38	**2-Methylhexanamide**	72	.....	.....	209.6	.....	.....	NH_3		.....	.....	.....
39	**N,N-Diphenylformamide**	73	.....	8.4	100.7	31	140; 135	53-4	.....	101	180	.....
40	**Vinylacetanilide**	73	.....	−35	169; 163	.....	.....	.....	184	114	160	.....
41	**Oleamide**	76	.....	α: 13.36 β: 16.25	250 (superheated steam); 216[5]	.....	40-6	NH_3		.....	.....	.....
42	**Thioacetanilide**	76	.....	.....	93	.....	.....	.....	184	114	150	.....
43	**Tiglamide**	76	.....	64.5-5.0	198.5 (cor.)	64	68	NH_3		.....	.....	.....
44	**Tiglanilide**	77	.....	64.5-5.0	198.5 (cor.)	64	68	.....	184	114	160	.....
45	**4-Methylhexananilide**	77	.....	.....	217-8[254]	.....	.....	.....	184	114	160	.....
46	**Lauranilide** (Dodecananilide)	78	.....	44; 42	299	.....	76	.....	184	114	160	.....
47	***d,l*-2,3-Dimethylbutananilide**	78	.....	−1.5	191.7	.....	.....	.....	184	114	160	.....
48	**Pentadecananilide**	78	.....	52.3	212[16]	39.5-40 (cor.)	77.2	.....	184	114	160	.....
49	***d,l*-Lactamide**	78.5-9.0; 76	.....	18	122[15]	.....	112.8	NH_3		.....	.....	.....
50	**Transbrassidanilide**	79	.....	59.7	256[10]	.....	94.2	.....	184	114	160	.....
51	**2-Acetophenetidide** (N-Acetyl-*o*-phenetidine)	79	.....	16.6	118.2	78	86.0	.....	229	79	104	.....
52	***d,l*-2-Methylpentanamide**	79.6; 80	.....	.....	195-6	.....	.....	NH_3		.....	.....	.....
53	**Tridecananilide**	80	.....	43; 41.6	312; 177[10]	.....	75.0	.....	184	114	160	.....
54	***d,l*-α-Chloropropionamide**	80	.....	.....	186	.....	.....	NH_3		.....	.....	.....
55	**Propionamide**	81; 77	214; 211	−20.8	141	31	63.4	NH_3		.....	.....	Mercury deriv., 201; Oxalate, 80.8-1.0
56	**Acetamide**	82	245; 238-40	16.6	118.2	78	86.0	NH_3		.....	.....	Mercury deriv., 196-7; Oxalate: 127.3; Phthalimide, 135-6
57	**Ethoxyacetamide**	82	.....	.....	206-7	.....	104.8	NH_3		.....	.....	.....
58	**N-Methyl-4-acetotoluidide**	83	.....	16.6	118.2	78	86.0	.....	210	83	.....	.....
59	**α-Bromoisobutyranilide**	83	.....	48-9	198-200	.....	.....	.....	184	114	160	.....
60	**γ-Phenylbutyramide**	84	.....	52	290	.....	.....	NH_3		.....	.....	.....
61	**Myristanilide**	84	.....	53.9	212[16]	.....	81	.....	184	114	160	.....
62	**Acrylamide**	85	.....	13	141; 140	.....	.....	NH_3		.....	.....	.....
63	**Allylurea**	85	.....	.....	.....	.....	.....	.....	58	.....	.....	.....
64	**Acetoacetanilide**	85	.....	.....	.....	.....	.....	.....	184	114	160	.....
65	***d,l*-α-Ethylphenylacetamide** (α-Phenylbutyramide)	86; 83	.....	42	270	.....	.....	NH_3		.....	.....	.....
66	**4-*n*-Propylacetanilide**	87	.....	16.6	118.2	78	86.0	.....	225	87	115	.....
67	**α-Undecylenamide** (α-Hendecyleneamide)	87	.....	24.5	275	.....	.....	NH_3		.....	.....	.....
68	**Propiolanilide**	87	.....	18	144d.	.....	.....	.....	184	114	160	.....
69	**3-Bromoacetanilide**	87	.....	16.6	118.2	78	86.0	18	251	87	120; 136	.....
70	***d,l*-3-Methylpentananilide**	87	.....	−41.6	197.5	.....	.....	.....	184	114	160	.....
71	***n*-Butyl oxamate**	88	.....	189.5 (anh.); 101(+ $1H_2O$)	.....	*di*: 204	.....	NH_3		.....	.....	.....
72	**2-Chloroacetanilide**	88	.....	16.6	118.2	78	86.0	.....	209; 207	87	99	.....
73	**D-Chaulmoogranilide**	89	.....	68.5	247-8[20]	.....	.....	.....	184	114	160	.....
74	**Palmitanilide**	90	.....	62.7	222[16]	42.5	86;82	.....	184	114	160	.....
75	**N-Phenylmaleimide**	91	.....	130	.....	*di*: 91 (cor.)	168-70; 190	.....	184	114	160	.....

*Derivative data given in order: m.p., crystal color, solvent from which crystallized.

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Xanthyl amide	Derived acid				Derived amine				Miscellaneous
				M P °C	B P °C	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	M P °C	B P °C	Acet amide	Benz amide	
76	**Bromoacetamide**	91		50	208	88			NH_3			
77	**α-Phenylpropionamide**	92	158		265				NH_3			
78	**Isopropyl urethane** (Isopropyl carbamate)	92							33			
79	**Arachidanilide**	92		77 75	204[1]		89		184	114	160	
80	***d l* α Chloropropionanilide**	92			186				184	114	160	
81	**2,2-Dimethylbutananilide**	92		−15 0	187 190				184	114	160	
82	**2-Nitroacetanilide**	92 94		16 6	118 2	78	86 0	71		92 94	98 110	
83	**Maleimide**	93		130		*di* 91 (cor)	168 70 190		NH_3			
84	**Elaidamide**	93 4		44 5 51	234[15]		65		NH_3			
85	**Transbrassidamide**	94		59 7	256[10]		94 2		NH_3			
86	**2-Ethylpentananilide**	94			209				184	114	160	
87	**N-Methyl-N-(1-naphthyl) acetamide**	94		16 6	118 2	78	86 0		294	94 5	121	
88	***n*-Caproanilide** (*n* Hexananilide)	95 92		−3 9	205 35		72		184	114	160	
89	**N-Butyranilide**	95		−5 5 −8	162 5 164	35	63		184	114	160	
90	**N-Benzylpalmitamide**	95		62 7	222[16]	42 5	86 82		184 5	60	105	
91	**Azelaic acid monoamide**	95		106 5	>360 sl d 237[15]	*di* 43 8	*di* 130 6		NH_3			
92	***d l*-2-Methylpentananilide**	95			195 6				184	114	160	
93	**Iodoacetamide**	95		83					NH_3			
94	**Stearanilide**	95		70 1 69 6			92		184	114	160	
95	**Heptanamide**	96	154 5	−7 46	223 0		72		NH_3			
96	**Trichlorolactamide**	96		124					NH_3			
97	**Semicarbazide**	96						1 4	113 5	*mono* 67 *di* (*sym*) 138	*mono* 172 5 *di* (*sym*) 241 (cor)	Gives semicarbazones with aldehydes and ketones
98	**3-Toluamide**	97, 94		111 3, 110 1	236, subl	86 6	108					Mercury deriv , 200
99	**Trichloroacetanilide**	97, 94		57 8	197 5	80			184	114	160	
100	**3-Acetophenetidide**	97		16 6	118 2	78	86 0		248	37	103	
101	**N-Benzylstearamide**	97		70 1 69 6			92		184 5	60	105	
102	**Glycollanilide**	97		78 9 80		106 8	138		184	114	160	
103	**Methoxyacetamide**	97			204 203				NH_3			
104	**Hydrocinnamanilide** (β Phenylpropionanilide)	98, 96		48 7, 40	279 80 (cor)	36 3	104		184	114	160	
105	**α-Hydroxyisobutyramide**	98		79	212	80 5	98		NH_3			
106	**Dichloroacetamide**	98, subl		5–6	194		99		NH_3			
107	**2-Methylhexananilide**	98			209 6				184	114	160	
108	**4-Methylhexanamide**	98			217 8[745]				NH_3			
109	**4-Methyl-2-nitroacetanilide**	99, 94		16 6	118 2	78	86 0	117		99	148	
110	**Capramide** (*n*-Decanamide)	99	148	31 3	268 7		67 0		NH_3			
111	**2-Bromoacetanilide**	99		16 6	118	78	86 0	32	250	99	116	
112	**Phenoxyacetanilide**	99		98 9, 99 100	285d		148 5		184	114	160	
113	**Pelargonamide**	99	147 5 8 5	12 3	254 4		68 5		NH_3			
114	**α-Bromopropionanilide**	99, 110		25 7	203 5				184	114	160	
115	***n*-Caproamide** (*n*-Hexaneamide)	100, 101	160	−3 9	203 35		72		NH_3			Oxalate, 71 1–3
116	**Tridecanamide**	100		43, 41 6	312, 177[10]		75		NH_3			
117	**Phenylpropiolamide**	100, 109		136–7, subl		83			NH_3			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No.	Name	Melting point, °C	Xanthylamide	Derived acid				Derived amine				Miscellaneous
				M.P., °C	B.P., °C	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	M.P., °C	B.P., °C	Acetamide	Benzamide	
118	**N,N-Diphenylacetamide**	101		16.6	118.2	78	86.0	53–4		101	180	
119	***β*-Iodopropionamide**	101		82; 85				NH_3				
120	**N,N′-Diacetyltrimethylenediamine**	101		16.6	118.2	78	86.0		136	*mono*: 126; *di*: 101	*mono*: 140; *di*: 147	
121	**Methylurea**	101	230						−6	28	80	Picrate, 127d.
122	**Phenoxyacetamide**	101		98–9; 99–100	285d.		148.5	NH_3				
123	**N-Methylacetanilide**	102		16.6	118.2	78	86.0		196	102	63	B.p. 237; Conc. $HNO_3 + H_2SO_4 \rightarrow$ *p*-Nitro deriv., 153
124	**Levulinanilide**	102		33–5, deliq.	245–6	61	84		184	114	160	
125	**Pentadecanamide**	102		52.3	212[16]	39.5–40 (cor.)	77.2	NH_3				
126	**Isocrotonamide**	102		15	169		81	NH_3				
127	**Isocrotonanilide**	102		15	169		81		184	114	160	
128	***n*-Undecanamide** (*n*-Hendecanamide)	103; 99		28.5; *α*:13.4; *β*:16.3	280–4		68.2	NH_3				
129	**3-Benzophenetidide** (N-Benzoyl-*m*-phenetidine)	103		122.4	249	89	119		248	97	103	
130	**N,N-Dicyclohexylacetamide**	103		16.6	118.2	78	86.0	20	225 sl. d.	103	153	
131	**3,4-Dimethylbenzanilide**	104		166; 164					184	114	160	
132	**2-Benzophenetidide** (N-Benzoyl-*o*-phenetidine)	104		122.4	249	89	119		229	79	104	
133	**Pyruvanilide**	104, subl.		13.6	165d; 80[25]				184	114	160	
134	**N-Cyclohexylacetamide**	104		16.6	118.2	78	86.0		134	104	149	
135	**2-*n*-Propylacetanilide**	104–5		16.6	118.2	78	86.0		222–4	104–5	119	
136	**2-Ethylpentanamide**	105; 103			209			NH_3				
137	**Isobutyranilide**	105		−46.1	154.7		76.8		184	114	160	
138	**4-*n*-Butylacetanilide**	105		16.6	118.2	78	86.0		261	105	126	
139	**Acrylanilide**	105		13	141; 140				184	114	160	
140	***β*-Phenylpropionamide** (Hydrocinnamamide)	105	189	48.7; 40	279–80 (cor.)	36.3	104	NH_3				
141	**Propionanilide**	106; 103		−20.8	141	31	63.4		184	114	160	Conc. $HNO_3 + H_2SO_4 \rightarrow$ *p*-Nitro deriv., 182
142	**Palmitamide**	106	142	62.7	222[16]	42.5	86; 82	NH_3				
143	**N-Benzylbenzamide**	106		122.4	249	89	119		184–5	60	105	
144	**D-Chaulmoogramide**	106		68.5	247–8[20]			NH_3				
145	***sym*-Dimethylurea**	106							−6	28	80	
146	***n*-Valeramide** (*n*-Pentanamide)	106	167	−34.5	186.4		75	NH_3				Oxalate, 61.1–.4
147	**Myristamide**	107; 103		53.9	212[16]		81	NH_3				
148	**N-Benzylbenzanilide**	107		122.4	249	89	119	37	298	58	107	
149	**Margaramide** (Heptadecanamide)	108		61.2	231[16]	48.5–9.0 (cor.)	82.6	NH_3				
150	**Thioacetamide**	108		93				NH_3				
151	**Fluoroacetamide**	108		31–2	167–9			NH_3				
152	**Levulinamide**	108d.		33–5, deliq.	245–6	61	84	NH_3				
153	**Azelaic acid monoanilide**	108		106.5	> 360 sl. d.; 237[15]	*di*: 143.8	*di*: 130.6		184	114	160	
154	**Arachidamide**	108–9		77; 75	204[1]		89	NH_3				

*Derivative data given in order: m.p., crystal color, solvent from which crystallized.

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Xanthylamide	Derived acid				Derived amine				Miscellaneous
				M P, °C	B P, °C	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	M P, °C	B P, °C	Acetamide	Benzamide	
155	**Anthranilamide**	109		147d				NH_3				
156	**2-Iodoacetanilide**	109		166	118 2	78	86	61, 58		109	139	
157	**Pimelic acid monoanilide**	109		104–5, subl	223[15]		*di* 136 6		184	114	160	
158	**Stearamide**	109	139 41	70 1, 69 6			92	NH_3				
159	**α-Methylhydrocinnamamide**	109						NH_3				
160	**Lauramide** (Dodecanamide)	170, 102		44, 42	299		76	NH_3				
161	***n*-Caprylamide** (*n*-Octanamide)	110, 108	148	16 3	237, 239 3		67 4	NH_3				
162	**Isovaleranilide**	110		−30 0	176 5		68 0		184	114	160	
163	***d l*-2-Methylbutananilide**	110			176–7, 174		55		184	114	160	
164	**3-Nitrophenylacetamide**	110		120				NH_3				
165	**2-Ethylacetanilide**	111		166	118 2	78	86 0		210–1	111	147	
166	**β-Bromopropionamide**	111		62 5				NH_3				
167	**3-Aminobenzamide**	111		174d				NH_3				
168	**2-Ethylbutanamide**	112, 107		−31 8	195			NH_3				
169	**4-Methylpentananilide** (Isocaproanilide)	112, 110		−33	199 1[752]		77 3		184	174	160	
170	***d,l*-2-Methylbutanamide**	112			176–7, 174		55	NH_3				
171	**2-Acetotoluidide**	112		166	118 2	78	86 0	200		110 1[1]	146	$KMnO_4$ → Acetylanthranilic acid, 185
172	***d*-Hydnocarpamide** (α-Cyclopentylundecylamide)	112–3		60 5				NH_3				
173	**4-Aminobenzamide**	114		118d				NH_3				
174	**Acetanilide**	114 (cor)		166	118 2	78	86 0		184	114	160	B p 304, Conc HNO_3 + H_2SO_4 → *p*-nitro deriv, 210
175	**N-Benzylcrotonamide**	114		72	189 (cor)	67 4	95–6		184–5	60	105	
176	**Ethyl oxamate**	114		189 5 (anh), 101(+ $2H_2O$) (rapid htng)		*di* 204			16 5, 19		71	
177	**2-Chlorobenzanilide**	114, 118		142, 140		106	106		184	114	160	
178	**Dihydroacetic acid monoanilide**	115		109	270				184	114	160	
179	***n*-Butyramide**	115	185–7	−5 5, −8	162 5, 164		63	NH_3				Mercury deriv, 222–4, Oxalate, 65 9 6 2
180	**Methacrylamide**	116		16	161			NH_3				
181	**α-Bromoisovaleranilide**	116		44	230d				184	114	160	
182	***trans*-α-Crotonanilide**	118, 115		72, w	189 (cor)	67 4	95–6		184	114	160	
183	**Phenylacetanilide**	118		76 5, subl	256 5 (cor)	65	89		184	114	160	Conc HNO_3 → 2,4-dinitrophenylacetic acid, 189
184	**Dichloroacetanilide**	118		5–6	194		99		184	114	160	
185	***N*-Ethyl-4-nitroacetanilide**	118		166	118 2	78	86 0	96		119	98	
186	**Trimesic acid trianilide**	118–20d		380 (cor)			*tri* 197 (sealed tube)		184	114	160	
187	**3-Iodoacetanilide**	119		166	118 2	78	86 0	33, 27		119	157	
188	**Cyanoacetamide**	120	222–3	66				NH_3				

*Derivative data given in order m p crystal color, solvent from which crystallized

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m. p.)* (Continued)

No	Name	Melting point °C	Xanthyl amide	Derived acid				Derived amine				Miscellaneous
				M P °C	B P °C	*p*-Nitro benzyl ester	*p*-Bromo phenacyl ester	M P, °C	B P °C	Acet amide	Benz amide	
189	**Glycolamide**	120		78 9, 80		106 8	138		NH_3			
190	**Isocaproamide** (Isohexanamide)	120 1	159-60	−33	199 1^{752}		77 3		NH_3			
191	**Chloroacetamide**	121	208 9	α 61 3 β 56 2, γ 52 5	189		104					
192	**2-Chlorophenoxyacetanilide**	121		145 6, w					184	114	160	
193	**Tribromoacetamide**	122		131, 135	245d				NH_3			
194	**Sebacic acid monoanilide**	122		33, subl	243^{15}	*di* 73 5, 72 6	*di* 147		184	114	160	
195	**3-Chlorobenzanilide**	122 5		158 155		107	116		184	114	160	
196	**α-Bromopropionamide**	123		25 7	203 5				NH_3			
197	**Furanilide**	123 5		133 4 132	230-2	133 5	138 5		184	114	160	
198	**Pyruvamide**	124		13 6	165d 80^{25}				NH_3			
199	**3-Methylpentanamide**	125		−41 6	197 5				NH_3			
200	**4-Chlorophenoxyacetanilide**	125		155 6 w 158			136		184	114	160	
201	**3-Benzotoluidide** (N Benzoyl *m* toluidine)	125		122 4	249	89	119 0		203	65	125	
202	**2-Toluanilide**	125		104-5, 107 8	259^{750}	90 7	57		184	114	160	
203	**Acetyl-β-phenylhydrazine**	125 6		16 6	118 2	78	86 0	19, 23	243	128, *di* 107	168, *di* 177	
204	**Adipic acid monoamide**	125-30		153 4 (cor)	216^{15}	106	154 5, 152 6		NH_3			
205	**Succinimide**	126	245-7	185, 182 8	235d	*di* 88	*di* 211		NH_3			
206	**3-Toluanilide**	126		111-3, 110 1	263, subl	86 6	108		184	114	160	
207	**Angelanilide**	126		45-6	185 (cor)				184	114	160	
208	**β-Resorcylanilide** (2,4-Dihydroxybenzanilide)	126 7		213d (rapid htng) 216, 217		188-9			184	114	160	
209	**2-Ethylbutananilide**	127, 127 5		−31 8	195				184	114	160	
210	**Suberic acid monoamide**	127		144 139 41		*di* 85	*di* 144 2		NH_3			
211	**4-Methoxyacetanilide**	127		16 6	118 2	78	86 0	58	240	130 127	154, 157	
212	**Angelamide**	127 8		45 6	185 (cor)				NH_3			
213	**Phenylpropiolanilide**	128, 126		136 7, subl		83			184	114	160	
214	**Nicotinamide**	128 129, 129 31		237-8 subl					NH_3			B p 150 60$^{5\cdot10^{-4}}$ Chloroaurate, 205, N-Ethyl, 188-9, N isopropyl, 184 6
215	**Pivalanilide**	128 (cor), 132-3		35 5	163 4		75-6		184	114	160	
216	**Suberic acid monoanilide**	128-9		144, 139-41		*di* 85	*di* 144 2		184	114	160	
217	**Isobutyramide**	129, 127	210-1	−46 1	154 7		76 8		NH_3			
218	**2-Methoxybenzamide**	129		100-1	200		113		NH_3			Mercury deriv , 241
219	**2-Bromo-4-nitroacetanilide**	129		16 6	118 2	78	86 0	105		129	160	
220	**Benzamide**	130, 129	222 5-3 5, 224	122 4	249	89	119		NH_3			Mercury deriv , 222, Phthalimide, 168

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Xanthylamide	Derived acid				Derived amine				Miscellaneous
				M P , °C	B P , °C	*p*-Nitrobenzyl ester	*p* Bromophenacyl ester	M P °C	B P °C	Acet amide	Benz amide	
221	**3,4-Dimethylbenzamide**	130		166, 164				NH_3				
222	**α,β-Dibromopropionamide**	130, 133		67 (stab), 50 (unstab)	160^{20}			NH_3				
223	**Anthranilanilide**	131		147					184	114	160	
224	**Bromoacetanilide**	131		50	208	88			184	114	160	
225	**2-Methoxybenzanilide**	131		100–1	200		113		184	114	160	
226	**Nicotinanilide**	132, bz , 85 (+ $2H_2O$), w , 265 (anh)		237 8, subl					184	114	160	
227	**2,2-Dimethylbutanamide**	132, 103		−15 0	187, 190				184	114	160	
228	***d,l*-2,3-Dimethylbutanamide**	132		−1 5	191 7			NH_3				
229	**3,3-Dimethylbutananilide**	132		6 7	184, 96[26]				184	114	160	
230	**3,3-Dimethylbutanamide**	132		6 7	184, 96[26]			NH_3				
231	**2,5-Dichloroacetanilide**	132		16 6	118 2	78	86 0	50		132	120	
232	**Malonic acid monoanilide**	132		134 8 9		*dl* 85 5			184	114	160	
233	**Urea** (Carbamide)	132 8	265, 274					NH_3				Phthalimide, 188–90, Picrate, 148
234	**2,4-Dimethylacetanilide**	133, 130		16 6	118 2	78	86 0		217	133, 130	192	
235	**Mesityleneamide** (3,5-Dimethylbenzamide)	133		16 6				NH_3				
236	**4-Isopropylbenzamide**	133		177, al				NH_3				
237	**α-Bromoisovaleramide**	133		44	230d			NH_3				
238	**4-Chlorophenoxyacetamide**	133		155–6, w , 158			136	NH_3				
239	***d l*-Mandelamide**	133 4 (cor)		118		123–4		NH_3				
240	**N-(2-Naphthyl)acetamide**	134		16 6	118 2	78	86 0	112		132	162	Br_2 → 1-Bromo deriv , 140
241	**3-Chlorobenzamide**	134		158, 155		107	116	NH_3				Mercury deriv , 245
242	**Phenacetin** (4-Acetophenetidide)	134		16 6	118 2	78	86 0	2 3	248 254	137	173	10% HNO_3 → 3-Nitro deriv , 103
243	**Chloroacetanilide**	134, 136–7		α 61 3, β 56 2, γ 52 5	189		104		184	114	160	
244	**2,3-Dimethylacetanilide**	135		16 6	118 2	78	86 0		221–2	135	189	
245	**Isovaleramide**	135, 136	182–3	−30 0	176 5		68 0	NH_3				
246	**Acetyl salicylanilide**	136		135 (rapid htng)	140d	90 5			184	114	160	
247	**3-Bromobenzanilide**	136		155		105	120		184	114	160	
248	**Salicylanilide**	136		158 3 (subl at 76)		97–8	140		184	114	160	
249	**α-Hydroxyisobutyranilide**	136		79	212	80 5	98		184	114	160	
250	**N,N-Diacetyltetramethylenediamine**	137		16 6	118 2	78	86 0	27	159	*dl* 137	*dl* 177	
251	**Benzo-2-iodonanilide** (N-Benzoyl-*o*-iodoaniline)	139		122 4 (subl at 100)	249	89	119	61, 58		109	139	
252	**3-Ethoxybenzamide**	139		137				NH_3				
253	**2,5-Dimethylacetanilide**	139		16 6	118 2	78	86 0	15 5	213–5	139	140	
254	**3-Aminobenzanilide**	140		174d					184	114	160	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Xanthylamide	Derived acid				Derived amine				Miscellaneous
				M P, °C	B P, °C	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	M P, °C	B P, °C	Acetamide	Benzamide	
255	**2-Toluamide**	140, 143	199 200 5	104–5, 107 8	259[751]	90 7	57		NH_3			Mercury deriv, 196
256	**Trichloroacetamide**	141		57–8	197 5	80			NH_3			
257	**2-Iodobenzanilide**	141		162		111	143		184	114	160	
258	**2-Bromobenzanilide**	141		150		110	102		184	114	160	
259	**3-Tolylurea**	142							203	65	125	
260	**2-Chlorobenzamide**	142		142, 140		106	106		NH_3			
261	**Salicylamide**	142		158 3 (subl at 76)		97–8	140		NH_3			Mercury deriv, 190
262	**Furamide**	142–3	210	133 4, 132	230–2	133 5	138 5		NH_3			
263	**3-Nitrobenzamide**	143, 142		140		141	132		NH_3			
264	**Iodoacetanilide**	143–4		83					184	114	160	
265	**3,5-Dimethylacetanilide**	144, 140		16 6	118 2	78	86		220	144, 140	136	
266	**2-Benzotoluidide** (N-Benzoyl-o-toluidine)	144		122 4	249	89	119		200	110–11	146	$KMnO_4$ → Benzoylanthranilic acid, 177
267	**3-Nitrosalicylamide**	145 (hyd)		125					NH_3			
268	**2,4-Dichloroacetanilide**	145		16 6	118 2	78	86 0	63		145	177	
269	*α-d l*-**Phenylsuccinamide** (*β* form)	145		167–8, 84 (anh)					NH_3			
270	**4-Toluanilide**	145, 148		179 80, 182 subl	275 (cor)	104 5	153		184	114	160	
271	**Diethylmalonic acid monoamide**	146		125		*di* 91			NH_3			
272	**Cyclohexancarboxanilide** (Hexahydrobenzanilide)	146, 131		30–1	233				184	114	160	
273	**Phenylurea**	147	225						184	114	160	
274	**N,N'-Dibenzoyltrimethylenediamine**	147		122 4	249	89	119		136	*mono* 126, *di* 101	*mono* 140, *di* 147	
275	**Benzo-2-ethylanilide** (N-Benzoyl-*o*-ethylaniline)	147		122 4	249	89	119		210–11	111	147	
276	**2,4,6-Trichloroacetanilide**	148		16 6	118 2	78	86 0	78		148	172	
277	**α-Bromoisobutyramide**	148		48–9	198–200				NH_3			
278	**Cinnamamide**	148, 142		133	300	116 8	145 6		NH_3			
279	**Succinic acid monoanilide**	148 5		185, 182 8	235 d	*di* 88	*di* 211		184	114	160	
280	*N*-**Cyclohexybenzamide**	149		122 4	249	89	119		134	104	149	
281	**Benzylurea**	149							184–5	60	105	
282	**Phthalic acid monoamide** (Phthalamic acid)	149		200–6, 197 (sealed tube), 230 (rapid htng)		*di* 155 5	*di* 152 8		NH_3			
283	*β*-**Benzoylpropionanilide**	150, 145		116					184	114	160	
284	**Ethylmalonic acid monoanilide**	150		111		75			184	114	160	
285	**2-Chlorophenoxyacetamide**	150		145–6, w					NH_3			
286	**Adipic acid monoanilide**	151 3		153–4 (cor)	216[15]	106	154 5, 152 6		184	114	160	
287	**Cinnamanilide**	151, 153		133	300	116 8	145 6		184	114	160	Acid $KMnO_4$ → Benzoic acid, 122 4

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Xanthyl amide	Derived acid				Derived amine				Miscellaneous
				M P, °C	B P, °C	*p* Nitro benzyl ester	*p*-Bromo phenacyl ester	M P, °C	B P, °C	Acetamide	Benzamide	
288	**4-Fluoroacetanilide**	152		16 6	118 2	78	86 0	– 1	186	152	185	
289	***d l*-Mandelanilide**	152		118		123 4			184	114	160	
290	**4-Acetotoluidide** (N-Acetyl-*p*-toluidine)	153, 147		16 6	118 2	78	86 0	45	200	147	158	$KMnO_4$ → 4-Acetamido-benzoic acid, 256, Br_2 → 3-Bromo deriv, 117
291	**N-Methyl-4-nitroacetanilide**	153		16 6	118 2	78	86 0	152		153	112	
292	**Veratranilide**	154		181					184	114	160	
293	**4-Fluorobenzamide**	154		182, 182 6					NH_3			
294	**3-Nitrobenzanilide**	154		140		141	132		184	114	160	
295	**Benzilamide**	154–5, 155		150		99 5	152		NH_3			
296	**3-Nitrosalicylamide**	155, 145		125 (+ H_2O)					NH_3			
297	**2,5-Dichlorobenzamide**	155		153					NH_3			
298	**2-Bromobenzamide**	155		150		110	102		NH_3			Mercury deriv, 242
299	**Dibenzylacetanilide**	155		89					184	114	160	
300	**2-Nitrobenzanilide**	155		146		112	107		184	114	160	
301	**3-Bromobenzamide**	155		155		105	120		NH_3			Mercury deriv, 235
302	**N-(1-Naphthyl) acetanilide**	155, 159 6		131, 135					184	114	160	
303	**Phthalonamide** (β form)	155d		146					NH_3			
304	**3-Nitroacetanilide**	155		16 6	118 2	78	86 0		114	*mono* 155, *di* 76	*mono* 155, *di* 150	
305	**Pimelic acid dianilide**	155–6		104–5, subl	223^{15}		*di* 136 6		184	114	160	
306	**Pivalamide**	155–7, 153–4		35 5	163–4		75–6		NH_3			
307	**N-Phenylsuccinimide**	156		185, 182 8	235d	*di* 88	*di* 211		184	114	160	
308	**Dibromoacetamide**	156		48	232–5				NH_3			
309	**L-Malamide**	156 5–8 0		100–1		*mono* 87 2, *di* 124 5	*di* 179		NH_3			
310	**Phenylacetamide**	156, 157	196	76 5, subl	256 5 (cor)	65	89		NH_3			
311	**3-Hydroxybenzanilide**	157, 155		200, subl		106–8	176, 176 1 4		184	114	160	
312	**Succinic acid monoamide** (Succinamic acid)	157		185, 182 8	235d	*di* 88	*di* 211		NH_3			
313	**N-Acetylindole**	157–8		16 6	118 2	78	86	52	253	157–8	68	
314	***d l*-Phenylsuccinamide** (α form)	158		167–8					NH_3			
315	**4-Benzotoluidide** (N-Benzoyl-*p*-toluidine)	158		122 4	249	89	119	45	200	147	158	CrO_3 → 4-Benzamido benzoic acid, 278
316	**N-(1-Napthyl) acetamide**	159		16 6	118 2	78	86 0	50		159	160	Br_2 → 4-Bromo deriv, 193, Fuming HNO_3 → dinitro deriv, 250

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Xanthyl amide	Derived acid				Derived amine				Miscellaneous
				M P , °C	B P , °C	*p*-Nitro benzyl ester	*p* Bromo phenacyl ester	M P , °C	B P , °C	Acet amide	Benz-amide	
317	**4-Toluamide**	159, 160	224-5	179-80, 182, subl	275 (cor)	104 5	153		NH_3			Mercury deriv , 260
318	**Crotonamide**	161, 158		72, w	189 (cor)	67 4	95 6		NH_3			
319	**N-(1-Naphthyl) benzamide**	161		122 4	249	89	119	50		159	160	
320	**N-(2-Naphthyl) benzamide**	162		122 4	249	89	119	112		132	162	
321	**4-Aminoacetanilide**	162		16 6	118 2		86 0	140, 147	267	*mono* 162 3, *di* 304	*mono* 128, *di* 300	Azo-β-naphthol deriv , 261
322	**4-Hydroxybenzamide**	162 (hyd)		215, 213 4, 210		180-2	191 5 (cor) 184		NH_3			
323	**Benzanilide**	163 160		122 4	249	89	119		184	114	160	Br_2 → 4-Bromo deriv , 204
324	**1-Naphthanilide**	163, 164		161 2 (cor)			135 5		184	114	160	
325	**Trichlorolactanilide**	164		124					184	114	160	
326	**Veratramide**	164		181					NH_3			
327	**2-Benzoylbenzamide**	165		128, 91 (hyd)		100 4			NH_3			
328	**L-Glutamamide**	165		211 (rapid htng), 197 (slow htng)					NH_3			
329	**Protocatechuanilide**	166		199-200d			188		184	114	160	
330	**4-Anisamide**	167, 163		184 6 184 2 (cor)	275-80	132	152		NH_3			Mercury deriv , 222
331	**4-Bromoacetanilide**	167, 168		16 6	118 2	78	86 0	66	245	168	204	
332	**Acetylanthranilanilide**	167		185 ac a					184	114	160	
333	**Diphenylacetamide**	168		148					NH_3			
334	**α-Benzoyl-β-phenylhydrazine**	168		122 4	249	89	119	19 23	243	128	168	
335	**2-Furanacrylamide** (β-(2-Furyl)-acrylic acid)	168-9		141	286				NH_3			
336	**Piperonylamide**	169		229, 228					NH_3			
337	***d l*-Tropamide**	169		117-8					NH_3			
338	**Methyliminodiacetic acid monoamide**	169		227d					NH_3			
339	**Methyliminodiacetic acid diamide**	169		227d					NH_3			
340	**4-Hydroxyacetanilide**	169		16 6	118 2	78	86 0	184, 186		*mono* 168, *di* 150	N- *mono* 216-7, N,O- *di* 234	
341	**4-Anisanilide**	169-71		184 6 184 2 (cor)	275-80	132	152		184	114	160	
342	**3-Hydroxybenzamide**	170 167		200 subl		106 8	176 176 7-4		NH_3			
343	**Sebacic acid monoamide**	170		33, subl	243^{15}	*di* 73 5 72 6	*di* 147		NH_3			
344	***cis*-Aconitanilide**	170d		125			*tri* 186		184	114	160	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No.	Name	Melting point, °C	Xanthylamide	Derived acid				Derived amine				Miscellaneous
				M.P., °C	B.P., °C	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	M.P., °C	B.P., °C	Acetamide	Benzamide	
345	**Malonic acid diamide** (Malondiamide)	170	270	134.8–.9	.....	*di*: 85.5	.....	NH_3		.....	.....	.....
346	**D,L-Phenylsuccinic acid monoanilide** (β form)	170	.....	167–8; 84 (anh.)	.....	.....	.....	.....	184	114	160	.....
347	**4-Ethoxybenzanilide**	170; 172	.....	198; 195–6	.....	.....	.....	.....	184	114	160	.....
348	**2-Naphthylanilide**	171; 173	.....	184; 185.5	.....	.....	.....	.....	184	114	160	.....
349	**N,N'-Diacetylethylenediamine**	172	.....	16.6	118.2	78	86.0	8.5	116	*di*: 172	*di*: 244	.....
350	**Benzo-2,4,6-trichloroanilide** (N-Benzoyl-2,4,6-trichloroaniline)	172	.....	122.4	249	89	119	78	.....	148	172	.....
351	**Azelaic acid diamide**	172	.....	106.5	>360 sl. d.; 237[15]	*di*: 43.8	*di*: 130.6	NH_3		.....	.....	.....
352	**Maleic acid monoamide** (Maleamic acid)	172–3; 153 sl.d.	.....	137–8; 130 (+3% fumaric acid)	.....	*di*: 91 (cor.)	168–70; 190	NH_3		.....	.....	.....
353	**4-Phenetylurea** (Dulcin)	173	.....	.....	.....	.....	.....	2–3	248; 254	137	173	.....
354	**4-Benzophenetidide** (N-Benzoyl-*p*-phenetidine)	173	.....	122.4	249	89	119	2–3	248; 254	137	173	.....
355	**Benzylanilide**	174–5	.....	150	.....	99.5	152	.....	184	114	160	.....
356	**Pimelic acid diamide**	175	.....	104–5, subl.	223[15]	.....	*di*: 136.6	NH_3		.....	.....	.....
357	***d,l*-Phenylsuccinic acid monoanilide** (α form)	175	.....	167–8; 84 (anh.)	.....	.....	.....	.....	184	114	160	.....
358	**4-Hydroxyphenylacetamide**	175	.....	148–50; 148, w.	.....	.....	.....	NH_3		.....	.....	.....
359	**Citraconic acid dianilide**	175.5	.....	92–3; 22d.	.....	70.6	.....	.....	184	114	160	.....
360	**Glutaric acid diamide**	175–6	.....	98	302–4	*di*: 69	*di*: 139.8	NH_3		.....	.....	.....
361	**2-(4-Toluyl) benzamide**	175–6	.....	139–140	.....	.....	.....	NH_3		.....	.....	.....
362	**2-Nitrobenzamide**	176; 175	.....	146	.....	112	107	NH_3		.....	.....	.....
363	**Phthalonic acid monoanilide**	176	.....	146	.....	.....	.....	.....	184	114	160	.....
364	**N,N-Dibenzoyltetramethylenediamine**	177	.....	122.4	249	89	119	27	159	*di*: 137	*di*: 177	.....
365	**Acetylanthranilamide**	177	.....	185, ac. a.	.....	.....	.....	NH_3		.....	.....	.....
366	**2,6-Dimethylacetanilide**	177	.....	16.6	118.2	78	86.0	.....	215; 218	177	168	.....
367	**D-Camphoric acid monoamide**	177	.....	187.5–8.0	.....	65.5	.....	NH_3		.....	.....	.....
368	**Mesaconic acid diamide**	177	.....	204.5 (cor.), subl.	.....	*di*: 134 (cor.)	.....	NH_3		.....	.....	.....
370	**4-Cyanobenzanilide**	179	.....	219; 214	.....	189	.....	.....	184	114	160	.....
371	**N-Benzylphthalamide**	179	.....	200–6; 191 (sealed tube); 230 rapid htng.)	.....	*di*: 155.5	*di*: 152.8	.....	184–5	60	105	.....
372	**4-Chloroacetanilide**	179	.....	16.6	118.2	78	86.0	72	.....	179	192	.....
373	**α-Phthalonamide**	179d.	.....	146	.....	.....	.....	NH_3		.....	.....	.....

*Derivative data given in order: m.p., crystal color, solvent from which crystallized.

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Xanthylamide	Derived acid				Derived amine				Miscellaneous
				M P , °C	B P , °C	*p* Nitro benzyl ester	*p* Bromophenacyl ester	M P , °C	B P , °C	Acetamide	Benzamide	
374	**2,4-Dimethylbenzamide**	179 81		127, 90 (+H_2O)					NH_3			
375	**D-Tartaric acid monoanilide**	180d		169 71		*di* 163	*di* 204		184	114	160	
376	**α-Acetyl-β-methylurea**	180		16 6	118 2	78	86 0		−6	28	80	
377	**Diphenylacetanilide**	180		148					184	114	160	
378	**3,5-Dinitrosalicylamide**	181		182					NH_3			
379	**1-Naphthylacetamide**	181		131, 135					NH_3			
380	**Maleic acid diamide**	181, 180		137		*di* 91 (cor)	168 70, 190		NH_3			
381	***unsym*-Dimethyl urea**	182	225						7		41	
382	**Thiourea**	182							NH_3			
383	**Hippuramide**	183		187		136	151		NH_3			
384	**4-Tolylurea**	183						45	200	147	158	
385	**3,5-Dinitrobenzamide**	183		204–5		157	159		NH_3			
386	**2-Iodobenzamide**	184		162		111	143		NH_3			
387	**4-Iodoacetanilide**	184		16 6	118 2	78	86 0	67–8		184	222	
388	**Benzo-4-fluoroanilide** (N-Benzoyl-*p*-fluoroaniline)	185		122 4	249	89	119	−1	186	152	185	
389	**N,N′-Diacetyl-*o*-phenylenediamine**	185		16 6	118 2	78	86 0	102		*di* 185	*di* 301	
390	**2-Nitrocinnamamide**	185		240		132	141		NH_3			
391	**Mesaconic acid dianilide**	185 7		204 5 (cor)		*di* 134 (cor)			184	114	160	
392	**Citraconic acid diamide**	185–7		92–3, 92d		*di* 70 6			NH_3			
393	**Chlorofumaranilide**	186		191–2		*di* 138 5			184	114	160	
394	**3-Iodobenzamide**	186		187		121	128		NH_3			
395	**Suberic acid dianilide**	186–7		144, 139–41		*di* 85	*di* 144 2		184	114	160	
396	**Maleic acid dianilide**	187		137		*di* 91 (cor)	168–70, 190		184	114	160	
397	**Maleic acid monoanilide**	187		137		*di* 91 (cor)	168–70, 190		184	114	160	
398	**Hippuric acid**	187 5		122 4	249	89	119	Glycine 228 30, 262d		206	187 5	Acetamide, 136, Benzamide, 151
399	***unsym*-Diphenylurea**	189	180					53 4		101	180	
400	**Aconitic acid dianilide**	189		194–5d (cor)			*tri* 186		184	114	160	
401	***meso*-Tartaric acid diamide**	189–90, 187		140		93			NH_3			
402	**4-Bromobenzamide**	189–90		251–3		180			NH_3			Mercury deriv , 266
403	**Itaconic acid dianilide**	190, 185		165		*di* 90 6	*di* 117 4		184	114	160	
404	**Picramide**	190		122 5					NH_3			Acetamide, 230, Benzamide, 196
405	**N,N′-Diacetyl-*m*-phenylenediamine**	191		16 6	118 2	78	86 0	63		*mono* 87–9, *di* 191	*mono* 125 *di* 240	
406	**Itaconic acid diamide**	191 2–8		165		*di* 90 6	*di* 117 4		NH_3			
407	**Mucic acid monoamide**	192d		214d , varies with htng rate, 223–255		310	225		NH_3			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Xanthyl amide	Derived acid				Derived amine				Miscellaneous
				M P °C	B P °C	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	M P °C	B P °C	Acet amide	Benzamide	
408	**4-Nitrophthalanilide**	192		165					184	114	160	
409	**2-Tolylurea**	192	228						200	110–11	146	
410	**Benzo-4-chloroaniline** (N Benzoyl *p*-chloroaniline)	192		122 4	249	89	119		72	179, 172	192	
411	**Biuret**	192d						NH_3				
412	**2-Naphthamide**	192 195		184 185 5				NH_3				
413	***D*-Camphoric acid diamide**	193		187 5 8 0		65 5		NH_3				
414	**4-Chlorobenzanilide**	194		243, 240		129 5	126		184	114	160	
415	**4-Coumaramide**	194		210 3 206 (anh)				NH_3				
416	**2-Benzoylbenzanilide**	195		128 91 (+1 H_2O)		100 4			184	114	160	
417	**3-Nitrocinnamamide**	196		199		174	178, 173	NH_3				
418	**D-Tartaric acid diamide**	196d		169 71		*dl* 163	*dl* 204	NH_3				
419	**2-Methyl-4-nitroacetanilide**	196 202		16 6	118 2	78	86 0	130		202		
420	**L-Malanilide** (Hydroxysuccinanilide)	197		100 1		*mono* 87 2 *dl* 124 5	*dl* 179		184	114	160	
421	**4-Hydroxybenzanilide**	198 196 7		215 213 4		180 2	191 5 (cor)		184	114	160	
422	**4-Nitrophenylacetamide**	198		153			207	NH_3				
423	**4-Nitrophenylacetanilide**	198		153			207	147 8		215	*dl* 193 , 203	
424	**Cyanoacetanilide**	198–9		66					184	114	160	
425	**Citric acid trianilide**	199 192 (+1 H_2O)		100 153 (anh)		*tri* 102	*tri* 148		184	114	160	
426	**4-Nitrophthalamide**	200d		165				NH_3				
427	***cis*-Aconitic acid dianilide**	200		125			*tri* 186		184	114	160	
428	**Methylsuccinic acid dianilide**	200		115					184	114	160	
429	**4-Nitrobenzamide**	200	232	241		168	137	NH_3				
430	**2-Naphthylacetamide**	200 205		141 2 143				NH_3				
431	**Isatin**	200 1										Acetamide, 147
432	**3-Nitrophthalic acid diamide**	201d		218		189		NH_3				
433	**Sebacic acid dianilide**	201		33, subl	243^{15}	*dl* 73 5 72 6	*dl* 147		184	114	160	
434	**1-Naphthoamide**	202		161 2 (cor)			135 5	NH_3				
435	**4-Ethoxybenzamide**	202		198 195–6				NH_3				
436	**2,4-Dinitrobenzamide**	203		183		142	158	NH_3				
437	***D*-Camphoric acid monoanilide**	204		187 5 8 0		65 5			184	114	160	
438	**Benzo-4-bromoanilide** (N Benzoyl-*p* bromoaniline)	204		122 4	249	89	119	66	245	168	204	
439	**4-Nitrocinnamamide**	204, 217		285		186	191	NH_3				
440	**N-Phenylphthalimide**	205		200 6 191 (sealed tube), 230 (rapid htng)		*dl* 155 5	*dl* 152 8		184	114	160	

*Derivative data given in order m p , crystal color solvent from which crystallized

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Xanthyl amide	Derived acid				Derived amine				Miscellaneous
				M P °C	B P °C	*p*-Nitro benzyl ester	*p*-Bromo phenacyl ester	M P °C	B P °C	Acet amide	Benz amide	
441	**Carballylic acid triamide**	207d 205 7d		166			*tri* 138 2	NH_3				
442	**Gallanilide**	207		253 4d 222 40d		141	134		184	114	160	
443	**Phthalonic acid dianilide**	208		146					184	114	160	
444	**Hippuranilide**	208		187		136	151		184	114	160	
445	**2-Coumaramide**	209d		207 8, subl		152 5		NH_3				
446	**Sebacic acid diamide**	210 208		133, subl	243[15]	*di* 73 5 72 6	*di* 147	NH_3				
447	**4-Iodobenzanilide**	210		270, 265		141	146		184	114	160	
448	**Citric acid triamide**	210–5		153 (slow htng)		*tri* 102	*tri* 148	NH_3				
449	**4-Nitrobenzanilide**	211 204		241		168	137		184	114	160	
450	***d l*-Phenylsuccinic acid diamide**	211		167 8 84 (anh)				NH_3				
451	**Protocatechuamide**	212		199 200d		188		NH_3				
452	**2,2′-Diphenic acid diamide**	212		227 233		*di* 187 182 6		NH_3				
453	**4-Nitroacetanilide**	213 4		16 6	118 2	78	86 0	147 8		215	*di* 199 203	
454	**Ethylmalonic acid diamide**	214		111		75		NH_3				
455	**3-Nitrophthalimide**	216		218		189		NH_3				
456	**Suberic acid diamide**	216 7		144 139 41		*di* 85	*di* 144 2	NH_3				
457	**Methylmalonic acid diamide**	217 206		137 138d				NH_3				
458	**4-Iodobenzamide**	217		270 265		141	146	NH_3				
459	**Benzylmalonic acid dianilide**	217		117d 121		*di* 119 5			184	114	160	
460	**4-Hydroxy-2-naphthamide**	217 8		225 6				NH_3				
461	**Acetylurea**	218		16 6	118 2	78	86 0	NH_3				
462	**3-Hydroxy-2-naphthamide**	218		222 3 (cor)				NH_3				
463	***sym* -Di-3-tolylurea**	218							203	65	125	
464	**Phthalic acid diamide**	220		200–6, 191 (sealed tube) 230 (rapid htng)		*di* 155 5	*di* 152 8	NH_3				
465	**Mucic acid diamide**	220		214d , varies with htng rate, 223–255		310	225	NH_3				
466	**Saccharin**	220	198 9	206				NH_3				
467	**Adipic acid diamide**	220, 229		153–4 (cor)	216[15]	106	152 6 154 5	NH_3				
468	***d l*-Phenylsuccinic acid dianilide**	222		167–8, 84 (anh)					184	114	160	

*Derivative data given in order m p , crystal color solvent from which crystallized

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Xanthyl amide	Derived acid				Derived amine				Miscellaneous
				M P °C	B P °C	*p* Nitro benzyl ester	*p* Bromo phenacyl ester	M P °C	B P °C	Acet amide	Benz amide	
469	β-Resorcylamide	222		213d (rapid htng) 216d 217		188 9			NH_3			
470	4-Cyanobenzamide	223		219 214		189			NH_3			
471	Diethylmalonic acid diamide	224		125	302 4	*di* 91			NH_3			
472	Glutaric acid dianilide	224		98		*di* 69	*di* 139 8		184	114	160	
473	5-Nitrosalicylanilide	224		229 30					184	114	160	
474	5-Nitrosalicylamide	225		229 30					NH_3			
475	Benzylmalonic acid diamide	225		117d 121		*di* 119 5			NH_3			
476	Methylsuccinic acid diamide	225		115					NH_3			
477	Malonic acid dianilide	225 227, 230		134 8- 9		*di* 85 5			184	114	160	
478	*d l*-Tartaric acid monoamide	226		203 4 (+1 H_2O) 205 6 (anh)		*di* 147 6			NH_3			
479	D-Camphoric acid dianilide	226		187 5 8 0		65 5			184	114	160	
480	Succinic acid dianilide	230, 226		185 182 8	235d	*di* 88	*di* 211		184	114	160	Heat above m p → succinanil, 155 6 + aniline, b p 184
481	2,2 -Diphenanilide	230		227 229 233		*di* 187 182 6			184	114	160	
482	Phthalimide	233 5 (cor) 238	176 7	200 6 191 (sealed tube) 230 (rapid htng)	249	89	119	122 119		232	198, 204	
483	3,5-Dinitrobenzanilide	234		204 5		157	159		184	114	160	
484	3-Nitrophthalic acid dianilide	234		218		189			184	114	160	
485	Terephthalic acid monoanilide	234 7		300, subl with out melting		*di* 263 5	*di* 225		184	114	160	
486	*d l*-Tartaric acid monoanilide	236		203 4 (+1 H_2O) 205 6 (anh)					184	114	160	
487	N-Benzylacrylamide	237		13	141, 140				184 5	60	105	
488	Carbanilide (*sym* -Diphenyl urea)	238, 240							184	114	160	
489	Muconic acid diamide	240d		289d (slow htng) 306 (rapid htng)					NH_3			
490	Adipic acid dianilide	241		153-4 (cor)	216^{15}	106	152 6, 154 5		184	114	160	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Xanthyl amide	Derived acid				Derived amine				Miscellaneous
				M P , °C	B P , °C	*p*-Nitrobenzyl ester	*p*-Bromophenacyl ester	M P , °C	B P , °C	Acetamide	Benzamide	
491	**N,N′-Dibenzoylethylenediamine**	244		122 4	249	89	119	8 5	116	*di* 172	*di* 244	
492	**Gallamide**	245		253-4d , 222 40d		141	134	NH_3				
493	**3-Hydroxy-2-naphthanilide**	249 (cor), 244		222-3 (cor)					184	114	160	
494	***sym*-Di-2-tolylurea**	250							200	110 1	146	
495	**Carballylic acid trianilide**	252		166			*tri* 138 2		184	114	160	
496	**Phthalic acid dianilide**	253 5		200 6, 191 (sealed tube), 230 (rapid htng)		*di* 155 5	*di* 152 8		184	114	160	
497	**Oxalic acid dianilide**	254		189 5 (anh), 101 (+2 H_2O) (rapid htng)		*di* 204			184	114	160	
498	**Succinic acid diamide**	255, 260d	275	185, 182 8	235d	*di* 88	*di* 211	NH_3				
499	**2,4,6-Trinitrobenzamide**	264d		228				NH_3				
500	**D-Tartaric acid dianilide**	264d		169-71		*di* 163	*di* 204		184	114	160	
501	**Fumaric acid diamide**	266d		293 5 286-7 (sealed tube), 200, subl		150 8		NH_3				
502	***sym*-Di-4-tolylurea**	268						45	200	147	158	
503	**Isophthalic acid monoamide**	280		348, subl		202 5	179 1	NH_3				
504	**Isophthalic acid diamide**	280		348, subl		202 5	179 1	NH_3				
505	**Acetylenedicarboxylic acid diamide**	294d		179				NH_3				
506	**Mucic acid monoanilide**	310		214, varies with htng rate, 223-255		310	225		184	114	160	
507	**N,N′-Diacetyl *p*-phenylenediamine**	310		16 6	118 2	78	86 0	140, 147	267	*mono* 162-3, *di* 304	*mono* 128, *di* 300	
508	**Fumaric acid dianilide**	314		286 7 (sealed tube), 293-5, 200, subl		150 8			184	114	160	
509	**N,N′-Diacetylbenzidine**	317		16 6	118 2	78	86 0	127		*mono* 199, *di* 317	*mono* 203-5, *di* 352	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XV. ORGANIC DERIVATIVES OF AMIDES AND IMIDES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Xanthyl amide	Derived acid				Derived amine				Miscellaneous
				M P , °C	B P °C	*p* Nitro benzyl ester	*p*-Bromophenacyl ester	M P , °C	B P , °C	Acetamide	Benzamide	
510	**Terephthalic acid dianilide**	334 7		300, subl without melting		*di* 263 5	*di* 225					
511	**N,N'-Dibenzoylbenzidine**	352		122 4	249	89	119	127		*mono* 199 *di* 317	*mono* 203 5 *di* 352	
512	**Trimesic acid triamide**	365d		380 (cor)			*tri* 197 (sealed tube)	NH_3				
513	**Oxalic acid diamide**	419d (sealed tube)		189 5 (anh), 101 (+2 H_2O), (rapid htng)		*di* 204		NH_3				

*Derivative data given in order m p , crystal color, solvent from which crystallized

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EXPLANATIONS AND REFERENCES TO TABLE XVI

Hydrolysis to the corresponding acid and alcohol *

$$RCOOR' + KOH \rightarrow \underset{\text{Alcohol}}{R'OH} + \underset{\downarrow H^+}{RCOOK} \rightarrow \underset{\text{Acid}}{RCOOH}$$

From the ester with aqueous sodium or potassium hydroxide
For directions and examples see Cheronis, p 539, Linstead, p 42, Vogel, pp 390, 391, 786, Wild, p 187
From the ester and potassium hydroxide in anhydrous or aqueous diethylene glycol
See Cheronis, p 538, C E Redemann and H J Lucas, *Ind Eng Chem*, *Anal Ed*, **9**, 514 (1937)
From the ester with sodium methoxide in methanol or with sodium ethoxide in ethanol
See Linstead, p 40, Vogel, p 391
From an α-hydroxy ester in water without catalyst
See A Findlay and E M H Hickmans, *J Chem Soc*, **95**, 1004 (1909)

Saponification equivalent

The saponification equivalent (S E) measures the number of equivalents of base required for complete hydrolysis of an ester It is defined as

$$S\ E = \frac{\text{Milligrams ester taken for hydrolysis}}{\text{Milliequivalents of KOH required for complete hydrolysis}}$$

For directions and examples see Cheronis, pp 975 6, Shriner, p 235 Vogel, p 392

NOTE For directions and examples for preparation of derivatives of the carboxylic acids formed on hydrolysis of esters see explanations and references to Tables XII, XIII and XIV, pp 186, 187, 188, 189

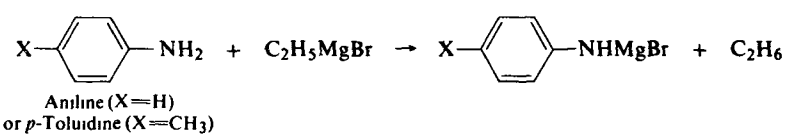
For directions and examples for preparation of derivatives of alcohols formed on hydrolysis of esters see explanations and references to Table VI, pp 77, 78, 79

Amide

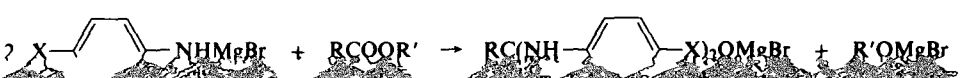
$$RCOOR' + NH_3 \rightarrow RCONH_2 + R'OH$$

From the ester with aqueous or alcoholic ammonia
For directions and examples see Linstead, p 42, Wild, p 188

Anilide and p-Toluidide



Aniline (X=H)
or *p*-Toluidine (X=CH_3)



EXPLANATIONS AND REFERENCES TO TABLE XVI (*Continued*)

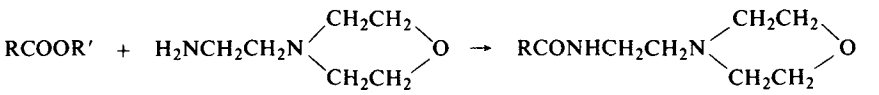
Hydrazide

$$RCOOR' + H_2NNH_2 \rightarrow RCONHNH_2 + R'OH$$

Hydrazide

From the ester and 90% hydrazine hydrate
For directions and examples see Linstead, p 42, Wild, p 191
From the ester and 85% hydrazine hydrate in alcohol
See Cheronis, p 535, Shriner, p 237, Vogel, p 395, P P T Sah, *Rec Trav chim*, **59**, 1036 (1940)

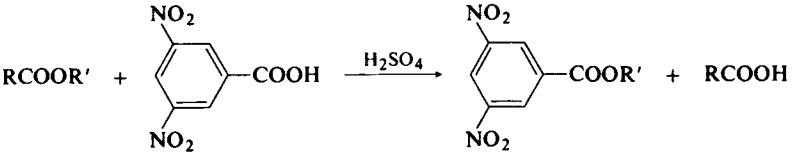
N-(β-Aminoethyl)morpholide *



N (β Aminoethyl)morpholide

From the ester and N-(β-aminoethyl)morpholine in ethylene glycol or without solvent
For directions and examples see Cheronis, p 536, R W Bost and L V Mullen, *J Amer Chem Soc*, **73**, 1967 (1951)

3,5-Dinitrobenzoate *



3 5 Dinitrobenzoate

From the ester with 3,5-dinitrobenzoic acid with a catalytic amount of sulfuric acid
For directions and examples see Linstead, p 43, Shriner, p 238, Vogel, p 393, W B Renfrow and A Chaney, *J Amer Chem Soc*, **68**, 150 (1946)
From the ester with 3,5-dinitrobenzoyl chloride and pyridine
See Cheronis, p 538

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.).*

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p* Toluidide	3,5 Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M.P., °C	B.P., °C	M.P. °C	B.P. °C				
1	**Ethyl nitrite**	17			0.900$_4^{15}$	75			−117.3	78.32			93, al	
2	**Methyl formate**	31.50	−99	1.34648[17] He (yel)	0.97421	60	8.4	100.7	−97	64.65	2.55	53	108 (cor.), al	
3	**Ethyl formate**	54.15	−79.4	1.35975	0.92247	74	8.4	100.7	−117.3	78.32	2.55	53	93, al	
4	**Methyl acetate**	57.1	−98.7	1.36170 1.3639	0.9274 0.93347	74	16.6	118.2	−97	64.65	82	153 147	108 (cor.), al	
5	**Ethyl trifluoroacetate**	60.5		1.3093[15]		142	−15.25	72.4	−117.3	78.32			93, al	
6	**Methyl nitrate**	65			1.217$_4^{15}$	77			−97	64.65			108 (cor.), al	
7	**Isopropyl formate**	71, 68			0.8728	88	8.4	100.7	−89.5	82.4	2.55	53	123, pet eth	
8	**Butyl nitrite**	75			0.911	103			−90.2	117.6 116			64, 62.5	
9	**Methyl chloroformate**	75		1.38675	1.2231	94.5			−97	64.65			108 (cor.), al	
10	**Ethyl acetate**	77.15	−83.6	1.372	0.90055	88	16.6	118.2	−117.3	78.32	82	153 147	93, al	
11	**Methyl propionate**	79.65	−87.5	1.3779	0.9151	88	−20.8	141	−97	64.65	81 81.3, 79	126 123	108 (cor.), al	
12	**Methyl acrylate**	80.3		1.3984	0.961[19.2]	86	13	140, 141	−97	64.65	84-5, pet eth	141	108 (cor.), al	Polymerizes on standing
13	***n*-Propyl formate**	80.85, 81	−92.9	1.37789	0.9071, 0.918	88	8.4	100.7		97.1	2.55	53	74, pet eth	
14	***tert*-Butyl formate**	83				102	8.4	100.7	25.5	82.5	2.55	53	142, pet eth	
15	**Allyl formate**	83.6			0.946	86	8.4	100.7		97.1	2.55	53	49-50	
16	**Ethyl nitrate**	87	−112		1.106	91			−117.3	78.32			93, al	
17	**Isopropyl acetate**	88.9, 91	−73.4	1.3740[25]	0.872	102	16.6	118.2	−89.5	82.4	82	153, 147	123, pet eth	
18	**Dimethyl carbonate** (Methyl carbonate)	90.5		1.3687	1.0702 1.0694	90			−97	64.65			108 (cor.), al	
19	**Methyl isobutyrate**	92.6, 92.26	−87.7, −84.7	1.3840	0.8906	102	−46.1	154.7	−97	64.65	128, 129	108.5-9.5	108 (cor.), al	
20	**Ethyl chloroformate**	93		1.3974	1.13519	108.5			−117.3	78.32			93, al	
21	***sec*-Butyl formate**	97		1.384	0.884	102	8.4	100.7		99.5	2.55	53	76	
22	***tert*-Butyl acetate**	97.8		1.386	0.867	116	16.6	118.2	25.5	82.5	82	153, 147	142, pet eth	
23	**Isobutyl formate**	98.4	−95.8	1.38568	0.88535, 0.8755	102	8.4	100.7		108.1	2.55	53	87	
24	**Isoamyl nitrite**	99		1.38708[21]	0.880[15]	117			−117	132			61	
25	**Ethyl difluoroacetate**	99		1.3463		124		134.5	−117.3	78.32	52		93, al	

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p* Toluidide	3,5-Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M.P., °C	B.P., °C	M.P. °C	B.P., °C				
26	**Methyl methacrylate**	99, 100 1	−50	1 413	0 936	100	16	161	−97	64 65	102 6		108 (cor) al	Polymerizes on standing or heating, 4-Bromoanilide, 116
27	**Ethyl propionate**	99 1	−73 85	1 3853	0 8889	102	−20 8	141	−117 3	78 32	81, 81 3, 79	126, 123	93, al	N-(β-Aminoethyl)morpholide, 85
28	**Ethyl acrylate**	101		1 4059[19 4]	0 9136[15]	100	13	141	−117 3	78 32	84-5, pet eth	141	93, al	Polymerizes on standing or heating
29	**Methyl pivalate** (Methyl trimethylacetate)	101		1 4228	0 891[0]	116	35 5	163-4	−97	64 65	155 7, 153 4, et ac - pet eth	119 20	108 (cor), al	
30	***n*-Propyl acetate**	101 55	−95	1 38468	0 8834	102	16 6	118 2		97 1	82	153 147	74, pet eth	
31	**Methyl *n*-butyrate**	102 3	−84 8	1 3879	0 8982	102	−5 5 −8	162 5, 164	−97	64 65	115 6	75	108 (cor), al	
32	**Allyl acetate**	104		1 40488	0 9276	100	16 6	118 2		97 1	82	153 147	49 50	
33	**Trimethyl orthoformate** (Methyl orthoformate)	105, 102		1 3793	0 9676	106	8 4	100 7	−97	64 65	2 55	53	108 (cor), al	
34	**Methyl isocrotonate**	106 2 108 2 (cor)				100	15	169	−97	64 65	101 2	132	108 (cor), al	
35	***n*-Butyl formate**	106 6	−91 9	1 38940	0 8885	102	8 4	100 7	−90 2	117 6, 116	2 55	53	64, 62 5	
36	**Ethyl isobutyrate**	109 8, 111	−88 2	1 3903	0 86930	116	−46 1	154 7	−117 3	78 32	128, 129	108 5-9 5	93, al	Hydrazide, 104, eth -al
37	***n*-Propyl nitrate**	110		1 3979	1 063	105				97 1			74, pet eth	
38	**Chloromethyl acetate**	111			1 094[15]	108 5	16 6	118 2			82	153 147		
39	**Isopropyl propionate**	111 3			0 8931[0]	116	−20 8	141	−89 5	82 4	81, 81 3, 79	126 123	123, pet eth	
40	***sec*-Butyl acetate**	112 0		1 3865[25]	0 872, 0 8648[25]	116	16 6	118 2		99 5	82	153, 147	76	
41	***n*-Propyl chloroformate**	113 115		1 40350	1 0901	122 5				97 1			74, pet eth	
42	**Methyl isovalerate**	116 7		1 3900[25]	0 8808	116	−30 0	176 5	−97	64 65	135, 137	106 7	108 (cor), al	
43	**Isobutyl acetate**	117 2 118		1 39008	0 8747	116	16 6	118 2		108 1	82	153, 147	87	
44	**Ethyl pivalate** (Ethyl trimethylacetate)	118 15		1 39061	0 85467	130	35 5	163-4	−117 3	78 32	155 7, 153-4, et ac - pet eth	119 20	93, al	
45	**Ethyl methacrylate**	118 5[-1]		1 41472	0 91063	114	16	161	−117 3	78 32	102 6		93, al	Polymerizes on heating, 4-Bromoanilide, 116

*Derivative data given in order m p crystal color solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M.P., °C	B.P., °C	M.P., °C	B.P., °C				
46	**Methyl crotonate**	118.8–119.3			0.9806[4]	100	72	189 (cor.)	−97	64.65	118, w., 115	132, bz	108 (cor.), al	
47	**Isopropyl isobutyrate**	120.76			0.84708[21.3]	130	−46.1	154.7		82.4	128, 129	108.5–9.5	123, pet. eth.	Hydrazide, 104, eth.-al
48	**Ethyl *n*-butyrate**	121.6	−100.8	1.40002	0.87917	116	−5.5, −8	162.5, 164	−117.3	78.32	115–6	75	93, al.	
49	***n*-Propyl propionate**	122.2, 123.4	−75.9	1.39325	0.8809	116	−20.8	141		97.1	81, 81.3, 79	126, 123	74, pet. eth.	
50	***tert*-Amyl acetate** (Dimethylethylcarbinyl acetate)	124		1.392	0.8738[19]	130	16.6	118.2	−8.55	102.3	82	153, 147	116, 117–8	
51	**Allyl propionate**	124				114	−20.8	141		97.1	81, 81.3, 79	126, 123	49–50	
52	**Isoamyl formate**	124.2	−93.5	1.39756	0.8820	116	8.4	100.7	−117	132	2.55	53	61	
53	**Ethyl isocrotonate**	125.5–126[749]		1.42423	0.91820	114	15	169	−117.3	78.32	101.2	132	93, al.	
54	***n*-Butyl acetate**	126.1	−73.5	1.39614	0.881	116	16.6	118.2	−90.2	117.6, 116	82	153, 147	64, 62.5	
55	**Diethyl carbonate** (Ethyl carbonate)	126.5	−43.0	1.3852	0.9752	118			−117.3	78.32			93, al.	
56	***tert*-Butyl isobutyrate**	126.7		1.3921		144	−46.1	154.7	25.5	82.5	128, 129	108.5–9.5	142, pet. eth.	Hydrazide, 104, eth.-al
57	**Methyl *n*-valerate** (Methyl *n*-pentanoate	127.7	−91.0	1.397	0.885	116	−34.5	186.35	−97	64.65	106	74	108 (cor.), al.	
58	**Isopropyl *n*-butyrate**	128			0.8652[13]	130	−5.5, −8	162.5, 164	−89.5	82.4	115–6	75	123, pet. eth.	
59	**Isobutyl chloroformate**	130, 128.8		$1.40711_{He}^{17.9}$		136.5				108.1			87	
60	**Methyl methoxyacetate**	130		1.39636	1.0511	104		203	−97	64.65	96.5–7.0, 92.4		108 (cor.), al.	
61	**Methyl chloroacetate**	130, 132		1.4221	1.238	108.5	α 61.3, β 56.2, γ 52.5	189	−97	64.65	121	162	108 (cor.), al.	
62	**Ethyl methoxyacetate** .	132			1.0118[15]	118		203	−117.3	78.32	96.5 7.0, 92–4		93, al.	
63	***n*-Amyl formate**	132.1, 130	−73.5	1.39916	0.8853	116	8.4	100.7	−78.5	138 (cor.)	2.55	53	46.4	
64	***sec*-Amyl(3) acetate** (Diethylcarbinyl acetate)	133			1.4005	130	16.6	118.2		116.1	82	153, 147	101, 99, 97	
65	***sec*-Amyl(2) acetate** (Methyl *n*-propylcarbinyl acetate)	133.5		1.3960	0.8692[18]	130	16.6	118.2		119.85	82	153, 147	62	
66	**Allyl isobutyrate**	134				128	−46.1	154.7		97.1	128, 129	108.5 9.5	49–50	Hydrazide, 104, eth.-al
67	**Ethyl isovalerate**	134.7	−99.3	1.4009	0.86565	130	−30.0	176.5	−117.3	78.32	135, 137	106–7	93, al.	
68	***n*-Propyl isobutyrate**	135		1.3959	0.8843[0]	130	−46.1	154.7		97.1	128, 129	108.5 9.5	74, pet. eth.	Hydrazide, 104, eth.-al

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M.P., °C	B.P. °C	M.P. °C	B.P. °C				
69	***n*-Butyl nitrate**	136			1.048[0]	119			−90.2	117.6 116			64, 62.5	
70	**Methyl pyruvate**	136.8 138, 134-7			1.154[0]	102	13.6	165d	−97	64.65	124.5 145	109 130	108 (cor.), al	2,4-Dinitrophenylhydrazone, 186.5-7.5 (cor.), yel., diox.-me al
71	**Methyl α-hydroxyisobutyrate**	137				118	79	212	−97	64.65		132.3, w	108 (cor.), al	
72	**Isobutyl propionate**	138, 137	−71.4	1.3975	0.8876[0]	130	−20.8	141		108.1	81, 81.3, 79	123-6	87	
73	**Ethyl crotonate**	138, 136.7[749]		1.42524	0.91752	114	72, w	189 (cor.)	−117.3	78.32	159-60, bz	132, bz	93, al	
74	**Allyl *n*-butyrate**	142				128	−5.5 −8	162.5, 164		97.1	115-6	75	49-50	
75	**Isoamyl acetate** (3-Methylbutyl acetate)	142		1.40034	0.8674	130	16.6	118.2	−117	132	82	153, 147	61	
76	**Isopropyl isovalerate**	142		1.3938[25]	0.8538[17]	144	−30	176.5	−89.5	82.4	135-137	106.7	123, pet. eth.	
77	***n*-Propyl *n*-butyrate**	143.8	−95.2	1.4005	0.872	130	−5.5 −8	162.5 164		97.1	115.6	75	74, pet. eth.	
78	**β-Methoxyethyl acetate** (Ethylene glycol monomethyl ether acetate, Methyl cellosolve acetate)	144			1.088	118	16.6	118.2		124.5	82	153 147		
79	**Methyl bromoacetate**	144d			1.657	153	50	208	−97	64.65	91		108 (cor.), al	
80	***n*-Butyl chloroformate**	145, 139		1.417[N.4]	1.079	136.5			−90.2	117.6, 116			64, 62.5	
81	**β-Chloroethyl acetate**	145		1.4234	1.178	122.5	16.6	118.2		131	82	153, 147		
82	**Methyl *d,l*-lactate**	145 144.8		1.4144	1.0931	104	16.8, 18	122[15]	−97	64.65	78.5-9.0 (cor.), bz.-al (3:1)	107	108 (cor.), al	
83	**Ethyl chloroacetate**	145	−26	1.42274	1.158	122.5	α 61.3, β 56.2, γ 52.5	189	−117.3	78.32	121	162	93, al	
84	***tert*-Butyl *n*-butyrate**	145-6.6		1.4001[17.5]		144	−5.5, −8	162.5, 164	25.5	82.5	115-6	75	142, pet. eth.	
85	**Triethyl orthoformate** (Ethyl orthoformate)	145.5		1.3922	0.8909	148	8.4	100.7	−117.3	78.32	2.55	53	93, al	
86	**Ethyl *n*-valerate** (Ethyl *n*-pentanoate)	145.5	−91.2	1.40094	0.8739	130	−34.5	186.35	−117.3	78.32	106	74	93, al	
87	**Ethyl α-chloropropionate**	146			1.087	136.5		186	−117.3	78.32	80	124	93, al	Phenylhydrazide, 95

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^n	D_4^{20}	Saponification					Amide	*p*-Toluidide	3 5 Dinitro benzoate	Miscellaneous
						Equivalent	Acid		Alcohol						
							M P °C	B P °C	M P °C	B P °C				
88	***n*-Butyl propionate**	146 8	−89 6	1 4038[15]	1 401	130	−20 8	141	−90 2	117 6, 116	81 81 3, 79	126, 123	64 62 5	
89	**Benzyl chloroacetate**	147		1 5246[18]	1 2223[4]	170 5	α 61 3, β 56 2 γ 52 5	189	−15 3	205 5	121	162	113	
90	**Di-isopropyl carbonate** (Isopropyl carbonate)	147 2 (cor)		1 3932	0 9162	146			−89 5	82 4			123, pet eth	
91	**Methyl isobutylcarbinyl acetate**	148			0 8805[0]	130	16 6	118 2	−97	64 65	82	153 147	108 (cor), al	
92	**Methyl ethoxyacetate**	148			1 0112[1]	118		206 7	−97	64 65	80 2	32, eth	108 (cor), al	
93	**Isobutyl isobutyrate**	148 6	−80 65	1 3999	0 87496[0]	144	−46 1	154 7		108 1	128, 129	108 5 9 5	87	Hydrazide, 104, eth -al
94	***n*-Amyl acetate** (*n*-Pentyl acetate)	149 25	−70 8	1 4031	0 8756	130	16 6	118 2	−78 5	138 (cor)	82	153 147	46 4	
95	**Ethyl α-hydroxyisobutyrate**	150				132	79	212	−117 3	78 32		132 3, w	93, al	
96	**Methyl glycolate**	151 2			1 1677[18]	90	78 9 80		−97	64 65	120 al - et ac	143, w	108 (cor), al	
97	**Methyl *n*-caproate** (Methyl *n*-hexanoate)	151 25	−71 0	1 405	0 88464	130	−3 9	205 35	−97	64 65	100 1	74 5	123, pet eth	
98	**Isopropyl *n*-valerate** (Isopropyl *n*-pentanoate)	153 5		1 4009	0 8579	144	−34 5	186 35	−89 5	82 4	106	74	61	
99	**Isoamyl chloroformate**	154		$1\ 41916_{He}^{12}$	1 032[15]	150 5			−117	132			93, al	
100	**Ethyl *d,l*-lactate**	154 5		1 410	1 030	118	16 8, 18	122[15]	−117 3	78 32	78 5 9 0 (cor), bz -al , (3 1)	107	93, al	
101	**Ethyl pyruvate**	155		0 0596[15 6]	1 408[15 6]	116	13 6	165d	−117 3	78 32	124 5, 145	109, 130	93, al	Phenylhydrazone, 118, dil al 4-Nitrophenylhydrazone, 185–7, 2 4-Dinitrophenylhydrazone, 154 5 155 (cor), diox -al
102	***n*-Propyl isovalerate**	155 5		1 40413[17 8]	0 8643[17 8]	144	−30	176 5		97 1	135, 137	106–7	74, pet eth	
103	***n*-Hexyl formate**	155 51	−62 65	1 40898[15] He (yel)	0 88133	130	8 4	100 7	−51 6 −46 1	157 5	2 55	53	58 4 (cor)	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3 5-Dinitro benzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M P °C	B P °C	M P °C	B P °C				
104	**β-Ethoxyethyl acetate** (Ethylene glycol monoethyl ether acetate, Ethyl cellosolve acetate)	156 2, 158		1 40292	0 9701	132	16 6	118 2		135	82	153, 147	75, al	
105	**Isobutyl *n*-butyrate**	157		1 40295[18 4]	0 8620	144	−5 5 −8	162 5 164		108 1	115 6	75	87	
106	**Ethyl dichloroacetate**	158		1 43860	1 2821	157	5 6	194	−117 3	78 32	98 (subl)	153	93, al	
107	**Ethyl bromoacetate**	159		1 451	1 506	167	50	208	−117 3	78 32	91		93, al	
108	**Ethyl glycolate**	160			1 0869[15]	104	78 9 80		−117 3	78 32	120, al - et ac	143, w	93, al	
109	**Isoamyl propionate**	160 2		1 4065	0 870	144	−20 8	141	−117	132	81 81 3 79	126 123	61	
110	**Ethyl α-bromopropionate**	162			1 524	181	25 7	203 5	−117 3	78 32	123	125	93, al	
111	**Cyclohexyl formate**	162 5[750]		1 443	1 010	128	8 4	100 7	25 1	161 1	2 55	53	112-3, al	
112	**β-Bromoethyl acetate**	163			1 524	167	16 6	118 2		149d	82	153, 147		
113	**Tetraethyl silicate** (Ethyl orthosilicate)	165 5, 168 5		1 38619	0 93975	52			−117 3	78 32			93, al	Gives SiO_2 on hydrolysis
114	***n*-Propyl *n*-valerate** (*n*-Propyl *n* pentanoate)	166 2, 167	−70 7	1 4065	0 8699	144	−34 5	186 35		97 1	106	74	74, pet eth	
115	***n*-Butyl *n*-butyrate**	166 6	−91 5	1 406	0 869	144	−5 5 −8	162 5, 164	−90 2	117 6 116	115 6	75	64, 62 5	
116	**Ethyl *n*-caproate** (Ethyl *n* hexanoate)	167 7	−67 5	1 40727	0 8710	144	−3 9	205 35	−117 3	78 32	100 1	74 5	93, al	
117	**Ethyl trichloroacetate**	168		1 450	1 380	191 5	57 8	197 5	−117 3	78 32	141	113	93, al	Phenylhydrazide, 123
118	**Isopropyl *d,l*-lactate**	168, 166 8		1 4082[25]	0 998	132	16 8, 18	122[15]	−89 5	82 4	78 5 9 0 (cor), bz -al (3 1)	107	123, pet eth	
119	**Di-*n*-propyl carbonate** (*n*-Propyl carbonate)	168 5 (cor)		1 4014	0 9411	146				97 1			74, pet eth	
120	***n*-Amyl propionate** (*n*-Pentyl propionate)	168 7	−73 1	1 4096[15]	0 8761[15]	144	−20 8	141	−78 5	138 (cor)	81, 81 3, 79	126, 123	46 4	
121	**Ethylidene diacetate**	169			1 061[12]	73	16 6	118 2	−12 6	197 85	82	153, 147	169	
122	**Isoamyl isobutyrate**	169			0 8760[0]	158	−46 1	154 7	−117	132	128, 129	108 5-9 5	61	Hydrazide, 104, eth -al
123	**Methyl acetoacetate**	170		1 41964	1 0765[0]	116			−97	64 65			108 (cor), al	Semicarbazone, 152 5, me al
124	**Isobutyl isovalerate**	171		1 40569	0 8534	158	−30	176 5		108 1	135, 137	106 7	87	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M P, °C	B P, °C	M P °C	B P, °C				
125	**Methyl enanthate** (Methyl *n*-heptanoate)	173 8	−55 8	1 412	0 88011	144	−74 7	223	−97	64 65	96, 96 5	81	108 (cor), al	
126	**Ethylene glycol diformate**	174			1 193[0]	59	8 4	100 7	−78 5	138 (cor)	2 55	53	46 4	
127	***sec*-Butyl *n*-valerate** (*sec*-Butyl *n*-pentanoate)	174 5		1 4081	0 8605[20]	158	−34 5	108 35		99 5	106	74	76	
128	**Cyclohexyl acetate**	175		1 442	0 970	142	16 6	118 2	25 1	161 1	82	153, 147	112 3, al	
129	***n*-Butyl chloroacetate**	175			1 081	150 5	α 61 3, β 56 2, γ 52 5	189	−90 2	117 6, 116	121	162	64, 62 5	
130	**Furfuryl acetate**	175 7		1 4627	1 118	140	16 6	118 2		172, 170	82	153, 147	80 1	
131	**Methyl methylacetoacetate**	177 4		1 418	1 030	130			−97	64 65			108 (cor), al	Semicarbazone, 138, al
132	***n*-Heptyl formate**	178 12		1 41505[15] He (yel)	0 87841	144	8 4	100 7	−34 6, −33 8	176 8	2 55	53	46 47	
133	***n*-Hexyl acetate**	178 1	−80 9, −60 9	1 41122[15] He (yel)	0 87336	144	16 6	118 2	−51 6, −46 1	157 5	82	153, 147	58 4 (cor)	
134	**Isoamyl *n*-butyrate**	178 6		1 411	0 864	158	−5 5, −8	162 5, 164	−117	132	115 6	75	61	
135	**Ethyl β-bromopropionate**	179			1 425	181	62 5		−117 3	78 32	111		93, al	2-Naphthylamide, 174
136	**Ethyl acetylglycolate**	179			1 0993[17]	73			−117 3	78 32			93, al	Hydrolysis → glycolic a + ac a + al
137	**Isobutyl *n*-valerate** (Isobutyl *n*-pentanoate)	179		1 4099	0 8625	158	−34 5	186 35		108 1	106	74	87	
138	**β-Hydroxyethyl formate** (Ethylene glycol monoformate)	180			1 1989[15]	90	8 4	100 7	−78 5	138 (cor)	2 55	53	46 4	
139	**Ethyl methylacetoacetate**	180 8 (cor), 187		1 419	1 0191	144			−117 3	78 32	73, eth		93, al	Anilide, 138-40, Semicarbazone, 194, 2,4-Dinitrophenyl hydrazone, 56-7
140	**Ethyl acetoacetate**	181		1 41976	1 025	130			−117 3	78 32			93, al	Semicarbazone, 129, 133, eth
141	**Methyl pyromucate** (Methyl 2-furoate)	181 3		1 4860	1 180	126	133 4, 132	230-2	−97	64 65	142-3	170 5, al	108 (cor), al	2,4-Dinitrophenylhydrazone, 93, 96, yel , al

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M.P. °C	B.P. °C	M.P. °C	B.P. °C				
142	**Dimethyl malonate** (Methyl malonate)	181.5	−62	1.41398	1.1539	66	134.8–9		−97	64.65	*mono* 106 110 *di*: 170 w.-al	*mono* 156d *di* 252 3, al	108 (cor.) al	Phenylhydrazide, 194
143	**Ethyl β-methoxyethyl carbonate**	182.6		1.4036[25]	1.0424[25]	148			−117.3	78.32			93 al	
144	**Methyl cyclohexanecarboxylate** (Methyl hexahydrobenzoate)	183		1.45372[15]	0.9954[15]	142	30.1	233	−97	64.65	185.6		108 (cor.), al	
145	**Diethyl oxalate** (Ethyl oxalate)	185.19	−41.5, −40.6	1.41043	1.0785	73	189.5 (anh.) 101 (+ $2H_2O$)		−117.3	78.32	*mono* 219 *di* 419d	*mono* 169 *di* 268	93, al	N-(β-Aminoethyl)-morpholide 170
146	***n*-Amyl *n*-butyrate** (*n*-Pentyl *n*-butyrate)	186.4	−72.3	1.412	0.866	158	−5.5, −8	162.5 164	−78.5	138 (cor.)	115–6	75	46.4	
147	***n*-Butyl *n*-valerate** (*n*-Butyl *n*-pentanoate)	186.9	−92.8	1.4123	0.8678	158	−34.5	186.35	−90.2	117.6 116	106	74	64 62.5	
148	**β-Hydroxyethyl acetate** (Ethylene glycol monoacetate)	187–9				104	16.6	118.2	−78.5	138 (cor.)	82	153 147	46.4	
149	***n*-Propyl *n*-caproate** (*n*-Propyl *n*-hexanoate)	187.15 186	−74.0	1.417	0.86719	158	−3.9	205.35		97.1	100.1	74.5	74, pet eth	
150	**Dimethyl sulfate** (Methyl sulfate)	188	−27	1.3874	1.3348[15]	63			−97	64.65			108 (cor.), al	
151	***n*-Butyl lactate**	188	−43	1.4216	0.984_{20}^{20}	146	16.8, 18	122[15]	−90.2	117.6 116	78.5–9.0 (cor.), bz.-al (3:1)	107	64 62.5	
152	**Ethyl enanthate** (Ethyl *n*-heptanoate)	188.6	−66.3	1.413	0.86856	158	−7.47	223	−117.3	78.32	96, 96.5	81	93, al	
153	**Methyl ethylacetoacetate**	189.7 (cor.)			0.989	144			−97	64.65	95.6, bz		108 (cor.), al	
154	**Di-isobutyl carbonate** (Isobutyl carbonate)	189.8 (cor.)		1.4072	0.9138	174				108.1			87	
155	***n*-Hexyl propionate**	190	−57.5	1.41621[15] He (yel.)	0.86980	158	−20.8	141	−51.6 −46.1	157.5	81, 81.3, 79	126 123	58.4 (cor.)	
156	**Ethylene glycol diacetate**	190.2	−31	1.4150	1.1040	73	16.6	118.2	−78.5	138 (cor.)	82	153, 147	46.4	
157	**Isoamyl isovalerate**	190.4		1.41300[18.7]	0.870	172	−30	176.5	−117	132	135, 137	106.7	61	
158	***n*-Heptyl acetate**	192.45		1.41653[15] He (yel.)	0.87070[15]	158	16.6	118.2	−34.6, −33.8	176.8	82	153, 147	46, 47	
159	**Cyclohexyl propionate**	193[750]			0.9718[0]	156	−20.8	141	25.1	161.1	81, 81.3, 79	126, 123	112.3, al	

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3 5 Dinitro benzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M P , °C	B P , °C	M P , °C	B P °C				
160	**Di-isopropyl oxalate** (Isopropyl oxalate)	193 4		1 4100	1 0097	87	189 5 (anh), 101 (+ $2H_2O$)		−89 5	82 4	*mono* 219, *di* 419d	*mono* 169, *di* 268	123, pet eth	
161	**Ethyl β-ethoxyethyl carbonate**	194 5		1 5064[25]	1 0115[25]	162			−117 3	78 32			93, al	
162	***sec*-Octyl acetate**	194 5		1 4141	0 8606[19]	172	16 6	118 2		179	82	153, 147	32	
163	**Methyl *n*-caprylate** (Methyl *n*-octanoate)	194 6	−41	1 417	0 878	158	16 3	237 239 3	−97	64 65	57	70	108 (cor), al	
164	**α-Tetrahydrofurfuryl acetate**	195, 194		1 4350	1 0624[25]	144	16 6	118 2		177-8[743]	82	153, 147	83-4	
165	**Methyl levulinate**	196, 191		1 42333	1 04945	130	33 5	245-6	−97	64 65	107-8, al	108 9, w	108 (cor), al	Semicarbazone, 142-3, Phenylhydrazone, 94-6, 2,4-Dinitrophenylhydrazone, 141 5-2 5 (cor), diox -al , Oxime, 96
166	**Ethyl cyclohexanecarboxylate** (Ethyl hexahydrobenzoate)	196		1 45012[15]	0 9672[15]	156	30 1	233	−117 3	78 32	185 6		93, al	
167	**Diethyl methylmalonate**	196			1 019[15]	87	137, 138d		−117 3	78 32	217, 206	*mono* 145d , *di* 228, 214	93, al	
168	**Phenyl acetate**	196 7		1 503	1 078	136	16 6	118 2	41 8, 42	182	82	153, 147	145 8 (cor), al	
169	**Ethyl ethylacetoacetate**	198		1 422	0 9856	158			−117 3	78 32	95 6, bz		93, al	Ketone cleavage → 2-pentanone, b p 102
170	***n*-Octyl formate**	198 8	−39 1	1 42082[15] He (yel)	0 87435	158	8 4	100 7	−16, −16 7	195	2 55	53	61-2	
171	**2-Ethyl-1-hexyl acetate**	199			0 8733[20/20]	172	16 6	118 2		184 6	82	153, 147		
172	**Methyl benzoate**	199 2	−12 4	1 5164	1 0888	136	122 4	249	−97	64 65	130	158	108 (cor), al	
173	**Diethyl malonate** (Ethyl malonate) ...	199 3	−51 5	1 41618	1 05513	80	134 8 9		−117 3	78 32	*mono* 106 10, *di* 170, w -al	*mono* 156d , *di* 252-3, al	93, al	Phenylhydrazide, 194
174	**Methyl cyanoacetate**	200	−22 5		1 0962[25]	99	66		−97	64 65	119 20		108 (cor), al	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3,5 Dinitro benzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M P, °C	B P °C	M P °C	B P, °C				
175	**Dimethyl mesaconate**	203		1 45119	1 0914	79	204 5 (cor)		−97	64 65	*mono* (α) 222 (β) 174, *di* 176 5	*mono* (α) 196, *di* 212, al	108 (cor), al	Dihydrazide, 215d , dil al
176	**Benzyl formate**	203		1 516	1 080	136	8 4	100 7	−15 3	205 5	2 55	53	113	
177	**Vinyl benzoate**	203			1 065	148	122 4	249			130	158		
178	**Cyclohexyl isobutyrate**	204[750]			0 9489[0]	170	−46 1	154 7	25 1	161 1	128 129	108 5 9 5	112-3, al	Hydrazide, 104, al -eth
179	**Dimethyl maleate**	204 4	7 6	1 44156	1 14513[15]	72	137		−97	64 65	*mono* 172 3, w , 153, sl d , *di* 181, me al	*di* , 142, eth	108 (cor), al	
180	**α-Tetrahydrofurfuryl propionate**	204-7			1 044	158	−20 8	141		177 8[743]	81, 81 3 79	126 123	83 4	
181	**Ethyl levulinate**	205 8		1 42288	1 01114	144	33 5	245-6	−117 3	78 32	107-8d	108-9, w	93, al	Semicarbazone, 147 8, Phenylhydrazone, 103-4, 2,4-Dinitrophenylhydrazone, 101 2, diox -al , Oxime, 96
182	**Ethyl allylacetoacetate**	206 sl d , 211-2 sl d		1 43[17 6]	0 9898	170			−117 3	78 32			93, al	Semicarbazone, 125, w
183	***n*-Amyl *n*-valerate** (*n*-Pentyl *n*-pentanoate)	207 4		1 4181[15]	0 8825[0]	172	−34 5	186 35	−78 5	138 (cor)	106	74	46 4	
184	**Di-*n*-butyl carbonate** (*n*-Butyl carbonate)	207 5 (cor)		1 4117	0 9238	174			−90 2	117 6, 116			64, 62 5	
185	***n*-Butyl *n*-caproate** (*n*-Butyl *n*-hexanoate)	207 74	−63 1, −64 3	1 41877[15] He (yel)	0 86530	172	−3 9	205 35	−90 2	117 6, 116	100-1	74 5	64, 62 5	
186	***n*-Hexyl *n*-butyrate**	207 88	−78	1 41875[15] He (yel)	0 86519	172	−5 5, −8	162 5, 164	−51 6, −46 1	157 5	115-6	75	58 4 (cor)	
187	**2-Tolyl acetate** ("*o*-Cresyl acetate")	208			1 048	150	16 6	118 2	31	191 2	82	153, 147	134 8 (cor), al	
188	**Diethyl sulfate** (Ethyl sulfate)	208		1 4010[18]	1 172[25]	77			−117 3	78 32			93, al,	
189	***n*-Propyl *n*-enanthate** (*n*-Propyl *n*-heptanoate)	208	−64 8	1 41835[15]	0 86556	172	−7 47	223		97 1	96, 96 5	81	74, pet eth	
190	**Ethyl *n*-caprylate** (Ethyl *n*-octanoate)	208 35	α −43 1, β −59 2	1 41775	0 8667	172	16 3	237, 239 3	−117 3	78 32	110, 106	70	93, al	N-(β-Aminoethyl) morpholide, 59

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M P, °C	B P, °C	M P °C	B P °C				
191	**Isobutyl enanthate** (Isobutyl *n*-heptanoate)	209			0 8593	186	−7 47	223		108 1	96, 96 5	81	87	
192	**Isopropyl levulinate**	209 3		1 42088	0 98724	158	33 5	245 6		82 4	107 8d	108–9, w	123, pet eth	Semicarbazone, 141–2, Phenylhydrazone, 108 9, 2,4-Dinitrophenylhydrazone, 88–9 (cor), 90 9
193	**Trimethylene glycol diacetate** (1,3-Diacetoxypropane)	210			1 069	80	16 6	118 2	−30	214 7 210 2	82	153 147	178	
194	***n*-Octyl acetate**	210			0 8847[0]	172	16 6	118 2	−16 −16 7	195	82	153 147	61 2	
195	***n*-Heptyl propionate**	210	−50 9	1 42605[15] He (yel)	0 86786	172	−20 8	141	−34 6 −33 8	176 8	81 81 3 79	126 123	46 47	
196	**Dimethyl citraconate**	210 5		1 44856	1 11531	79	92 91d eth lgr	206 11, sl d	−97	64 65	100 1		108 (cor), al	Dihydrazide, 177, w , 1-Naphthylamide, 169–70
197	***n*-Propyl pyromucate** (*n*-Propyl 2-furoate)	211		1 4737[25 9]	1 0745[25 9]	154	133–4, 132	230 2		97 1	142 3	170 5, al	74, pet eth	
198	**Ethylene glycol dipropionate**	211			1 0544[15/15]	87	−20 8	141	−78 5	138 (cor)	81, 81 3, 79	126 123	46 4	
199	**Cyclohexyl *n*-butyrate**	212[750]			0 9572[0]	170	−5 5, −8	162 5, 164	25 1	161 1	115 6	75	112–3, al	
200	**3-Tolyl acetate** ("*m*-Cresyl acetate")	212	12	1 4978	1 049	150	16 6	118 2	11 95	202 7	82	153, 147	164 5 (cor), al	
201	**Ethyl acetopyruvate**	213 5		1 4757[17]	1 1251	158	101, bz		−117 3	78 32	131 2d , al		93, al	
202	**Ethyl benzoate**	212 4 213 2	−34 7	1 50570	1 04684	150	122 4	249	−117 3	78 32	130	158	93, al	N-(β-Aminoethyl) morpholide, 123 4
203	**4-Tolyl acetate** ("*p*-Cresyl acetate")	212 5		1 500	1 051	150	16 6	118 2	36	202	82	153 147	188 6 (cor), al	
204	**Di-*n*-propyl oxalate** (*n*-Propyl oxalate)	213 9	−51 7	1 4168	1 0169	87	189 5 (anh), 101 (+2 H_2O)			97 1	*mono* 219, *di* 419d	*mono* 169, *di* 268	74, pet eth	$NH_4OH \rightarrow$ Di-*n*-propyl oxamate, 90–2, me al
205	**Methyl pelargonate**	214, 213–4			0 892	172	12 3	254 4	−97	64 65	99	84	108 (cor), al	
206	**Dimethyl glutarate**	214[751]	−34 7	1 42415	1 0874	80	98	302 4	−97	64 65	*di* 175	*di* 218	108 (cor), al	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M P , °C	B P , °C	M P , °C	B P , °C				
207	**2,6-Dimethylphenyl acetate** (*vic-m*-Xylenyl acetate)	214-6				164	16 6	118 2	49	203	82	153, 147	158 8 (cor), al	
208	**Methyl 2-toluate** (Methyl 2-methylbenzoate)	215			1 068	150	104-5, 107 8	259[751]	-97	64 65	142 8 (cor)	144	108 (cor), al	
209	**Benzyl acetate**	217		1 5200	1 055	150	16 6	118 2	-15 3	205 5	82	153, 147	113	N-(β-Aminoethyl) morpholide, 95 2
210	**Diethyl succinate**	217 25	-20 8	1 41975	1 0398	87	185 182 8	235d	-117 3	78 32	*mono* 157, *di* 260d , w	*mono* 179 80, *di* 254 5-5 5, 260	93, al	N-(β-Aminoethyl) morpholide, 174
211	**Diethylene glycol monoethyl ether acetate**	218			1 013	176	16 6	118 2		198	82	153, 147	oil	
212	**Diethyl fumarate**	218 4, 213-4	0 55	1 44103	1 052	86	286 7 (sealed tube), 233-5, 200, subl		-117 3	78 32	*mono* 270, 300-2, subl , *di* 266d	*mono* 233 0-4 5, *di* 313 4, ac a	93, al	
213	**Isopropyl benzoate**	218 5		1 4890[25]	1 013	164	122 4	249	-89 5	82 4	130	158	123, pet eth	
214	**Methyl phenylacetate**	220		1 507	1 068	150	76 5, subl	256 5 (cor)	-97	64 65	156	135-6	108 (cor), al	
215	*l*-**Linalyl acetate**	220		1 4460	0 8951	196	16 6	118 2		199	82	153, 147		$[\alpha]_D$ -3 to -17, 4-Nitrobenzoate, 70
216	**Methyl 3-toluate** (Methyl 3-methylbenzoate)	221, 215			1 061	150	111 3, 110-1	263, subl	-97	64 65	94, 97	118	108 (cor), al	
217	***n*-Propyl levulinate**	221 2		1 42576	0 98955	158	33-5	245 6		97 1	107-8d	108-9, w	74, pet eth	Semicarbazone, 129-30, Hydrazone, 88-90, Phenylhydrazone, 67-8 (cor), al , Oxime, 96
218	**Diethyl *d,l*-tartronate**	222-5d			1 152[15]	88	156-8d		-117 3	78 32	*di* 198, dil al , 195-6d		93, al	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p* Toluidide	3,5-Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M P °C	B P °C	M P °C	B P °C				
219	**Diethyl maleate**	222 7	−17	1 44156	1 066	86	137		−117 3	78 32	*mono* 172 3, w 152 3 sl d *di* 181, me al	*di* 142, eth	93, al	
220	**Methyl salicylate**	224		1 5369	1 184	152	158 3		−97	64 65	142, 139	156	108 (cor), al	
221	**Ethyl *n*-butoxyethyl carbonate**	224		1 4143[2]	0 9756[25]	190			−117 3	78 32			93, al	
222	***sec*-Butyl levulinate**	225 8		1 42495	0 96698	172	33 5	245 6		99 5	107 8d	108 9, w	76	Oxime, 96
223	***n*-Heptyl *n*-butyrate**	225 87	−57 5	1 42279[15] He (yel)	0 86371	186	−5 5 −8	162 5, 164	34 6 −33 8	176 8	115 6	75	46 47	
224	**2,4-Dimethylphenyl acetate** (*unsym-m*-Xylenyl acetate)	226 (cor)		1 4990[15]	1 0298[15 5]	164	16 6	118 2	27	211 5 (cor)	82	153, 147	164 6 (cor), 95% al	
225	**Methyl *n*-caprate** (Methyl *n*-decanoate)	226		1 426	0 873	186	31 5	268 70	−97	64 65	108 100 1	78	108 (cor), al	
226	***n*-Amyl *n*-caproate** (*n*-Pentyl *n* hexanoate)	226 16	−50, −47	1 42280[15] He (yel)	0 86349	186	−3 9	205 35	−78 5	138 (cor)	100 1	74 5	46 4	
227	***n*-Butyl *n*-enanthate** (*n*-Butyl *n*-heptanoate)	226 2		1 42280[15]	0 86382	186	−7 47	223	−90 2	117 6, 116	96 96 5	81	64 62 5	
228	***n*-Hexyl *n*-valerate** (*n*-Hexyl *n*-pentanoate)	226 3	−63 1	1 42286[15]	0 86345	186	−34 5	186 35	−51 6 −46 1	157 5	106	74	58 4 (cor)	
229	***n*-Propyl *n*-caprylate** (*n*-Propyl *n*-octanoate)	226 43	−46 2	1 42351[15] He (yel)	0 86591	186	16 3	237 239 3		97 1	110 106	57	74, pet eth	
230	**Ethyl 2-toluate** (Ethyl 2-methyl benzoate)	227		1 507[21 6]	1 0325[21 5]	164	104-5, 107 8	259[751]	−117 3	78 32	142 8 (cor)	144	93, al	
231	**Ethyl pelargonate**	227	α −55 0, β −36 7	1 42200	0 8657	186	12 3	254 4	−117 3	78 32	99	84	93, al	N-(β-Aminoethyl) morpholide, 61 3
232	***l*-Menthyl acetate**	227			0 9185	198	16 6	118 2	43	216	82	153, 147	153	
233	**Ethyl phenylacetate**	227 5		1 49921[18 5]	1 0333	164	76 5, subl	256 5 (cor)	−117 3	78 32	156	135-6	93, al	N-(β-Aminoethyl) morpholide, 88 9
234	***n*-Octyl propionate**	227 9	−41 6	1 42185[15] He (yel)	0 86633	186	−20 8	141	−16, −16 7	195	81, 81 3, 79	126, 123	61-2	
235	**Diethyl itaconate**	228		1 4377	1 0467	93	165		−117 3	78 32	*di* 191 2-8, al		93, al	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M.P., °C	B.P., °C	M.P., °C	B.P., °C				
236	**Diethyl mesaconate**	229		1.4488	1.0453	93	204.5 (cor.), subl		−117.3	78.32	*mono* (α) 222 (β) 174 *di* 176.5	*mono* (α) 196 *di* 212, al	93, al	
237	**Di-isobutyl oxalate** (Isobutyl oxalate)	229		1.4180	0.97373	101	189.5 (anh.), 101 (+2 H_2O)			108.1	*mono* 219 *di* 419d	*mono* 169 *di* 268	87	
238	**Allyl benzoate**	230		1.067_4^4	1.0578_{15}^{15}	162	122.4	249		97.1	130	158	49, 50	
239	**Isobutyl levulinate**	230.9		1.42677	0.96770	172	33.5	245.6		108.1	107.8d	108.9, w	87	Semicarbazone, 112.3, Phenylhydrazone, 84.6, 2,4-Dinitrophenylhydrazone, 55.6, Oxime, 96
240	***n*-Propyl benzoate**	231		1.500	1.023	164	122.4	249		97.1	130	158	74, pet eth	
241	**Diethyl citraconate**	231		1.4442	1.0491	93	92d, eth lgr	206.11 sl d	−117.3	78.32	100.1		93, al	1-Naphthylamide, 169-70
242	**Methyl 3-chlorobenzoate**	231				170.5	158, 155		−97	64.65	134		108 (cor.), al	
243	**β-Phenylethyl acetate**	232-224		1.5108	$1.057^{22.5}$	164	16.6	118.2	−25.8	219.8	82	153 147	108	
244	**Ethyl β-(2-furyl) acrylate**	232	14	1.5286	1.0891^{15}	166	141	286	−117.3	78.32	168.9, w		93, al	
245	**Di-(β-methoxyethyl) carbonate**	232		1.4193^{25}	1.0936^{25}	178				124.5				
246	**Di-isoamyl carbonate**	233 (cor.)		1.4174	0.9067	202			−117	132			61	
247	**Diethyl glutarate**	233.66	−23.8	1.02229	1.42395	94	98	302-4	−117.3	78.32	*di* 175-6	*di* 218	93, al	N-(β-Aminoethyl) morpholide, 152.7
248	**Ethyl 3-toluate**	234		$1.505^{21.4}$	$1.0265^{21.4}$	164	111.3, 110.1	263, subl	−117.3	78.32	94, 97	118	93, al	
249	**Ethyl salicylate**	234		1.52542	1.1396	166	158.3, subl at 76		−117.3	78.32	142, 139	156	93, al	
250	**Methyl 2-chlorobenzoate**	234				170.5	142, 144		−97	64.65	142, 202	131	108, (cor.), al	
251	**Ethyl 4-toluate**	234.5		$1.5089^{18.2}$	$1.0269^{18.2}$	164	179-80, subl	275 (cor.)	−117.3	78.32	160, 158	160, 165	93, al	
252	**Diethyl bromomalonate**	235			1.426_4^{15}	239	113d		−117.3	78.32	*di* 181, al	*di* 217, ac a	93, al	

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M.P., °C	B.P., °C	M.P., °C	B.P., °C				
253	**Ethylene glycol di-*n*-butyrate**	235-7[749]		1.42619$_{He}$	1.0005	101	−5.5, −8	162.5, 164	−78.5	138 (cor.)	115.6	75	46.4	
254	**Diethyl butylmalonate**	235-40			1.425	101			−117.3	78.32	*di* 200		93, al	
255	**2,4,6-Trimethylphenyl acetate** (Mesityl acetate)	236				178	16.6	118.2	70, 69	220	82	153, 147		
256	**2,5-Dimethylphenyl acetate** (*p*-Xylenyl acetate)	237[768]			1.0264[15]	164	16.6	118.2	74.5	212	82	153, 147	137.2 (cor.), al	
257	***n*-Butyl levulinate**	237.8		1.42905	0.97353	172	33.5	245-6	−90.2	117.6, 116	107.8d	108-9, w	64, 62.5	Semicarbazone, 102-3, Phenylhydrazone, 79.81, 2,4-Dinitrophenylhydrazone, 65.8, Oxime, 96
258	**Benzyl *n*-butyrate**	238-40			1.033[16]	178	−5.5, −8	162.5, 164	−15.3	205.5	115-6	75	113	
259	**Methyl hydrocinnamate** (Methyl β-phenylpropionate)	239			1.0455[0]	164	48.7, 40	279-80 (cor.)	−97	64.65	105, 82	135	108 (cor.), al	
260	***n*-Propyl salicylate**	239, 249-51		1.51610	1.0979	180	158.3			97.1	142, 139	156	74, pet eth	
261	**Guaiacol acetate** (2-Methoxyphenyl acetate)	240		1.5101[25]	1.1285[25]	166	16.6	118.2	32, 28.2	205	82	153, 147	141.2 (cor.), al	
262	**Isopropyl salicylate**	240-2, 237		1.50650	1.0729	180	158.3, subl at 76		−89.5	82.4	142, 139	156	123, pet eth	
263	**Dimethyl *l*-malate**	242		1.4425	1.2334	81	100-1		−97	64.65	*di* 156-7	*di* 206-7	108 (cor.), al	$[\alpha]_D^{20}$ −6.85
264	**Geranyl acetate**	242		1.4660	0.9174[15]	196	16.6	118.2		230	82	153, 147	62-3	
265	**Isobutyl benzoate**	242.2 (cor.)			0.999	178	122.4	249		108.1	130	158	87	
266	**Di-*n*-butyl oxalate** (*n*-Butyl oxalate)	243, 245.5	−29.6	1.4240	0.98732	101	189.5 (anh.), 101 (+ $2H_2O$)		−90.2	117.6, 116	*mono* 219, *di* 419d	*mono* 169, *di* 268	64, 62.5	
267	**Methyl 2-bromobenzoate**	244				215	150		−97	64.65	155		108 (cor.), al	
268	***n*-Octyl *n*-butyrate**	244.1	−55.6	1.42674[15] He (yel)	0.86288	200	−5.5, −8	162.5, 164	−16, −16.7	195	115.6	75	61.2	
269	**Ethyl *n*-caprate** (Ethyl *n*-decanoate)	244.9	β −20, γ −30.6	1.42575	0.8650	200	31.5	268.70	−117.3	78.32	108, 100.1	78	93, al	N-(β-Aminoethyl) morpholide, 60.1

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3 5 Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M P , °C	B P °C	M P °C	B P °C				
270	**Diethyl adipate**	245, 133 8[15]	−21	1 42765	1 0090	101	153-4 (cor)	216[15]	−117 3	78 32	*mono* 125 30, w , *di* 220	241	93, al	N-(β-Aminoethyl) morpholide 165
271	**Methyl phenoxyacetate**	245			1 150[17 5]	166	98 9	285d	−97	64 65	101 5		108 (cor) al	
272	**Thymyl acetate**	245			1 009[0]	192	16 6	118 2	51 5	233 5	82	153 147	103 2 (cor), al	
273	**Carvacryl acetate**	245 (cor)		1 49128[28]	0 98959[25]	192	16 6	118 2	1	237 5	82	153, 147	83	
274	**Diethylene glycol diacetate** (β,β'-Diacetoxy diethyl ether)	245 51, 148[26]		1 4348	1 1078[15/5]	95	16 6	118 2	−10 45	244 5	82	153 147	149 ac a	
275	***n*-Butyl *n*-caprylate** (*n*-Butyl *n*-octanoate)	245 02	−41 9, −43	1 42647[15] He (yel)	0 86278	200	16 3	237	−90 2	117 6 116	110 106	70	64 62 5	
276	***n*-Heptyl *n*-valerate** (*n*-Heptyl *n*-pentanoate)	245 2	−46 4	1 42536[15] He (yel)	0 86225	200	−34 5	186 35	−34 6 −33 8	176 8	106	74	46 47	
277	***n*-Amyl *n*-enanthate** (*n*-Pentyl *n*-heptanoate)	245 4	−49 5	1 42627[15] He (yel)	0 86232	200	−7 47	223	−78 5	138 (cor)	96 96 5	81	46 4	
278	***n*-Hexyl *n*-Caproate** (*n*-Hexyl *n*-decanoate)	245 4	−55 25	1 42637[15] He (yel)	0 86216	200	−3 9	205 35	−51 6 −46 1	157 5	100 1	74 5	58 4 (cor)	
279	**Di-(β-ethoxyethyl) carbonate**	245 5		1 4239[25]	1 0635[25]	206				135			75, al	
280	**Diethylene glycol monobutyl ether acetate**	246			0 983	204	16 6	118 2		228-30	82	153 147		
281	**Isobutyl phenylacetate**	247			0 999[18]	192	76 5 (cor)	256 5 (cor)		108 1	156	135-6	87	
282	**Ethyl hydrocinnamate** (Ethyl β-phenylpropionate)	247 2			1 0147	178	40, 48 7	279-80 (cor)	−117 3	78 32	105, 82	135	93, al	
283	**Di-*n*-propyl succinate**	248, 246	−10 4	1 4252	1 011	101	185, 182 8	235d		97 1	*mono* 157, *di* 260d , w	*mono* 179 80, *di* 254 5-5 5, 260	74, pet eth	
284	**Methyl 2-methoxybenzoate**	248		1 534[19 5]	1 1571[19]	166	100 1	200	−97	64 65	129		108 (cor), al	
285	**Methyl undecylenate** (Methyl hendecylenate)	248	−27 5	1 43928	0 889[15]	198	24 5	275	−97	64 65	87		108 (cor), al	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M.P., °C	B.P. °C	M.P. °C	B.P. °C				
286	**Isoamyl levulinate**	248.8		1.43102	0.96136	186	33.5	245.6	−1.17	132	107.8d	108.9, w	61	Semicarbazone, 91-2, Phenylhydrazone, 70.2, 2,4-Dinitrophenylhydrazone, 50.5 Oxime, 96
287	**Diethyl acetonedicarboxylate**	250d			1.113	101	135		−117.3	78.32			93, al	Dianilide, 155, bz., Semicarbazone, 94.5, $Cu(OAc)_2$ → Cu enolate, 142.3, grn bz
288	***n*-Butyl benzoate**	250.3	−22.4		1.000	178	122.4	249	−90.2	117.6, 116	130	158	64, 62.5	
289	**Ethyl phenoxyacetate**	251			$1.104^{17.5}$	180	98-9	285d	−117.3	78.32	101.5		93, al	
290	**Methyl 3-methoxybenzoate**	252		1.52236	1.131	166	109-10		−97	64.65			108 (cor.), al	α-Phenylethylamide, 128.6, 9.0, Benzylamide, 111.8, 2.8
291	**Diethyl *l*-malate**	253		1.4362	1.1290	95	100-1		−117.3	78.32	*dl* 156.7	*dl* 206.7	93, al	$[\alpha]_D^{20}$ −10.18
292	***n*-Amyl levulinate** (*n*-Pentyl levulinate)	253.4		1.43192	0.96136	186	33.5	245.6	−78.5	138 (cor.)	107.8d	108.9, w	46.4	2,4-Dinitrophenylhydrazone, 84.2, Oxime, 96
293	***n*-Butyl phenylacetate**	254		1.489	0.994	192	76.5, subl	256.5 (cor.)	−90.2	117.6, 116	156	135.6	64, 62.5	
294	**β-Methoxyethyl benzoate** (Methyl "cellosolve" benzoate)	255		1.5040^{25}	1.0891^{25}	180	122.4	249		124.5	130	158		4-Nitrobenzoate, 50.5, dil al
296	**Diethyl pimelate**	255	−23.8	1.42985	0.9929	108	105	223^{15}	−117.3	78.32	*dl* 175	*dl* 206, al	93, al	N-(β-Aminoethyl) morpholide, 137.9
297	**Ethyl benzoylformate**	256-7		1.5190^{25}	1.222^{25}	178	66		−117.3	78.32	91		93, al	Phenylhydrazone, 64, 2,4-Dinitrophenylhydrazone, 196.7d (cor.)

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p* Toluidide	3 5 Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M P °C	B P °C	M P °C	B P °C				
298	**Glyceryl triacetate**	258			1 161[15]	72 7	16 6	118 2	17 9	290d	82	153 147		Tris-4-nitrobenzoate, 188
299	**Ethyl 3-methoxybenzoate**	260		1 5161	1 0993	180	109 10		−117 3	78 32			93, al	Benzylamide, 111 8 2 8, α-Phenylethylamide, 128 6 9 0
300	**β-Ethoxyethyl benzoate** ("Cellosolve" benzoate)	260–1[738 5]		1 4969[25]	$1\ 0585_{25}^{25}$	194	122 4	249		135	130	158	75, al	
301	**Isobutyl salicylate**	260 2		1 50872	1 0639	194	158 3, subl at 76			108 1	142, 139	156	87	
302	***n*-Amyl *n*-caprylate** (*n*-Pentyl *n*-octanoate)	260 21	−34 8	1 43019[15] He (yel)	0 86132	214	16 3	237 239 3	−78 5	138 (cor)	110, 106	70	46 4	
303	***n*-Hexyl *n*-enanthate** (*n*-Hexyl *n*-heptanoate)	260 9	−47 9	1 42939[1] He (yel)	0 86114	214	−7 47	223	−51 6, −46 1	157 5	96, 96 5	81	58 4 (cor)	
304	***n*-Heptyl *n*-caproate** (*n*-Heptyl *n*-hexanoate)	260 97	−34 4	1 42934[15] He (yel)	0 86115	214	−3 9	205 35	−34 6, −33 8	176 8	100 1	74 5	46 47	
305	**Ethyl 2-methoxybenzoate**	261		1 5224	1 1124	261	100 1	200	−117 3	78 32	129		93, al	
306	***n*-Octyl *n*-valerate** (*n*-Octyl *n* pentanoate)	261 1	−42 5	1 42743[15] He (yel)	0 86148	214	−34 5	186 35	−16 −16 7	195	106	74	61 2	
307	**Isoamyl benzoate**	262 3		1 4950	1 004	192	122 4	249	−117	132	130	158	61	
308	**Dimethyl *d*-camphorate**	263		1 46334[16 9]	1 0747	114	187 5 8 0		−97	64 65	*mono* (α-amide β-acid), 176, (β-amide-α-acid), 182 3, *di* 192-3	α 212 4, β 190-6	108 (cor), al	
309	**Ethyl undecylenate** (Ethyl hendecylenate)	264		1 4449[23]	$0\ 88271_{15}^{15}$	212	24 5	275	−117 3	78 32	87		93, al	
310	**Isobutyl succinate**	265		1 427	0 974	115	185, 182 8	235d		108 1	*mono* 157, *di* 260d , w	*mono* 179 80, *di* 254 5 5 5, 260	87	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M.P., °C	B.P. °C	M.P. °C	B.P., °C				
311	**Ethyl benzoylacetate**	265 sl. d., 270 d.		1.5498	1.116	192			−117.3	78.32			93, al.	Ketone cleavage → acetophenone, m.p. 19.65, b.p. 202
312	**Di-isoamyl oxalate** (Isoamyl oxalate)	267.8, 262		1.427	0.961	115	189.5 (anh.) 101 (+ $2H_2O$)		−117	132	*mono* 219, *di* 419d	*mono* 169, *di* 268	61	
313	**Dimethyl suberate**	268	−5	1.43326	1.0198	101	144, 139-41		−97	64.65	*mono* 125.7, *di* 216.7	*di* 218, 219	108 (cor.), al.	
314	**Methyl laurate**	268		1.432	0.870	214	44, 42	299	−97	64.65	100, 99	87	108 (cor.), al.	β-Naphthol → β-naphthyl methyl ether, 72
315	**Ethyl 4-methoxybenzoate** (Ethyl anisate)	269	7	1.5254	1.1038	180	184.6, 184.2 (cor.)	275.80	−117.3	78.32	167, 162.3, w.	186	93, al.	N-(β-Aminoethyl) morpholide, 130.6
316	**Ethyl laurate**	269	−1.7	1.4321	0.8671_{15}^{19}	228	44, 42	299	−117.3	78.32	100, 99	87	93, al.	
317	**Trimethyl aconitate**	270				72	194-5 (cor.) d.		−97	64.65	*tri* turns br. at 250, sinters at 260		108 (cor.), al.	
318	***n*-Butyl salicylate**	270-2, 268		1.51148	1.0728	194	158.3, subl. at 76		−90.2	117.6, 116	142, 139	156	64, 62.5	
319	**Ethyl cinnamate**	271	6.70	1.55982	1.0490	176	133	300	−117.3	78.32	147-8	168	93, al.	N-(β-Aminoethyl) morpholide, 121.9
320	**Di-*n*-butyl succinate**	274.5	−29.3	1.4298	0.9760	115	185, 182.8	235d	−90.2	117.6, 116	*mono* 157, *di* 260d, w.	*mono* 179.80, *di* 254.5-5.5, 260	64, 62.5	
321	**Ethyl 2-nitrobenzoate**	275	30			195	146		−117.3	78.32	176		93, al.	
322	**Triethyl aconitate**	275d		1.45562	1.1064	86	194-5 (cor.)		−117.3	78.32	*tri* turns br. at 250, sinters at 260		93, al.	
323	**Di-isopropyl *d*-tartarate**	275			1.1274	117	169.71		−89.5	82.4	*mono* 171-2, *di* 196d, al.		123, pet. eth.	$[\alpha]_D^{20}$ +14.886, Phenylhydrazide, 240
324	**Ethyl 4-ethoxybenzoate**	275			1.076^{21}	194	198, 195-6		−117.3	78.32	202		93, al.	Hydrazide, 126-7, al.

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p* Toluidide	3 5 Dinitro benzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M P °C	B P °C	M P °C	B P °C				
325	***n*-Octyl *n*-caproate** (*n* Octyl *n* hexanoate)	275 2	−28 4	1 43256[15] He (yel)	0 86032	228	−3 9	205 35	−16 −16 7	195	100 1	74 5	61 2	
326	**Isoamyl salicylate**	276 8		1 50799	1 0535	208	158 3 subl at 76		−117	132	142 139	156	61	
327	***n*-Heptyl *n*-enanthate** (*n* Heptyl *n* heptanoate)	277 2	−33 3	1 43183 He (yel)	0 86039	228	−7 47	223 0	−34 6 −33 8	176 8	96 96 5	81	46 47	
328	***n*-Hexyl *n*-caprylate** (*n* Hexyl *n* octanoate)	277 44	−30 6	1 43230[1] He (yel)	0 86033	228	16 3	237 239 3	−51 6 −46 1	157 5	110 106	70	58 4 (cor)	
329	**Resorcinol diacetate**	278 sl d			1 179	97	16 6	118 2	110 (stab) 108 8 5 (labile)	280 8 (cor)	82	153 147	*di* 201	
330	**Diethyl suberate**	282	5 9	1 43236	1 9807	115	144 139 41		−117 3	78 32	*mono* 125 7 *di* 216-7	*di* 218-9	93 al	N-(β-Aminoethyl) morpholide, 157 2
331	**Resorcinol monoacetate**	283				152	16 6	118 2	110 (stab) 108- 8 5 (labile)	280 8 (cor)	82	153 147	*di* 201	
332	**Dimethyl phthalate** (Methyl phthalate)	283 8		1 5138	1 191	97	200 6 191 (sealed tube)		−97	64 65	*mono* 149 *di* 220	*mono* 150 (slow htng) 160 5 (rapid htng)	108 (cor) al	
333	**Diethyl isophthalate**	286[733]	11 5			111	348 (subl)		−117 3	78 32	*mono* 280 *di* 280		93 al	
334	**Diethyl *d*-camphorate**	286		1 45354[26 2]	1 0298	128	187 5- 8 0		−117 3	78 32	*mono* (α amide β-acid) 176 (β amide-α-acid) 182 3, *di* 192 3	α 212-4 β 190-6	93, al	
335	**Glyceryl tripropionate**	289			1 083[19]	86 7	−20 8	141	17 9	290d	81 81 3, 79	126 123		Tris-4-nitrobenzoate, 188

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M P °C	B P °C	M P °C	B P, °C				
336	**Diethyl phthalate** (Ethyl phthalate)	289 5, 298		1 5019	1 1175	111	200 6, 191 (sealed tube)		−117 3	78 32	*mono* 149, *di* 220	*mono* 150 (slow htng), 160 5 (rapid htng)	93, al	
337	***n*-Heptyl *n*-caprylate** (*n*-Heptyl *n*-octanoate)	290 6	−10 2	1 43492[1] He (yel)	0 85958	242	16 3	237 239 3	−34 6, −33 8	176 8	110, 106	70	46, 47	
338	***n*-Octyl *n*-enanthate** (*n* Octyl *n*-heptanoate)	290 8	−21 5	1 43488[1] He (vel)	0 85961	242	−7 47	223 0	−16, −16 7	195	96, 96 5	81	61 2	
339	**Diethyl azelate**	291	−18 5	1 43509	0 97294	122	106 5	>360 sl d 237[15]	−117 3	78 32	*mono* 93 5 *di* 175	*di* 201-2	93 al	N-(β-Aminoethyl) morpholide, 141 3
340	**Triethyl citrate**	294		1 44554	1 1369	92	153 (anh) 100 (+1 H_2O)		−117 3	78 32	*tri* 210 5d , w	*tri* 189, al	93, al	
341	**Ethyl myristate**	295	α 11 9 β 12 3	1 4362	0 8573[25]	256	53 9	202[16]	−117 3	78 32	103	93	93, al	N-(β-Aminoethyl) morpholide, 76
342	**Di-*n*-propyl *d*-tartarate**	297			1 1390	117	169 71			97 1	*mono* 171-2, *di* 196d , al		74, pet eth	$[\alpha]_D^{20}$ +12 00, Phenylhydrazide, 240
343	**Isoamyl succinate**	297		1 434	0 958	129	185 182 8	235d	−117	132	*mono* 157 *di* 260d , w	*mono* 179-80, *di* 254 5 5 5, 260	61	
344	**Di-(β-*n*-butoxyethyl)carbonate**	297 8		1 4279[25]	0 9766[65]	262					170 6[743]			
345	**Diethyl benzylmalonate**	300			1 077[15]	125	117d		−117 3	78 32	225		93, al	
346	**α-Tetrahydrofurfuryl benzoate**	300 2 [50]			1 137$_0^{20}$	206	122 4	249		177 8[743]	130	158	83-4	
347	**Di-isopropyl phthalate** (Isopropyl phthalate)	302			1 065[19]	115	200 6, 191 (sealed tube)		−89 5	82 4	*mono* 149 *di* 220	*mono* 150 (slow htng), 160-5 (rapid htng)	123, pet eth	
348	***n*-Octyl *n*-caprylate** (*n*-Octyl *n*-octanoate)	306 8	−15 1	1 43698[15] He (yel)	0 85919	256	16 3	237, 239 3			110, 106	70	61 2	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Including esters of inorganic acids

a) Liquids. 1) (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D^{20}	D_4^{20}	Equivalent	Saponification				Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
							Acid		Alcohol					
							M P , °C	B P °C	M P , °C	B P °C				
349	**Diethyl sebacate**	307	1 3	1 43657	0 9631	129	33, subl	243^{15}	−117 3	78 32	*mono* 170 *di* 210, 208	*di* 201	93, al	
350	**2-Tolyl benzoate** ("*o*-Cresyl" benzoate)	307			$1\ 114^{19}$	212	122 4	249	31	191 2	130	158	138 4 (cor), al	
351	**Ethyl 1-naphthoate**	309			$1\ 1274_{15}^{15}$	200	161 2 (cor)		−117 3	78 32	202 205		93, al	
352	**Glyceryl tributyrate**	318			$1\ 033^{1}$	100 7	−5 5 −8	162 5, 164	17 9	290d	115 6	75		Tris-4-nitrobenzoate, 188
353	**Di-*n*-butyl *d,l*-tartarate** (Di-*n*-butyl racemate)	320			$1\ 0879^{18}$	131	205 6 (anh), 203–4 (+1 H_2O)		−90 2	117 6, 116	*di* 226, w -me al		64, 62 5	Dianilide, 235-6
354	**Benzyl salicylate**	320				228	158 3, subl at 76		−15 3	205 5	142, 139	156	113	
355	**Di-*n*-butyl phthalate** (*n* Butyl phthalate)	340 7		1 4900	$1\ 047_{20}^{20}$	139	200 6, 191 (sealed tube)		−90 2	117 6, 116	*mono* 149, *di* 220	*mono* 150 (slow htng), 160 5 (rapid htng)	64, 62 5	N-(β-Aminoethyl) morpholide, 124
356	**Di-*n*-butyl sebacate**	345			0 9329[15]	157	133, subl	243^{15}	−90 2	117 6, 119	*mono* 126 5, *di* 210, 208	*di* 201	64, 62 5	Phenylhydraziide, 194
357	**Di-isoamyl phthalate** (Isoamyl phthalate)	349			$1\ 024^{17}$	153	200–6, 191 (sealed tube)		−117	132	*mono* 149, *di* 220	*mono* 150 (slow htng), 160–5 (rapid htng)	61	
358	**Tricresyl phosphate**	400d , 275 80^{20}	−30	1 5568	$1\ 197^{25}$	122 7			36	202 32			188 6 (cor), al	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

Reduced pressure b.p. only

a) Liquids. 2) (Listed in order of increasing m.p. of the corresponding amide)*

No	Name	Boiling point °C	Melting point, °C	n_D^{20}	D_4^{20}	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
						Equivalent	Acid		Alcohol					
							M.P., °C	B.P. °C	M.P., °C	B.P., °C				
1	**3,5-Dimethylphenyl acetate** (*Sym-m*-Xylenyl acetate)	130[26], 120[11]				164	16.6	118.2	63.2 68	220.2	82	153, 147	195.4, al	
2	**Dimethyl azelate**	156[20], 146.2[10]		1.43607	1.0069	108	106	>360 sl. d.	−97	64.65	*mono* 93.5, *di* 172	*di* 201.2, 198	108 (cor.), al	
3	**Dimethyl adipate**	107.6[11]	8.5	1.4277	1.0625	87	153.4 (cor.)	216[15]	−97	64.65	*mono* 125 30, w., *di* 220	241	108 (cor.), al	
4	***β-n*-Butoxyethyl benzoate** (Butyl "cellosolve" benzoate)	156.5 7.0[14.5], 131.6 2.6[3.0]		1.4925[25]	1.0277_{25}^{45}	222	122.4	249		170 6[7.1]	130	158		4-Nitrophenylurethane, 58.7 9.1, CCl_4
5	**Ethyl furoylacetate**	170[20] 143[10]		1.5055[16]	1.1651_{17}^{17}				−117.3	78.32	159, al.		93, al.	Oxime, 131.2, dil., al.
6	**Methyl furoylacetate**	144.5[20], 96–8[1]							−97	64.65	159, al.		108 (cor.), al.	Semicarbazone, 141–2, bz.-al. (3:1), Oxime, 124.5, bz.
7	**Di-*n*-propyl adipate**	155[16]	−20	1.4314	0.9790	115	153.4			97.1	*mono* 161 *di* 220	*di* 241	74, pet. eth.	
8	**Dimethyl pimelate**	119.3 9.6[10]	−20.6	1.42888	1.0383	94	105		−97	64.65	*di* 175	*di* 206, al.	108 (cor.), al.	
9	**Di-*n*-propyl maleate**	114–7[6]		1.444[18.3]	1.026	100	137			97.1	*di* 181, me. al.	*mono* 195d., chl., *di* 142, eth.	74, pet. eth.	

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point, °C	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
				Equivalent	Acid		Alcohol					
					M.P., °C	B.P., °C	M.P. °C	B.P. °C				
1	**Dimethyl succinate**	18.2	196	73	185, 182.8	235d	−97	64.65	*mono* 157, *di* 260d	*mono* 179.80, *di* 254.5 5.5 260	108 (cor.), al	n_D^{20} 1.41965 D_4^{20} 1.1192
2	**Methyl myristate**	18.5	323	242	53.9	202[16]	−97	64.65	103	93	108 (cor.), al	n_D^{t} 1.428
3	**Ethyl piperonylate**	18.5	286	194		228, 229	−117.3	78.32	169, al		93, al	
4	**Diethyl *d*-tartarate**	18.6	280	103	169.71		−117.3	78.32	*mono* 171-2, *di* 196d, al		93, al	n_D^{20} 1.44677, D_4^{20} 1.2028 $[\alpha]_{Hg(grn)}^{20}$ +7.87, Phenylhydrazide, 204
5	**Phenyl propionate**	20	211	150	−20.8	141	41.8 42	182 183	81	123 126	145.8 (cor.), al	D_{25}^{25} 1.0467, Tribromo, 95
6	**Ethyl margarate**	20.6 (β)		298	61.2	231[16]	−117.3	78.32	108, 106		93, al	
7	**Methyl 3-chlorobenzoate**	21	231	170.5	158, 155		−97	64.65	134		108 (cor.), al	
8	**Benzyl benzoate**	21	323-4 (cor.)	212	122.4		−15.3	205.5	130	158	113	n_D^{21} 1.5681, D^{19} 1.1224
9	**Di-*n*-butyl *d*-tartarate**	22		131	169.71		−90.2	117.6, 116	*mono* 171-2 *di* 196d, al		64, 62.5	D_4^{18} 1.0886, $[\alpha]_D^{15}$ + 10.09, Phenylhydrazide, 240
10	**3,4-Dimethylphenyl acetate**	22	235	164	16.6	118.2	62.5	225	82	153, 147	181.6, rods, al	
11	**Isobutyl stearate**	(a) 22.5, (b) 28.9, (two forms)		340	70.1			108.1	109, 108.4, al	102	87	
12	**Isoamyl stearate**	23		354	70-1		−117	132	109, 108.4, al	102	61	
13	**Cetyl acetate** (*n*-Hexadecyl acetate)	α 18.5, β 24.2, 22		284	16.6	118.2	49.27	190[18]	82	153, 147	66	
14	**Ethyl palmitate**	α 19.4, β 24.2	185	284	62.7	222[16]	−117.3	78.32	106-7, 105.3, al	98	93, al	
15	**Methyl anthranilate** (Methyl 2-aminobenzoate)	24.4	299.8	151	146		−117.3	78.32	109	151	93, al	N-(β-Aminoethyl) morpholide, 126, Picrate, 106
16	**Di-*n*-propyl *d,l*-tartarate**	25	286[765]	117	203-4 (+1 H_2O), 205-6 (anh.)			97.1	226, w-me al		74, pet eth	D_4^{20} 1.1256
17	**Dimethyl sebacate**	26.6, 27-8		115	133, subl	243[15]	−97	64.65	*mono* 170, *di* 210, 208	*di* 201	108 (cor.), al	n_D^{28} 1.43549, D_4^{28} 0.98818, Phenylhydrazide, 194

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
				Equivalent	Acid		Alcohol					
					M P °C	B P, °C	M P, °C	B P, °C				
18	**Methyl β-(2-furyl) acrylate**	27	227	152	141	286	−97	64 65	168 9		108 (cor), al	
19	***n*-Butyl stearate**	27 5, 28		340	70 1		−90 2	117 6, 116	109 108 4, al	102	64 62 5	
21	***d*-Bornyl acetate**	29	226, 221	196	16 6	118 2	204 5 5 5	212	82	153, 147	154	$n_D^{22.6}$ 1 4633, D_4^{15} 0 991 (undercooled)
22	**Methyl margarate**	29		284	61 2	231[16]	−97	64 65	108, 106		108 (cor), al	
23	**Eugenyl acetate**	30	282	206	16 6	118 2	−9 1	253	82	153, 147	130 8 (cor), 95% al	n_D^{20} 1 52069 D_{15}^{1} 1 087
24	**Methyl palmitate**	30	184[12]	270	62 7	222[16]	−97	64 65	106 7 105 3, al	98	108 (cor), al	n_D^{45} 1 4317
25	***n*-Amyl stearate** (*n*-Pentyl stearate)	30		354	70 1		−78 5	138 (cor)	109, 108 4, al	102	136 (cor)	
26	**Ethyl 2-nitrobenzoate**	30	275	195	146		−177 3	78 32	176		93, al	
27	***n*-Octadecyl acetate**	α 29 97, β 31 95		312	16 6	118 2	α 57 95, 59 5	210 5[15]	82	153, 147	66	β-Form exist below 0°, α-Form seeding with crys or cooling soln of the compound
28	**Ethyl 2-naphthoate**	32	304	200	184, 185 5		−117 3	78 32	192–3, 195, al	192, al	93, al	n_D^{20} 1 596, D_4^{20} 1 117
29	**Methyl-3-bromobenzoate**	32		229	155		−97	64 65	155		108 (cor), al	
30	**Methyl 4-toluate**	33	222 5, 217	150	179–80, subl	275 (cor)	−97	64 65	160, 158	160, 165	108 (cor), al	
31	**Thymyl benzoate**	33		255	122 4		51 5	233 5	130	158	103 2, al	
32	**Di-(β-ethoxyethyl) phthalate**	33		155	200 6, 191 (sealed tube)			134 8	*mono* 149, *di* 220	*mono* 150 (slow htng), 160–5 (rapid htng) *di* 201	75, al	
33	**Ethyl stearate**	α 30 9, β 33 5	199[10]	312	70–1		−117 3	78 32	109, 108 4, al	102	93, al	α → β Slowly on rubbing, N-(β-Aminoethyl) morpholide, 58
34	**Di-isopropyl *d,l*-tartarate**	34	275[765]	117	203 4 (+ $1H_2O$), 205–6 (anh)		−89 5	82 4	226, w - me , al		123, pet eth	D_4^{20} 1 1166
35	**Ethyl pyromucate** (Ethyl furoate)	34	197	140	133 4, 132	230–2	−117 3	78 32	142–3	170 5, al	93, al	n_D 1 4797, $D_4^{20.8}$ 1 1174 (undercooled)
36	**Diethyl 4-nitrophthalate**	34		133 5	165		−117 3	78 32	200 d	*mono* 172	93, al	
37	**Ethyl benzilate**	34		256	150		−117 3	78 32	153, chl	189–90	93, al	

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point °C	Saponification					Amide	*p*-Toluidide	3,5-Dinitro benzoate	Miscellaneous
				Equivalent	Acid		Alcohol					
					M P °C	B P, °C	M P °C	B P °C				
38	**2,4,5-Trimethylphenyl acetate** (Pseudocumenyl acetate)	34–4 5	245 6	178	16 6	118 2	71	232	82	153, 147		
39	**Methyl cinnamate**	36	261	162	133	300	−97	64 65	147 8	168	108 (cor) al	
40	**Ethyl *d,l*-mandelate**	37	254	180	118		−117 3	78 32	133 4	172, al	93, al	
41	**Dimethyl itaconate**	38	208	79	165		−97	64 65	*di* 191 2 8, al		108 (cor), al	n_D^{20} 1 44413 D_4^{18} 1 12410
42	**Methyl sebacate**	38	288d	216	133, subl	243^{15}	−97	64 65	*mono* 170, *di* 210, 208	*di* 201	108 (cor), al	Phenylhydrazide, 194
43	**Methyl stearate**	38 8	$214–5^{15}$	298	70–1		−97	64 65	109, 108 4, al	102	108 (cor), al	
44	**Benzyl cinnamate**	39		238	133	300	−15 3	205 5	147	168	113	
45	**Methyl dibenzylacetate**	41		254	89		−97	64 65	128 9, bz	175, abs al	108 (cor), al	
46	**Phenyl salicylate** (Salol)	42		214	158 3, subl at 76		41 8, 42	182, 183	142 139	156	145 8 (cor), al	Tribromo deriv of phenol, 95
47	**Benzyl succinate**	42		208	185 182 8	235d	−15 3	205 5	*mono* 157, *di* 260d	*mono* 179 80, *di* 254 5 5 5, 260	113	
48	**Dibenzyl phthalate**	43 -		173	200 6, 191 (sealed tube)				*mono* 149, *di* 220	*mono* 150 (slow htng), 160 5 (rapid htng), *di* 201	113	
49	**Diethyl terephthalate**	44	302	111	300, subl without melting		−117 3	78 32	>225		93, al	Dianilide, 334–7, $PhNO_2$
50	**Cinnamyl cinnamate**	44		264	133	300	33	257	147–8	168	121	
51	**Ethyl 2-nitrocinnamate**	44		221	240		−117 3	78 32	185		93, al	
52	**Methyl 2-chloro-cinnamate**	44		196 5	212, yel , al		−97	64 65	168		108 (cor), al	
53	**Diethyl 3-nitrophthalate**	46		133 5	218		−117 3	78 32	*di* 201d	*di* 226	93, al	N-(β-Aminoethyl) morpholide, 131 9
54	**Ethyl 3-nitrobenzoate**	47	296	195	140		−117 3	78 32	*di* 187, 189 90, dil me al		93, al	
55	**Dicyclohexyl oxalate**	47, 42		127	189 5 (anh), 101 (+ $2H_2O$)		25 15	161 1	*mono* 219, *di* 419d	*mono* 168, *di* 268	112–3, al	
56	**2-Phenylethyl cinnamate**	47 8		252	133	300	−25 8	219 8	147 8	168	108	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
				Equivalent	Acid		Alcohol					
					M.P. °C	B.P., °C	M.P., °C	B.P. °C				
58	**1-Naphthyl acetate**	48-49		186	16.6	118.2	94	278-80	82	153, 147	217.4, yel al	
59	**Methyl 4-methoxybenzoate** (Methyl anisate)	49, 45	255	166	184-6	275-80	−97	64.65	167, 162.5, w	186	108 (cor.), al	
60	**Phenacyl acetate** (Benzoylcarbinyl acetate, ω-Acetoxyacetophenone)	49		178	16.6	118.2	86	118 20^{11}	82	153, 147		
61	**Di-3-tolyl carbonate** (Di-"*m*-cresyl" carbonate)	49		242				12	203		165.4 (cor.), al	
62	**Triphenyl phosphate**	49	260^{20}	108.7			41.8, 42	182, 183			145.8 (cor.), al	D_4^{20} 1.185, Tribromo deriv of phenol, 95
63	**Dibenzyl *d*-tartarate**	50		165	169-71		−15.3	205.5	*mono* 171.2, *di* 196d, al		113	Phenylhydrazide, 240
64	**Dibenzyl succinate**	51.2		149	185, 182.8	235d	−15.3	205.5	*mono* 157 *di* 260d	*mono* 179-80, *di* 254.5-5.5, 260	113	
65	**Methyl piperonylate**	51-2	$270-1^{777}$	180	229, 228		−97	64.65	169, al		108 (cor.), al	
66	**Cetyl palmitate** (*n*-Hexadecyl palmitate)	51.6		480	62.7	222^{16}	49.27	190^{18}	106.7 105.3, al	98	66	
68	**Furfuryl diacetate**	52	220	99	16.6	118.2			82	153 147		Hydrolysis → furfural, b.p., 161.7, Semicarbazone, 202
69	**Ethylene glycol dilaurate**	52		213	44, 42	299	−12.6	197.85	100, 99	87	169	
70	**Phenyl stearate**	52		360	70-1		41.8, 42	182, 183	109, 108.4, al	102	145.8 (cor.), al	Tribromo deriv of phenol, 95
71	**Methyl *d,l*-mandelate**	53.3	250 sl. d	166	118		−97	64.65	133-4	172, al	108 (cor.), al	
72	**Dimethyl tartronate**	53.4		74	156-8d		−97	64.65	*di* 198, dil. al		108 (cor.), al	
73	**Dimethyl oxalate**	54	163.5^{262}	59	189.5 (anh.), 101 (+ $2H_2O$)		−97	64.65	*mono* 219, *di* 419d	*mono* 168, *di* 268	108 (cor.), al	
74	**Tetraethyl pyromellitate**	54		91.5	275		−117.3	78.32			93, al	
75	**Diethyl *meso*-tartrate**	55		103	140		−117.3	78.32	*di* 187, 189-90, dil. me al		93, al	Bis-phenylhydrazide, 245

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Saponification					Amide	*p*-Toluidide	3 5-Dinitro benzoate	Miscellaneous
				Equivalent	Acid		Alcohol					
					M P, °C	B P, °C	M P °C	B P °C				
76	**3-Tolyl benzoate** ("*m*-Cresyl" benzoate)	55	314	212	122 4	249	12	203	130	158	165 4 (cor), al	
77	**Ethyl 4-nitrobenzoate**	56	186 3	195	241		−117 3	78 32	201, 198	204, 192	93, al	N-(β-Aminoethyl) morpholide, 186 3
78	**1-Naphthyl benzoate**	56		248	122 4	249	94	278-80	130	158	217 4, yel , al	
79	**Cetyl stearate** (*n*-Hexadecyl stearate)	56 6		508	70-1		49 27	190[18]	109, 108 4, al	102	66	
80	**Di-isobutyl *d,l*-tartarate**	58	311	131	203 4 (+ $1H_2O$), 205 6 (anh)			108 1	*di* 226, w -me al		87	
81	**Ethyl diphenylacetate**	58		240	148		−117 3	78 32	167 5 8 0	172 3	93, al	
82	**Ethyl 2-benzoylbenzoate**	58		254	128 (anh) 91 (+ $1H_2O$), w		−117 3	78 32	165 (cor), 162		93, al	N-(β-Aminoethyl) morpholide, 150 2
83	**Diethyl naphthalate**	58 60		136	274		−117 3	78 32			93, al	
84	**Methyl diphenylacetate**	60		226	148		−97	64 65	167 5 8 0	172 3	108 (cor), al	
85	**Di-2-tolyl carbonate** (Di-"*o*-cresyl" carbonate)	60		242			30 75	190 8			138 4 (cor), al	
86	**Methyl 2-(4-toluyl)-benzoate**	61		254	139-46		−97	64 65	175 6, al		108 (cor), al	
87	**Dimethyl *d*-tartarate**	61 5		89	169 71		−97	64 65	*mono* 171 2, *di* 196d , al		108 (cor), al	Two other forms, m p 48 and 50, Phenylhydrazide, 240
88	**Ethylene glycol dimyristate**	63 0		241	53 9	202[16]	−12 6	197 85	103	93	169	
89	**Dimethyl 4-nitro-phthalate**	66		119 5	165		−97	64 65	200d	*mono* 172	108 (cor), al	
90	**Dicyclohexyl phthalate**	66		165	200-6 191 (sealed tube)		25 15	161 1	*mono* 149, *di* 220	*mono* 150 (slow htng), 160-5 (rapid htng), *di* 201	112-3, al	n_D^{20} 1 451, D_4^{20} 1 383
92	**Ethyl oxanilate**	66-7		193	148 9		−117 3	78 32	228		93, al	
93	**Dimethyl isophthalate**	67 8		97	348, subl		−97	64 65	*mono* 280, *di* 280		108 (cor), al	
94	**Ethyl 2-(4-toluyl)benzoate**	68, 69	314, 299	268	139-40		−117 3	78 32	175 6, w		93, al	
95	**Phenyl benzoate**	69, 71	314	198	122 4	249	41 8; 42	182, 183	130	158	145 8 (cor), al	$AlCl_3$ → 4-Hydroxy benzophenone, Tribromo deriv of phenol, 95

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
				Equivalent	Acid		Alcohol					
					M P °C	B P °C	M P °C	B P °C				
96	**Dimethyl 3-nitrophthalate**	69		133 5	218		−97	64 65	*di* 201d	*di* 226	108 (cor), al	
97	**Methyl 3-hydroxybenzoate**	70		152	200, subl		−97	64 65	170 167	163, dil al	108 (cor), al	
98	**Ethylene glycol dipalmitate**	70 5 69		269	62 7	222^{16}	−12 6	197 85	106 7 105 3, al	98	169	
99	**2-Naphthyl acetate**	71		186	16 6	118 2	123	285 6	82	153 147	210 2 al	
100	**Glyceryl tristearate**	71		297	70 1		17 9	290d	109 108 4 al	102		n^{80} 1 4399 D_4^{80} 0 862
101	**4-Tolyl benzoate** ("*p*-Cresyl" benzoate)	71	316	212	122 4	249	36	202	130	158	188 6 (cor), al	
102	**Glyceryl tribenzoate**	72, lgr , 76, al		135	122 4	249	17 9	290d	130	158		
103	**Phenyl cinnamate**	72		238	133	300	41 8 42	182 183	147 8	168	145 8 (cor), al	Tribromo deriv of phenol, 95
104	**Ethylene glycol dibenzoate**	73		135	122 4	249	−12 6	197 85	130	158	*di* 169	
105	**Methyl 2-nitrocinnamate**	73		207	240		−97	64 65	185		108 (cor), al	
106	**Di-isobutyl *d*-tartarate**	73-4, 70		131	169 71			108 1	*mono* 171 2, *di* 169d , al		87	Phenylhydrazide, 240
107	**Ethyl 3-hydroxybenzoate**	73 8	282	166	200, subl		−117 3	78 32	170, 167	163, dil al	93 al	
108	**Diphenyl phthalate** (Phenyl phthalate)	74-5, 70		159	200 6, 191 (sealed tube)		41 8, 42	182, 183	*mono* 149 *di* 220	*mono* 150 (slow htng), 160 5 (rapid htng), *di* 201	145 8 (cor), al	Tribromo deriv of phenol, 95
109	**Methyl 3-hydroxy-2-naphthoate**	75		202	222-3 (cor)		−97	64 65	217 8 (cor), yel , al	221-3	108 (cor), al	
110	**Methyl benzilate**	75		242	150		−97	64 65	154 5, chl	189 90	108 (cor), al	
111	**Ethylene glycol di-*n*-stearate**	76, 73		297	70, 69 6		−12 6	197 85	109, 108 4, al	102	169	
112	**Trimethyl citrate**	76, 78 9	283 7d	78	100, 153 (anh)		−97	64 65	*tri* 210-5d , w	*tri* 189, al	108 (cor), al	
113	**Methyl 2-naphthoate**	77	290	186	184, 185 5		−97	64 65	192-3, al	192, al	108 (cor), al	
114	**Methyl α-phenyl-*n*-butyrate**	77-8		178	42	270	−97	64 65	85-7		108 (cor), al	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Saponification					Amide	*p*-Toluidide	3,5-Dinitrobenzoate	Miscellaneous
				Equivalent	Acid		Alcohol					
					M P , °C	B P , °C	M P , °C	B P , °C				
115	**Diphenyl carbonate**	78	306	214			41 8, 42	182 183			145 8 (cor), al	Phenylhydrazine → N,N′-diphenylcarbazide, Tribromo deriv of phenol, 95
116	**Methyl 3-nitrobenzoate**	78	279	181	140		−97	64 65	143	162	108 (cor), al	
117	**Ethyl 3-nitrocinnamate**	79		221	199		−117 3	78 32	196		93, al	
118	**Isoeugenyl acetate**	79	283	206	16 6	118 2		267 5	82	153, 147	158 4 (cor), BuOH	Dibromide, 132-3
119	**Methyl 2-benzoylbenzoate**	79–80, 52	352	240	128 (anh), 91 (+1 H_2O), w		−97	64 65	165 (cor), 162		108 (cor), al	
120	**Benzyl oxalate**	80		135	189 5 (anh) 101 (+2 H_2O)		−15 3	205 5	*mono* 219, *di* 419d	*mono* 169 *di* 268	113	
121	**Methyl 4-bromobenzoate**	81		215	251 3		−97	64 65	189 90, w		108 (cor), al	
122	**Benzoin acetate**	83		254	16 6	118 2	133	344	82	153, 147		
123	**Pentaerythritol tetraacetate**	84		76	16 6	118 2	262 253		82	153, 147		
124	**Pyrocatechol dibenzoate** (Catechol dibenzoate)	84		159	122 4	249	105	245 6	130	158	*di* 152	
125	**Ethyl 3-hydroxy-2-naphthoate**	85	291	216	222 3 (cor)		−117 3	78 32	217 8 (cor), yel , al	221-3	93, al	
126	**Diguaiacol carbonate** (Di-(2-methoxyphenyl) carbonate, "Guaiacol carbonate")	87		274			32	205			141 2 (cor), al	Monobromo deriv , 178
127	**Dimethyl *d l*-tartarate**	90 (stab), 84 (metastab)	282	89	203 4 (+1 H_2O), 205 6 (anh)		−97	64 65	226, w - me al		108 (cor), al	
128	**Di-2-tolyl oxalate** (Di-"*o*-cresyl" oxalate)	91		135	189 5 (anh), 101 (+2 H_2O)		30 75	190 8	*mono* 219 *di* 419d	*mono* 169, *di* 268	138 4 (cor), al	
129	**Ethyl 3,5-dinitrobenzoate**	94, 93		240	204-5		−117 3	78 32	183		93, al	N-(β-Aminoethyl) morpholide, 189 5
130	**2-Naphthyl salicylate**	95 5, 93 5		264	158 3 subl at 76		123	285-6	142, 139	156	210 2, al	
131	**Methyl 4-nitrobenzoate**	96		181	241		−97	64 65	201, 198	204, 192	108 (cor), al	
132	***n*-Propyl 4-hydroxybenzoate**	96		180	215, 210			97 1	162 (+1 H_2O), w	203-4, al	123, pet eth	
133	**1,2,4-Triacetoxybenzene** ("Hydroquinone triacetate")	96-7		76	16 6	118 2	140 5		82	153, 147		

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point °C	Saponification					Amide	*p*-Toluidide	3,5 Dinitrobenzoate	Miscellaneous
				Equivalent	Acid		Alcohol					
					M P °C	B P, °C	M P, °C	B P °C				
134	**Ethyl 3,5-dinitrosalicylate**	99		256	182, 173 (+1 H_2O)		−117 3	78 32	181		93, al	
135	**Dimethyl fumarate**	101 7	193 25	72	286 7 (sealed tube), subl 200		−97	64 65	*mono* 270, 300 2 subl *di* 266d		108 (cor), al	$n_D^{110\,5}$ 1 40625, $D^{110\,5}$ 1 0397
136	**Ethyl 5-nitrosalicylate**	102		211	229 30		−117 3	78 32	225		93, al	
137	**Dimethyl naphthalate**	104		122	274		−97	64 65			108 (cor), al	
138	**Di-3-tolyl oxalate** (Di-"*m*-cresyl" oxalate)	105		135	189 5 (anh), 101 (+2 H_2O)		12	203	*mono* 219, *di* 419d	*mono* 169 *di* 268	164 5 (cor), al	
139	**Phloroglucinol triacetate** (1,3,5-Triacetoxybenzene)	105-6		76	16 6	118 2	200 9 (slow htng), 217 9 (rapid htng)		82	153, 147	*tri* 162	
140	**Diphenyl adipate**	106		149	153-4 (cor)	216^{15}			*mono* 125-30, w , *di* 220	241	145 8 (cor), al	Tribromo deriv of phenol, 95
141	**Acetylsalicylaldehyde diacetate** ("Salicyl aldehyde triacetate")	107, 103		89	16 6	118 2			82	153, 147		Hydrolysis → salicylaldehyde, b p 197 (cor)
142	**2-Naphthyl benzoate**	107		248	122 4	249	123	285-6	130	158	210 2, al	
143	**Methyl 3,5-dinitrobenzoate**	108		226	204 5		−97	64 65	183		108 (cor), al	
144	**Dimethyl mesotartrate**	111		89	140		−97	64 65	*di* 187, 189 90, dil me al		108 (cor), al	Bis-phenylhydrazide, 245
145	**Di-4-tolyl carbonate** (Di-"*p*-cresyl" carbonate)	114		242			36	202			188 6 (cor), al	
146	**Ethyl oxamate**	114 5		117	210		−117 3	78 32	419d		93, al	
147	**Cholesteryl acetate**	114		416	16 6	118 2	148 5		82	153, 147		
148	**Ethyl 4-hydroxybenzoate**	116		166	215, 210		−117 3	78 32	162 (+1 H_2O), w	203-4, al	93, al	N-(β-Aminoethyl) morpholide, 184
149	**Resorcinol dibenzoate**	117		159	122 4	249	110 (stab), 108 8 5 (labile)	280 8 (cor)	130	158	*bis* 201	
150	**Ethyl 3-nitrosalicylate**	118		211	125 (+1 H_2O)		−117 3	78 32	145		93, al	
151	**Methyl 5-nitrosalicylate**	119		197	229 30		−97	64 65	225		108 (cor), al	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVI. ORGANIC DERIVATIVES OF ESTERS

b) Solids (Listed in order of increasing m.p.)* (Continued)

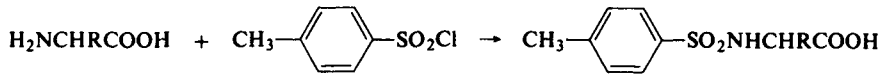
No	Name	Melting point, °C	Boiling point, °C	Saponification					Amide	*p*-Toluidide	3,5-Dinitro benzoate	Miscellaneous
				Equivalent	Acid		Alcohol					
					M P °C	B P °C	M P, °C	B P °C				
152	**Diphenyl succinate**	121		135	185 182 8	235d	41 8, 42	182, 183	*mono* 157, *di* 260d	*mono* 179 80, *di* 254 5 5 5, 260	148 5 (cor), al	Tribromo deriv of phenol, 95
153	**Di-4-tolyl succinate** (Di-"*p*-cresyl" succinate)	121		149	185 182 8	235d	36	202	*mono* 157, *di* 260d	*mono* 179 80, *di* 254 5-5 5, 260	188 6 (cor), al	
154	**Hydroquinone diacetate**	124		97	16 6	118 2	171	286	82	153, 147	*bis* 317	
155	**Methyl 3-nitro-cinnamate**	124		207	199		−97	64 65	196		108 (cor), al	
156	**Methyl 3,5-dinitro-salicylate**	127		242	182		−97	64 65	181, 173 (+1 H_2O)		108 (cor), al	
157	**Methyl 4-hydroxy-benzoate**	131		152	215, 210		−97	64 65	162 (+1 H_2O), w	203-4, al	108 (cor), al	
158	**Methyl 3-nitro-salicylate**	132		197	125 (+1 H_2O)		−97	64 65	145		108 (cor), al	
159	**Triethyl trimesate**	133		98	380 (cor)		−117 3	78 32	*tri* 365d (cor)		93, al	
160	**Ethyl 4-nitro-cinnamate**	137, 142		221	285		−117 3	78 32	204, 217		93, al	
161	**Dimethyl terephthalate**	141		97	300 (subl without melting)		−97	64 65	*di* >225		108 (cor), al	
162	**Tetramethyl pyromellitate**	142		77 5	275		−97	64 65			108 (cor), al	
163	**Trimethyl trimesate**	144		84	380 (cor)		−97	64 65	*tri* 365d (cor)		108 (cor), al	
164	**Di-4-tolyl oxalate** (Di-"*p*-cresyl" oxalate)	148-9		135	189 5 (anh), 101 (+2 H_2O)		36	202	*mono* 219, *di* 419d	*mono* 169, *di* 268	188 6 (cor), al	
165	**Methyl 4-nitro-cinnamate**	161		207	285		−97	64 65	204, 217		108 (cor), al	
166	**Diethyl mucate**	163-4		133	214d , 223-55		−117 3	78 32	*mono* 192d , *di* 220		93, al	
167	**Pyrogallol triacetate**	165, 172		84	16 6	118 2	133	309	82	153, 147	*tri* 205	
168	**Dimethyl mucate**	165 7d		119	214d , 223-55		−97	64 65	*mono* 192d , *di* 220		108 (cor), al	
169	**Methyl gallate**	200-1		184	253-4d , 222 40d		−97	64 65	189		108 (cor), al	
170	**Hydroquinone di-benzoate**	204 (cor), 199		159	122 4	249	171, 172	286	130	158	*bis* 317	

*Derivative data given in order m p , crystal color, solvent from which crystallized

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EXPLANATIONS AND REFERENCES TO TABLE XVII

*p-Toluenesulfonamide (p-Toluenesulfonyl derivative).**



p-Toluenesulfonamide

From the amino acid in aqueous sodium hydroxide with *p*-toluenesulfonyl chloride in ether.

For directions and examples see: Cheronis, pp. 453–454; Linstead, pp. 77–78; Shriner, p. 231; Vogel, p. 437; Wild, pp. 169–170; E. Fischer and P. Bergell, *Chem. Ber.*, **35**, 3779, 3784 (1902); E. W. McChesney and W. K. Swann, *J. Amer. Chem. Soc.*, **59**, 1116 (1937).

From the amino acid in aqueous sodium hydroxide with *p*-toluenesulfonyl chloride.

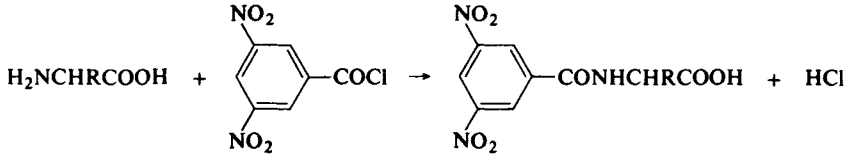
See: J. I. Harris and T. S. Work, *Biochem. J.*, **46**, 582 (1950).

From the amino acid with *p*-toluenesulfonyl chloride and triethylamine in aqueous tetrahydrofuran.

See: D. Theodoropoulos and L. C. Craig, *J. Org. Chem.*, **21**, 1376 (1956).

For an extensive list of references for the preparation of the *p*-toluenesulfonyl derivatives of amino acids *see*: J. P. Greenstein and M. Winitz, *Chemistry of the Amino Acids*, Vol. 2, John Wiley and Sons, New York, 1961, pp. 886–889.

*3,5-Dinitrobenzamide (3,5-Dinitrobenzoyl derivative).**

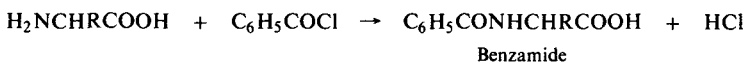


3,5-Dinitrobenzamide

From the amino acid in aqueous sodium hydroxide with 3,5-dinitrobenzoyl chloride.

For directions and examples see: Cheronis, p. 453; Vogel, p. 436; Wild, p. 168; B. C. Saunders, *Biochem. J.*, **28**, 580 (1934); *J. Chem. Soc.*, 1397 (1938); B. C. Saunders, G. J. Stacey and I. G. E. Wilding, *Biochem. J.*, **36**, 368 (1942); B. W. Town, *Biochem. J.*, **35**, 578 (1941).

Benzamide (Benzoyl derivative).



Benzamide

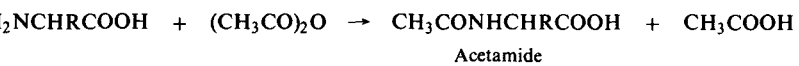
From the amino acid in aqueous sodium carbonate or bicarbonate and benzoyl chloride.

For directions and examples see: Linstead, p. 77; Vogel, p. 436; Wild, p. 167.

From the amino acid in aqueous sodium hydroxide with benzoyl chloride.

See: Cheronis, p. 453; E. Fischer and P. Bergell, *Chem. Ber.*, **35**, 3779, 3784 (1902); **39**, 597 (1906).

Acetamide (Acetyl derivative).



Acetamide

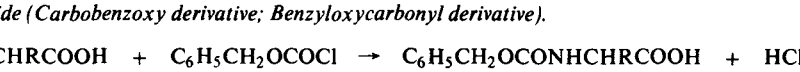
From the amino acid with acetic anhydride in water.

For directions and examples see: Linstead, p. 77; Shriner, p. 226; Wild, p. 167; R. M. Herbst and D. Shemin in *Organic Syntheses*, Coll. Vol. 2, (Ed. A. H. Blatt), John Wiley and Sons, New York, 1943, p. 11.

From the amino acid in aqueous sodium hydroxide with acetic anhydride.

See: Cheronis, p. 454; M. Bergmann and L. Zervas, *Biochem. Z.*, **203**, 288 (1928).

Carbobenzoxamide (Carbobenzoxy derivative; Benzyloxycarbonyl derivative).



Carbobenzoxamide

From the amino acid in aqueous sodium hydroxide with carbobenzoxy chloride (benzyl chloroformate).

For directions and examples see: M. Bergmann and L. Zervas, *Chem. Ber.*, **65**, 1192 (1932); M. Winitz, L. Bloch-Frankenthal, N. Izumiya, S. M. Birnbaum, C. G. Baker and J. P. Greenstein, *J. Amer. Chem. Soc.*, **78**, 2423 (1956).

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

EXPLANATIONS AND REFERENCES TO TABLE XVII (Continued)

For an extensive list of references for the preparation of the carbobenzoxy derivatives of amino acids *see:* J. P. Greenstein and M. Winitz, *Chemistry of the Amino Acids*, Vol. 2, John Wiley and Sons, New York, 1961, pp. 887-895.

*Phenylurethane (Phenylurea derivative).**

$$H_2NCHRCOOH + C_6H_5N{=}C{=}O \rightarrow \underset{\text{Phenylurethane}}{C_6H_5NHCONHCHRCOOH}$$

From the amino acid with aqueous potassium hydroxide and phenylisocyanate.
For directions and examples see: Linstead, p. 78; Shriner, p. 211; Wild, p. 171.

*Phenylhydantoin.**

$$C_6H_5NHCONHCHRCOOH \xrightarrow{HCl} \underset{\text{Phenylhydantoin}}{C_6H_5N(CO)NH(CO)CHR} + H_2O$$

From the phenylurethane (obtained as described above) in aqueous hydrochloric acid.
For directions and examples see: Cheronis, p. 456.

Rf Values.

For the determination of the Rf values of amino acids in aqueous phenol, in collidine-lutidine and in butanol-acetic acid mixtures *see:* R. J. Block, R. LeStrange and G. Zweig, *Paper Chromatography*, Academic Press, New York, 1952, pp. 51-66; E. Lederer and M. Lederer, *Chromatography*, Elsevier Publishing Co., New York, 1957, pp. 306-311.

NOTE: For additional information regarding directions and examples for the preparation of derivatives of amino acids which are similar to those of amines (e.g., phenylurethane, acetamide, etc.) see explanations and references to Table XVIII, p. 291, 292, 293, 294.

*Derivatives recommended for first trial.
WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

TABLE XVII. ORGANIC DERIVATIVES OF AMINO ACIDS
(Listed in order of increasing decomposition temperatures)* **

No	Name	Decomp temp °C	Specific rotation			Rf values***			*p* Toluene-sulfonyl	Phenyl urea	Benzoyl	3 5 Dinitro benzoyl	Picrate	Miscellaneous
			$[\alpha]_D$	T, °C	Conc (C) and solvent	Aqueous phenol	Collidine-Lutidine	Butanol-Ac acid						
1	**3-Aminohydro-cinnamic acid**	84-5												Acetyl, 162, Hydrochloride, 191
2	**N-Methyl-β-alanine**	99 100												Hydrochloride, 105, aq al
3	**Aminomalonic acid**	109									61, pet eth			Formyl, 48, Heat → glycine decom temp 228 30 262
4	**2-Aminophenyl-acetic acid**	119									179, al			Acetyl, 158, Formyl, 110
5	**2-Amino-1-Naphthoic acid**	126												N-Acetyl, 195-6, al
6	**N-Phenyl-glycine**	127								195	63			Acetyl 124
7	**4-Aminohydro-cinnamic acid**	132									194-5			Acetyl 143 (anh) 124 (hyd)
8	**L-Ornithine**	140	11 5	25	c = 6 5	0 79	0 11	0 15		190	240 (*mono*), 189 (*di*)		208	α,δ-Dicarbo-benzyloxy, 112 4
9	**Anthranilic acid** (2 Amino benzoic acid)	147				0 85			217	181	182	278	104	
10	**3-Aminophenyl-acetic acid**	151												Amide, 164 6, al Chloro-acetyl 187-8, al
11	**5-Amino-pentanoic acid** (ω-Amino-*n*-valeric acid)	157									105 94			
12	**2-Aminocin-namic acid**	158, yel									191 3, al			Monoacetyl, 250 1, al , Diacetyl 158, lgr
13	**DL-β-Amino-*n*-valeric acid** DL-3-Amino pentanoic acid)	160 5									145 6			N-β Naphthalenesulfonyl 134
14	**2-Amino-4-toluic acid**	165										. . .		Acetyl, 279-81
15	**3-Aminoben-zoic acid**	174				0 86				270 264	248	270		
16	***trans*-4-Amino-cinnamic acid**	175-6									274			Acetyl, 259 60
17	**ω-Aminotri-decylic acid**	177									111 105			Benzenesulfonyl, 120, al
18	**3-Amino-4-toluic acid** (Homoanthranilic acid)	177												Amide, 146, Acetyl, 184, Formyl, 186, al

* Derivative data given in order m p , crystal color, solvent from which crystallized

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*** Aqueous phenol 80°, w/w for basic amino acids 3 vol —% of a conc aq NH_4 has to be present (in a separate vessel) in the chamber, otherwise low values are obtained Collidine-lutidine mixture 2,6-lutidine (100 ml), 2,4,6-collidine (100 ml), water (100 ml), diethylamine (3 ml), Butanol-acetic acid-water 40 ml 10 ml 10 ml

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			$[\alpha]_D$	T °C	Conc (C) and solvent	Aqueous phenol	Collidine-Lutidine	Butanol-Ac acid						
19	**4-Amino-1-naphthoic acid**	177												Acetyl, 189, Amide, 175
20	*trans*-**3-Amino-cinnamic acid**	181, yel									229			Acetyl, 237, al
21	**3-Amino-1-naphthoic acid**	181												Acetyl, 254 5
22	**N-Ethylglycine**	182												Hydrochloride, *ca* 180
23	**L-Canavanine**	184	7 9	20		0 51					*tri* 186		163 4	
24	**L-Glutamine**	185				0 6								Carbo-benzyloxy, 137
25	**Hippuric acid**	187												4 Nitrobenzyl ester 136 4-Bromo phenacyl ester, 151
26	**4-Aminobenzoic acid**	188				0 81				300	278	290		
27	**DL-Canaline**	190-5									158 60 (*di*)			γ-Carboben-zyloxy, 208-10
28	**Betaine** (Tri-methyl-glycine)	193						0 43						Formyl, 183
29	**DL-β-Amino-butyric acid**	194				0 78					154			
30	**DL-Glutamic acid**	199				0 31	0 20	0 3	117		153 155			Acetyl, 187
31	**4-Aminophenyl-acetic acid**	199 200									205-6, al			Acetyl, 168 70, Chloroacetyl, 158-60
32	**β-Alanine**	200				0 66	0 22	0 37		168	120	202		Carboben-zyloxy, 106
33	**L-Isoserine**	200				0 39					107-9			
34	**ω-Amino-*n*-caproic acid** (6-Amino-hexanoic acid)	202									45-7			
35	**γ-Aminobutyric acid**	203				0 75								Hydrochloride, 135 Heat → pyrrolidone, 24, pet eth
36	**DL-Proline**	203 (mono-hyd) 191				0 88	0 28	0 43		170		217	135-7	
37	**γ-Amino-*n*-caproic acid** (4-Amino-hexanoic acid)	205-7									150 2			Hydrochloride, 120 1
38	**6-Amino-1-naphthoic acid**	205-6												Acetyl, 170 2, 252-3
39	**1-Amino-2-naphthoic acid**	205 r h											.	Heating with conc HCl → 1-naphthyl-amine, 50

*Derivative data given in order m p , crystal color, solvent from which crystallized

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TABLE XVII. ORGANIC DERIVATIVES OF AMINO ACIDS
(Listed in order of increasing decomposition temperatures)* ** (Continued)

No	Name	Decomp temp °C	Specific rotation			Rf values***			p-Toluene sulfonyl	Phenyl urea	Benzoyl	3,5 Dinitro benzoyl	Picrate	Miscellaneous
			$[\alpha]_D$	T °C	Conc (C) and solvent	Aqueous phenol	Collidine-Lutidine	Butanol-Ac acid						
40	**L-Arginine**	207	11 8	20	c = 0 87 in 0 5 N-NaOH	0 89	0 17	0 2			298 (*mono*), 235 (*di*)	150	217 (*mono*), 190 (*di*)	Monocarbobenzyloxy, 175
			12 5	20	c = 3 48 in water									
41	**L-Glutamic acid**	211 r h , 197 s h	31 2	22 4	c = 1 0 in 6N-HCl	0 31	0 2	0 3	131					Acetyl, 199, Carbobenzyloxy, 120
			11 5	18	c = 1 47 in water									
42	**5-Amino-1-naphthoic acid**	212												Acetyl, 296, al
43	**Sarcosine**	212				0 78				102	104	153		Acetyl, 135
44	**L-3,5-Di-iodotyrosine**	213	2 9	20	c = 5 08 in 1 1 N-HCl	0 61	0 55							
45	**L-α-Asparagine**	213-5				0 47								Carbobenzyloxy, 164
46	**DL-γ-Amino-n-valeric acid** (DL-4-Aminopentanoic acid)	214 (cor)									132			
47	**L-Canaline**	214				0 77					99 (*di*)		192 3	
48	**β-Aminoisovaleric acid**	217												Hydrochloride, 120
49	**β-Hydroxyvaline**	218								182	153 (*mono*)			2-Naphthalenesulfonyl, 261
50	**L-Proline**	220 2	−93 0	20	c = 2 42 in 0 6 N-KOH	0 88	0 28	0 43	130-3				154	Phenylhydantoin, 144
			−52 6	20	c = 0 57 in 0 5 N-HCl									
51	**L-Citrulline**	222	3 7	20	c = 2 in water	0 63	0 23	0 25					206	
52	**7-Amino-1-naphthoic acid**	223-4												Acetyl, 229
53	**L-Lysine**	224	14 6	20	c = 6 5 in water	0 81	0 11	0 14		184	235 (*mono*), 149 (*di*)		266	Monohydrochloride 235 Dihydrochloride, 193 α,ε-Dicarbobenzyloxy, 150
			25 9	22 9	c = 2 0 in 6 N-HCl									
54	**β-L-Asparagine**	227				0 40	0 21	0 19	175	164	189	196	180	Carbobenzyloxy, 165
55	**3,5-Diaminobenzoic acid**	228												3,5-Diacetyl, 184, Et ester, 84
56	**L-Serine**	228	14 45	25	c = 9 34 in 1 N-HCl	0 36	0 28	0 27						Carbobenzyloxy, 121
			−6 83	20	c = 10 4 in water									
57	**Glycine**	228 30, 262				0 41	0 24	0 26	147	197	187 5	179	202	Carbobenzyloxy, 120
58	**DL-Thyroxine**	230 s h , 250 r h				0 86	0 76				210 5			N-Chloroacetyl, 201, Me ester 156
59	**DL-β-Hydroxynorvaline**	230								156	170			Phenylhydantoin, 154 5

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			$[\alpha]_D$	T, °C	Conc (C) and solvent	Aqueous phenol	Collidine-Lutidine	Butanol-Ac acid						
60	**DL-β-Amino-hydrocinnamic acid**	231									194 6			Hydrochloride, 218, Formyl, 128-9, Acetyl, 161, al
61	**DL-Homo-aspartic acid** (α-Amino-α-methyl succinic acid)	232												Amide, 266
62	**D-β-Amino-hydrocinnamic acid**	234-5	7 0	20	water									N-Formyl, 142-3
63	**L-β-Amino-hydrocinnamic acid**	234-5	−7 5	25	water									N-Formyl, 142 3
64	**3-Amino-salicylic acid**	235									189			Acetyl, 215, N-Benzenesulfonyl, 194
65	**DL-Allo-threonine**	237				0 50	0 34				176 (*mono*), 174 (*di*)			
66	**DL-Arginine**	238				0 89	0 17	0 2			230 (*di*, anh), 176 (*di*, hyd)		200 (*mono*), 196 (*di*)	
67	**4-Dimethyl-aminobenzoic acid**	242												Amide, 206, Anilide, 182 3
68	**β-Amino-β-phenyliso-butyric acid**	243									205			
69	**DL-Isoserine**	246				0 39				184	151			Phenylurethane, 183-4
70	**DL-Serine**	246				0 36	0 28	0 27	213	169	149-50			Carbobenzyloxy, 125
71	**4-Hydroxy-phenylglycine**	248									117			Monoacetyl, 203, Diacetyl, 174 5, Amide, 135
72	**Isoaspartic acid** (α-Amino-α-methylmalonic acid)	250												Diamide, 200 1 Heat → alanine, 295 d
73	**DL-Threonine**	251				0 50	0 34	0 35			177 8	145		Phenylhydantoin, 164
74	**DL-α-Amino-phenylacetic acid**	256 (subl)									175, al			Acetyl, 198 5, Formyl, 180
75	**L-Cystine**	260	−214 4	24 4	c = 1 0 in 1 02 N-HCl			0 1	204 5	160	181 (*di*)	180		Dicarbobenzyloxy, 123
			−70 0	18 5	c = 0 4 in 0 2 N-NaOH									
76	**DL-α-Amino-hydratropic acid** (DL-α-Phenyl-alanine)	260 (subl)												N-Carboethoxy, 191, al

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*** Aqueous phenol 80% w/w for basic amino acids 3 vol —% of a conc aq NH_3 has to be present (in a separate vessel) in the chamber, otherwise low values are obtained. Collidine-lutidine mixture 2,6-lutidine (100 ml), 2,4,6-collidine (100 ml), water (100 ml), diethylamine (3 ml), Butanol-acetic acid-water 40 ml 10 ml 10 ml

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			$[\alpha]_D$	T °C	Conc (C) and solvent	Aqueous phenol	Collidine-Lutidine	Butanol Ac acid						
77	**Glycylglycine**	260				0 39		0 22	178	176	208	210		Carboben-zyloxy, 178
78	**DL-β-Phenyl-alanine**	264				0 85	0 48	0 68	134 5	182	188		173	Carboben zyloxy, 103
79	**DL-Aspartic acid**	270 (>300)				0 19	0 21	0 24			119 (hyd), 176 (anh)			Carboben-zyloxy, 116
80	**DL-α-Amino-octanoic acid**	270				0 89	0 55				128			
81	**L-Aspartic acid**	270	24 6	24	c = 2 0 in 6 N HCl	0 19	0 21	0 24	140	162	185			Carboben-zyloxy, 116
82	**DL-α-Amino-nonanoic acid**	273									128			
83	**L-Hydroxy-proline**	274	−47 3	20	c = 1 31 in 1 N-HCl	0 63	0 28		153	175	100 (*mono*), 92 (*di*)			
			−75 2	22 5	c = 1 0 in water									
84	**DL-Trypto-phane**	275				0 75	0 50	0 50	176			240		N-Benzenesul-fonyl 185 Carboben zyloxy, 169-70
85	**α-Aminoiso-butyric acid**	280				0 74	0 32				198			1-Naphthyl-urea, 198
86	**DL-α-Amino-heptanoic acid**	281									135			
87	**DL-Methionine**	281				0 81	0 42	0 55	105		145			Acetyl, 114, Formyl, 100, Carboben-zyloxy, 112
88	**5-Aminosalicy-lic acid**	283									252			Monoacetyl, 218 Diacetyl, 184
89	**DL-Lanthionine**	283				0 26	0 11				195 8 (*di*)			
90	**L-Methionine**	283	−8 11	25	c = 0 8 in water	0 81	0 42	0 55				94 5 (hyd), 150 (anh)		Acetyl, 98 9 1-Naphthyl-urea, 188
91	**L-(+)-Iso-leucine**		40 6	20	c = 5 1 in 6 1 N-HCl	0 84	0 45	0 72	130-2	121	117			Formyl, 156
			11 29	20	c = 3 1 in water									
92	**L-Phenylala-nine**	283 320	−35 1	20	c = 1 94 in water	0 85	0 48	0 68	164	181	146	93		Carboben-zyloxy, 126 8
93	**L-Hexahydro-tyrosine**	285												N-4-Nitro-benzoyl, 225
94	**D-(−)-Iso-leucine**	285	−40 86	20	c = 4 53 in 6 1 N-HCl	0 84	0 45	0 72	130 2	121	117			Formyl, 156
95	**L-Histidine**	288, 253	13 0	22 7	c = 1 5 in 6 N-HCl	0 69	0 27	0 2	202 4		230 (*mono*)	189	86	Carboben-zyloxy, 209
			−39 0	25	c = 1 13 in water									
96	**L-Cysteic acid**	289 260	8 66	20	c = 1 85 g in 25 ml water									Diphenylacyl ester, 203

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			$[\alpha]_D$	T, °C	Conc (C) and solvent	Aqueous phenol	Collidine-Lutidine	Butanol Ac acid						
97	**L-Tryptophane**	290 252	−31 5 6 17	22 7 20	c = 1 0 in water c = 2 42 in 0 5 N-NaOH	0 75	0 50	0 5	176	166	183	233		Carboben-zyloxy 126
98	**DL-N-Methyl-α-alanine**	292												Methylamide, 43, Hydro-chloride, 110
99	**DL-Isoleucine**	292, 275 s h				0 84	0 45	0 72	141	120	118			Formyl, 121
100	**L-(+)-α-Aminobutyric acid**	292, 303 s h	18 65	19	c = 4 8 in 6 N-HCl	0 71	0 31	0 45			121			Formyl, 126, 1-Naphthyl-urea, 195
101	**DL-Leucine**	293, s h 332				0 84	0 45	0 73		165	137 41	187		
102	**DL-α-Amino-α-methyl-valeric acid** (DL-α-Amino-α-methyl pentanoic acid)	295, s h												1-Naphthyl-urea 196
103	**DL-Alanine**	295				0 60	0 28	0 38	139		166	177		Carboben-zyloxy, 114 5
104	**D-α-Amino-hydratropic acid**	295 (subl)	70 0	18	water									Formyl 194 5
105	**L-Alanine**	297	14 7 2 7	15 22	c = 5 8 in 0 97 N-HCl c = 10 3 in water	0 60	0 28	0 38	133		151			Carbobenzyl oxy, 84 1-Naphthyl-urea, 220 2
106	**DL-Norleucine**	297 327				0 84	0 45	0 74	124					Formyl, 114
107	**DL-Valine**	298, s h , 282				0 78	0 36	0 6	110	164	132	158		
108	**L-Djenkolic acid**	300-50	−60 5 −47 5	20 5 25	1% in 1N-HCl 2% in 1N-HCl	0 40	0 13				166 (*mono*), 88 (*di*)			
109	**D-N-Methyl-α-alanine**	300	5 6	20	water									Hydrochloride, 165 6
110	**Taurine**	300-5				0 42								N-Me , 241, N-Et , 147
111	**L-(+)-Norleucine**	301	21 3 6 26	20 20	c = 4 25 in 6 N-HCl c = 0 7 in water	0 84	0 45	0 74			53			Formyl, 115-6, 2-Naph-thalenesul-fonyl, 149
112	**DL-Norvaline**	303, s h				0 80	0 39	0 65		117				Formyl, 132, Phenylhy-dantoin, 103
113	**Creatine** (α-Methylguan-idoacetic acid)	303											218 20	Diacetyl, 165
114	**4-Aminocyclo-hexanecar-boxylic acid**	303-4												Heat → lactam, 191-2

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			$[\alpha]_D$	T °C	Conc (C) and solvent	Aqueous phenol	Collidine-Lutidine	Butanol Ac acid						
115	**DL-α-Amino-butyric acid**	304				0 71	0 31	0 45		170	147			1-Naphthyl-urea, 194, Phthalyl, 96
116	*meso*-**Lan-thionine**	304				0 26	0 11				198 200			Dicarbo-benzyloxy, 139-40
117	**Creatinine**	305, 260											220	
118	**L-α-Amino-phenylacetic acid**	305 10	−111 0, −157	20, 20	water dil HCl									Acetyl 191, Formyl 190
119	*meso*-**2,3-Di-aminosuccinic acid**	306										(*dl*) 212 hyd		Diacetyl, 235
120	**L-(+)-Norva-line**	307	23 0	20	c = 10 in 10% HCl	0 80	0 39				64			Acetyl, 137
121	**L-Tyrosine**	314-8 r h	−8 64	20	c = 4 4 in 6 3 N HCl	0 51	0 51	0 45	N- 188	104	N- 166 7, 211 2 (*dl*)			N-Acetyl, 148, Diacetyl, 172, N-Carboben-zyloxy, 101
		290 5 s h	−13 2	18	c = 0 91 in 3 N-NaOH									
122	**L-(+)-Valine**	315	28 8	20	c = 3 4 in 6 N-HCl	0 78	0 36	0 60	147		127	157 8		Carboben-zyloxy, 64-5
123	**L-Leucine**	337	15 1	25 9	c = 2 0 in 6 N-HCl	0 84	0 45	0 73	124	115	118	187		
			−10 8	24 7	c = 2 0 in water									
124	**DL-Tyrosine**	340 r h, 295 s h				0 51	0 51	0 45	224 6		N- 197	252 4 (*dl*)		
125	**1-Aminocyclo-hexanecar-boxylic acid**	350, 320 s h											209-10	Hydrochloride, 310
126	**DL-2,3-Di-aminosuccinic acid**										164 (*dl*) hyd			Diacetyl, 235
127	**DL-Ornithine**					0 79	0 11	0 15	188 (*mono*)	192	4 N 285-8, 188 (*dl*)		208 (*dl*)	
128	**L-(+)-Alloiso-leucine**		38 1	20	c = 3 97 in 6 N-HCl					151				Formyl, 126, 1-Naphthylurea, 166, Benzene-sulfonyl, 147
129	**DL-Lysine**					0 81	0 11	0 14		196	249 (*mono*); 146 (*dl*)		225 (*mono*)	Monohydro-chloride, 260 3, Dihy-drochloride, 187-9
130	**L-Cysteine**					0 57								S-Benzyl, 216, Oxid → L-cystine, 260 d Hydrochlo-ride, 175-8, $[\alpha]_D^{25}$ 9 5 (c = 2 in water)

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***Aqueous phenol 80°, w/w for basic amino acids 3 vol —% of a conc aq NH_3 has to be present (in a separate vessel) in the chamber otherwise low values are obtained Collidine-lutidine mixture 2,6-lutidine (100 ml) 2,4 6-collidine (100 ml), water (100 ml) diethylamine (3 ml) Butanol-acetic acid-water 40 ml 10 ml 10 ml

EXPLANATIONS AND REFERENCES TO TABLE XVIII

Acetamide (Acetyl derivative) *

$$RNH_2 + (CH_3CO)_2O \rightarrow CH_3CONHR + CH_3COOH$$

$$RR'NH + (CH_3CO)_2O \rightarrow CH_3CONRR' + CH_3COOH$$

Acetamide

For primary and secondary amines only

From the amine with acetic anhydride without solvent

For directions and examples see Cheronis, pp 591 593, Linstead, p 60, Vogel, p 652, Wild, p 218, J J Sudborough, *J Chem Soc*, **79,** 533 (1901), L C Raiford, R Taft and H P Lankelma, *J Amer Chem Soc*, **46,** 2051 (1924)

From the amine with acetic anhydride in aqueous sodium hydroxide

See F D Chattaway, *J Chem Soc*, 2495 (1931)

From the amine with acetic anhydride in pyridine

See Cheronis, pp 590, 592 593

From the amine hydrochloride with acetic anhydride in aqueous sodium acetate

See Linstead, p 60, Vogel, p 652

From the amine with acetic anhydride in water

See Shriner, p 226

From the amine with acetic anhydride in acetic acid

See Wild, p 218

Benzamide (Benzoyl derivative) *

$$RNH_2 + C_6H_5COCl \rightarrow C_6H_5CONHR + HCl$$

$$RR'NH + C_6H_5COCl \rightarrow C_6H_5CONRR' + HCl$$

Benzamide

For primary and secondary amines only

From the amine with benzoyl chloride in aqueous sodium hydroxide

For directions and examples see Cheronis, pp 591, 593-594, Linstead, p 60, Vogel, p 652, Wild, p 219

From the amine with benzoyl chloride in a pyridine-benzene mixture

See Shriner, p 226

From the amine with benzoyl chloride in benzene

See Shriner, p 227

From the amine with benzoyl chloride in an aqueous sodium hydroxide-chloroform mixture

See Shriner, p 226

From the amine with benzoyl chloride

See Vogel, p 653

Benzenesulfonamide (Benzenesulfonyl chloride derivative) *

$$RNH_2 + C_6H_5SO_2Cl \rightarrow C_6H_5SO_2NHR + HCl$$

$$RR'NH + C_6H_5SO_2Cl \rightarrow C_6H_5SO_2NRR' + HCl$$

Benzene-sulfonamide

For primary and secondary amines only

From the amine with benzenesulfonyl chloride in aqueous sodium hydroxide

For directions and examples see Cheronis, pp 595 596, Shriner, pp 103-104, Vogel, p 653, O Hinsberg, *Chem Ber*, **23,** 2962 (1890), **38,** 906 (1905)

From the amine in aqueous sodium hydroxide with benzenesulfonyl chloride in methanol

See Cheronis, p 596

From the amine with benzenesulfonyl chloride in benzene

See Wild, p 221

From the amine in aqueous sodium hydroxide with benzenesulfonyl chloride in acetone

See Wild, p 221

From the amine with benzenesulfonyl chloride in aqueous pyridine

See Wild, p 221

From the amine with benzenesulfonyl chloride in pyridine

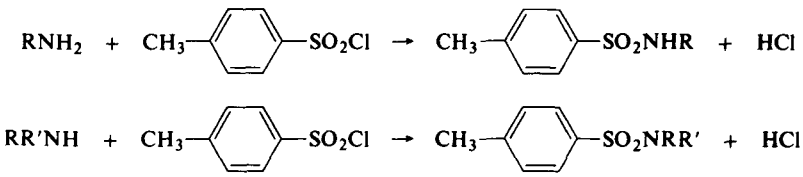
See Vogel, p 653

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

From the amine with benzenesulfonyl chloride in aqueous sodium hydroxide
See Wild, p 221

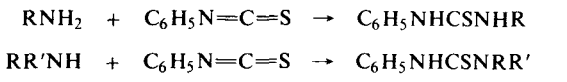
p-Toluenesulfonamide (p-Toluenesulfonyl chloride derivative) *



p-Toluenesulfonamide

For primary and secondary amines only
From the amine with *p*-toluenesulfonyl chloride in aqueous sodium hydroxide
For directions and examples see Cheronis, p 595, Linstead, p 60, Shriner, pp 103 104, Vogel, p 653
From the amine with *p*-toluenesulfonyl chloride in benzene
See Wild, p 221
From the amine with *p*-toluenesulfonyl chloride in acetone
See Wild, p 221
From the amine with *p*-toluenesulfonyl chloride in pyridine
See F Bell, *J Chem Soc*, 2787 (1929)
From the amine with *p*-toluenesulfonyl chloride in aqueous pyridine
See Wild, p 221

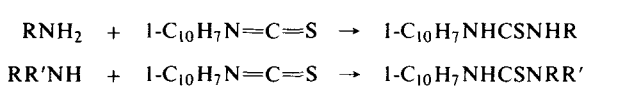
Phenylthiourea *



Phenylthiourea

For primary and secondary amines only
From the amine with phenylisothiocyanate in alcohol
For directions and examples see Cheronis, pp 599–600, Shriner, p 227, Vogel, p 422, Wild, p 227, T Otterbacher and F C Whitmore, *J Amer Chem Soc*, **51**, 1909 (1929)
From the amine with phenylisothiocyanate without solvent
See Vogel, p 422, Wild, p 227, N A Lange, H L Ebert and L K Youse, *J Amer Chem Soc*, **51**, 1911 (1929)

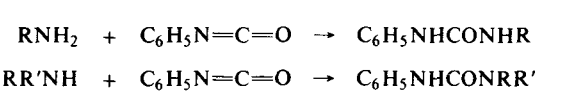
1-Naphthylthiourea *



1-Naphthylthiourea

For primary and secondary amines only
From the amine with 1-naphthylisothiocyanate in ethanol
For directions and examples see Cheronis, pp 600–601, Vogel, p 422, Wild, p 227, C M Suter and E W Moffet, *J Amer Chem Soc*, **55**, 2497 (1933)
From the amine with 1-naphthylisothiocyanate without solvent
See Vogel, p 422, Wild, p 227, C M Suter and E W Moffett, *J Amer Chem Soc*, **55**, 2497 (1933)

Phenylurea



Phenylurea

For primary and secondary amines only
From the amine with phenylisocyanate in petrol ether

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

For directions and examples see Linstead, p 61, Wild, pp 223 224
From the amine with phenylisocyanate without solvent
See N A Lange, H L Ebert and L K Youse, *J Amer Chem Soc*, **51**, 1911 (1929)

1-Naphthylurea *

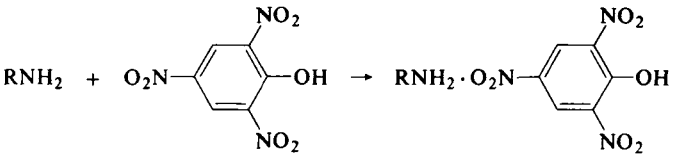
$$RNH_2 + 1\text{-}C_{10}H_7N{=}C{=}O \rightarrow 1\text{-}C_{10}H_7NHCONHR$$

$$RR'NH + 1\text{-}C_{10}H_7N{=}C{=}O \rightarrow 1\text{-}C_{10}H_7NHCONRR'$$

1 Naphthylurea

For primary and secondary amines only
From the amine with 1-naphthylisocyanate without solvent
For directions and examples see Cheronis, p 599, H E French and A F Wirtel, *J Amer Chem Soc*, **48**, 1736 (1926)
From the amine with 1-naphthylisocyanate in petrol ether
See Linstead, p 61, Wild, pp 223 224
From the amine with 1-naphthylisocyanate with water
See Wild, p 224

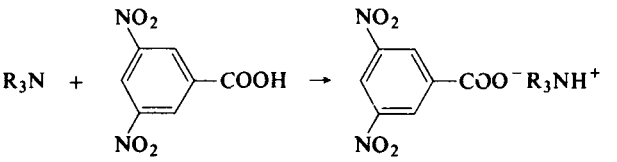
Picrate *



Picrate
(Molecular complex)

For primary, secondary and tertiary amines
From the amine with picric acid in methanol or in ethanol
For directions and examples see Cheronis, pp 603 604, Linstead, p 50, 61, Shriner, p 229, Vogel, pp 422–423, Wild, p 212
From the amine with picric acid in water
See Vogel, p 422
From the amine with picric acid in acetone or benzene
See Wild, p 212
From the amine with picric acid
See Shriner, p 229

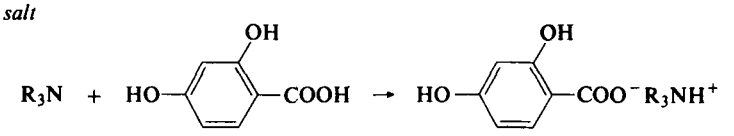
3,5-Dinitrobenzoic acid salt *



Trialkylammonium
3,5-dinitrobenzoate

Especially for tertiary amines
From the amine with 3,5-dinitrobenzoic acid in methanol or ethanol
For directions and examples see Cheronis, pp 602 603, Wild, p 215, C A Buehler, E J Currier and R Lawrence, *Ind Eng Chem, Anal Ed*, **5**, 277 (1933), C A Buehler and J D Calfree, *Ind Eng Chem, Anal Ed*, **6**, 351 (1934)

β-Resorcylic acid salt



β-Resorcylic acid Trialkylammonium resorcylate

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

EXPLANATIONS AND REFERENCES TO TABLE XVIII (Continued)

Especially for tertiary amines.

From the amine with β-resorcylic acid in ether.

For directions and examples see: Cheronis, p. 603; K. W. Wilson, F. E. Anderson and R. W. Donohoe, *Anal. Chem.*, **23**, 1032 (1951).

*Chloroplatinic acid salt.**

$$R_3N + H_2PtCl_6 \rightarrow [R_3NH]_2^+PtCl_6^=$$

Chloroplatinate

Especially for tertiary amines.

From the amine in aqueous hydrochloric acid with aqueous chloroplatinic acid.

For directions and examples see: Shriner, p. 230; Wild, p. 213.

Hydrochloride.

$$RNH_2 + HCl \rightarrow [RNH_3^+]Cl^-$$

Hydrochloride

For primary, secondary and tertiary amines.

From the amine with gaseous hydrogen chloride in ether, benzene or chloroform.

For directions and examples see: Cheronis, p. 601; Shriner, p. 224; Wild, p. 211.

From the amine with dilute aqueous hydrochloric acid.

See: Wild, p. 211.

*Methiodide.**

$$R_3N + CH_3I \rightarrow [R_3NCH_3^+]I^-$$

Methiodide

Especially for tertiary amines.

From the amine with methyl iodide without solvent.

For directions and examples see: Linstead, p. 61; Shriner, p. 228; Vogel, p. 660; Wild, p. 232.

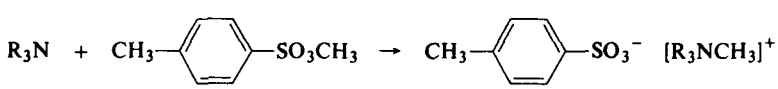
From the amine with methyl iodide in isopropyl ether.

See: Cheronis, p. 604.

From the amine with methyl iodide in ether or benzene.

See: Vogel, p. 660.

*Metho-p-toluenesulfonate (Methyl p-toluenesulfonate).**



Metho-*p*-toluenesulfonate

Especially for tertiary amines.

From the amine with methyl *p*-toluenesulfonate in isopropyl ether.

For directions and examples see: Cheronis, p. 604.

From the amine with methyl *p*-toluenesulfonate in benzene.

See: Linstead, p. 62; Shriner, p. 229; Vogel, p. 660; Wild, p. 233; C. S. Marvell, E. W. Scott and K. L. Amstutz, *J. Amer. Chem. Soc.*, **51**, 3638 (1929).

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines a) Liquids 1) (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acetamide	Benzamide	Benzene sulfonamide	*p*-Toluene sulfonamide	Phenyl thiourea	Picrate	Miscellaneous
1	**Methylamine**	−6			$0\ 699_4^{-11}$	28	80	30	75	113	207, 215	
2	**Dimethylamine**	7			$0\ 6804_4^0$		41	47	79	135	158	
3	**Ethylamine**	16 5 19			$0\ 7057_4^0$		71	58	63	106 135	165	
4	**Isopropylamine**	33		$1\ 377^{15}$	$0\ 691_4^{18}$			26		101		1-Naphthylurea, 200, 1-Naphthylthiourea, 143
5	**Ethyl methyl amine**	36									196	Chloroplatinate, 207, Hydrochloride, 126–30
6	***tert*-Butylamine**	46		$1\ 3794^{18}$	$0\ 7004^{15}$	101 2	134			120	198	Hydrochloride, 270–80
7	***n*-Propylamine**	49		$1\ 3901^{17}$	$0\ 714_4^{25}$		84	36	52	63	135	1-Naphthylurea, 196
8	**Isopropyl methyl amine**	50			$0\ 7026_4^{19}$					120	135	Phenylurea, 131
9	**Cyclopropylamine**	50		$1\ 421^{20}$	$0\ 824_4^{20}$		99	120 (*di*)			149	Hydrochloride, 100
10	**Ethyleneimine**	56			$0\ 832^{24}$				52		142	Oxalate, 115
11	**Diethylamine**	56		$1\ 3873^{18}$	$0\ 7108_4^{18}$		42	42	60	34	155	1-Naphthylthiourea, 108
12	**Allylamine**	58		$1\ 4194^{22}$	$0\ 7436_{20}^{20}$			39	64	98	140	
13	**DL-*sec*-*n*-Butylamine** (2-Aminobutane)	63		$1\ 395^{17}$	$0\ 718^{20}$		76	70	55	101	139 40	
14	***unsym*-Dimethylhydrazine**	63		$1\ 4075^{22}$	$0\ 7914^{22}$							Hydrochloride, 81–2, Oxalate, 142, Sulfate, 105
15	**Trimethyleneimine** (Azetidine)	63		$1\ 4287^{24}$	$0\ 8436^{20}$						166–7	Chloroplatinate, 203, Chloroaurate, 192
16	**Isobutylamine**	69		$1\ 3988^{17}$	$0\ 724_4^{25}$		57	53	78	82	150	
17	***n*-Butylamine**	77		1 401	$0\ 7401_4^{20}$					65	151	1-Naphthylurea, 149, 1-Naphthylthiourea, 108-9, Hydrochloride, 195
18	**2-Amino-2-methylbutane**	78			$0\ 756_4^0$						183	
19	**DL-*sec*-Butyl methyl amine**	78 9			$0\ 740^{15}$						78	Chloroplatinate, 151
20	**Ethyl propyl amine**	80 1		1 3966	$0\ 773^{24}$							Hydrochloride, 225, Chloroplatinate, 198, Chloroaurate, 86
21	***Sym*-Dimethylhydrazine**	81		$1\ 4209^{20}$	$0\ 8274_4^{20}$						147 50	Oxalate, 119, Hydrochloride, 168
22	**Cyclobutylamine**	82		$1\ 4363^{19}$	$0\ 8328_4^{20}$							Chloroplatinate, 210 5
23	**Di-isopropylamine**	84			$0\ 722^{22}$						140	N-Nitroso, 48, Chloroplatinate, 186 9, Hydrochloride, 216-7
24	**Pyrrolidine**	89		$1\ 4270^{15}$	$0\ 852^{22}$				123		112, yel, 163–4, red	
25	***n*-Butyl methyl amine**	90–1		$1\ 4018^{18}$	$0\ 7367_4^{15}$						111	Hydrochloride, 170, Chloroplatinate, 205
26	**5-Amino-1-pentene**	91–4										Chloroplatinate, 166, Chloroaurate, 195
27	**DL-2-Amino-*n*-pentane** (*sec*-*n*-Amylamine)	92			$0\ 7384_0^{20}$							Hydrochloride, 168, Oxalate, 226, 131 Chloroaurate, 82-3
28	**Isoamylamine**	96		$1\ 4096^{18}$	$0\ 751^{18}$					102	138	1-Naphthylurea, 132

*Derivative data given in order m.p., crystal color, solvent from which crystallized.

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point, °C	n_D	Density g/ml	Acetamide	Benzamide	Benzene sulfon amide	*p* Toluene sulfon-amide	Phenyl thiourea	Picrate	Miscellaneous
29	**D-2-Methyl-*n*-butyl-amine** (*active*-Amyl amine)	96			$0\ 7505^{25}_{4}$							$[\alpha]_D^{25}$ −5 86, Hydro-chloride, 176, Chloroplatinate, 240
30	**2-Methylpyrrolidine**	97 8			$0\ 84^{20}_{20}$						88 5 9 5	Oxalate, 178 9, Chloroplatinate, 172 3 (anh), 206-7, rapid htng Picrate of N-methyl deriv , 235
31	**3-Methylpyrrolidine**	103 5		$1\ 4480^{20}$	$0\ 8654^{0}_{4}$						106	Chloroplatinate, 194
32	***n*-Amylamine**	104			$0\ 7614^{20}_{4}$					69	139	2-Naphthylthiourea, 114
33	**2-(Methylamino)-*n*-pentane**	105			$0\ 947^{20}$						77 8	Chloroplatinate, 138
34	**Piperidine**	106		$1\ 4530^{20}$	$0\ 8606^{20}_{4}$		48	93 4	96	101	152	
35	**2-Aminodiethylether**	108 9		$1\ 4101^{20}$	$0\ 8512^{20}_{4}$						122	Picrolonate, 204
36	**Di-*n*-propylamine**	109 10		$1\ 4046^{20}$	$0\ 7384^{20}_{4}$			51		69	75	1-Naphthylurea, 93
37	**2,5-Dimethylpyrrolidine**	110 3		$1\ 4357^{15}$	$0\ 8185^{12}_{4}$						117 8	Hydrochloride, 188 90, Chloroplatinate, 225
38	**2,4-Dimethylpyrrolidine**	115 7		$1\ 4325^{20}$	$0\ 8297^{20}_{4}$						116 7	Chloroplatinate, 210
39	**1,2-Ethylenediamine**	116	8 5	$1\ 454^{26}$	$0\ 898^{25}_{4}$	172 (*dl*)	244 (*dl*)	168 (*dl*)	360 (*dl*)	102	233 (*dl*)	
40	**L-2-Methylpiperidine**	117	50 1								116 7	Hydrochloride, 190, Chloroplatinate, 194
41	**DL-2-Methylpiperidine**	118-9		$1\ 4464^{24}$	$0\ 8436^{24}_{4}$		45		55		164	Hydrochloride, 207, Oxalate, 125
42	**DL-1,2-Diaminopropane**	119-20			$0\ 878^{15}$	139 (*dl*)	192 (*dl*)				135 (*dl*)	
43	**Isohexylamine**	125			$0\ 758^{25}_{4}$						123 5	Hydrochloride, 220, Oxalate, 166, Chloroplatinate, 200
44	**DL-3-Methylpiperidine**	126		$1\ 446^{24}$	$0\ 845^{24}_{4}$						138 (*dl*)	Hydrochloride, 172, N-2,4-Dinitrophenyl deriv , 67
45	**2,6-Dimethylpiperidine**	127-8		$1\ 4366^{25}$	$0\ 816^{25}_{4}$		111	50			162 4	Chloroplatinate, 212
46	***n*-Hexylamine**	130	−19		$0\ 763^{25}_{4}$		40	96		77	126	
47	**3-Amino-*n*-hexane**	130										Hydrochloride, 227, Chloroplatinate, 190 200
48	**Morpholine**	130					75	118	147	136	146	
49	**Cyclohexylamine**	134		$1\ 4372^{20}$	$0\ 8191^{20}_{4}$	101	149	89		148		
50	**Trimethylenediamine** (1,3-Diaminopropane, 1,3-Propylenediamine)	136			$0\ 884^{25}_{4}$	1,3-*dl* 126, 107	1,3-*dl* 140 147	96	148		250	Chloroplatinate, 240
51	**2,2,6-Trimethyl-piperidine**	138 9									195 6	Hydrochloride, 236, Chloroaurate, 128
52	**Di-isobutylamine**	139	−77	$1\ 4093^{20}$	$0\ 745^{20}_{4}$	86		55, 57		113	121	
53	**4-Amino-*n*-heptane**	139 40			$0\ 767^{20}_{4}$							Hydrochloride, 246-7, Chloroplatinate, 235
54	**1,3-Diaminobutane**	141 2									240-5	Hydrochloride, 171 2
55	**2-Amino-*n*-heptane**	142		$1\ 4199^{19}$	$0\ 7665^{19}_{4}$							Hydrochloride, 133, Oxalate, 204-5, Chloroaurate, 63 4
56	***unsym*-Diethylethylene-diamine**	145			$0\ 827^{19}_{19}$					115 (*mono*), 211 (*dl*)		Chloroplatinate, 211
57	**Furfurylamine** (α-Furylmethylamine)	145 6									150	Oxalate, 145, With CO_2 from air → comp , 75, Hydro-chloride, 110

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acetamide	Benzamide	Benzene sulfonamide	*p*-Toluene sulfonamide	Phenyl thiourea	Picrate	Miscellaneous
58	**Cyclohexyl methyl amine**	145 7					85-6				170	Hydrochloride, 193
59	**2-Ethylpiperidine** (α-Ethylpiperidine)	146 7			$0\ 8651^{0}_{0}$			64-5			133	Hydrochloride, 181, Chloroplatinate, 202
60	**2,2,4-Trimethyl-piperidine**	148			$0\ 832^{15}$							Chloroplatinate, 215, Methiodide, 266
61	***Sym*-Diethylethylene-diamine**	149 50										Hydrochloride, 260, Chloroplatinate, 223, Chloroaurate, 220
62	**4-Ethylpiperidine** (γ-Ethylpiperidine)	151		$1\ 4503^{25}$	$0\ 876^{0}$			74-5				Chloroplatinate, 173, Chloroaurate, 105
63	**3-Ethylpiperidine** (β-Ethylpiperidine)	153			$0\ 871^{16}_{4}$						63	Hydrochloride, 141, Chloroplatinate, 183
64	***n*-Heptylamine**	155	-23	$1\ 41954^{26}_{\alpha}$	$0\ 777^{20}$					75	121	1-Naphthylthiourea, 68 9
65	**Di-*n*-butylamine**	159								86	59	1 Naphthylthiourea, 123
66	**Tetramethylenediamine** (1,4-Diaminobutane, Putrescine)	159	27		$0\ 877^{25}_{4}$	137 (*dl*)	177 (*dl*)		224 (*dl*)		249-50 (*dl*)	
67	**DL-2-Hydroxy-*n*-propylamine** (Isopropanolamine)	163			$0\ 973^{18}$						142	Chloroplatinate, 195, Hydrochloride, 73
68	**Hexahydrobenzylamine**	163 5		$1\ 4646^{18}$	$0\ 87^{20}_{4}$		98, 107				184 6	Hydrochloride, 254
69	**Cyclohexyl ethyl amine**	164			$0\ 868^{0}_{0}$						133	Hydrochloride, 184
70	**2-Ethylcyclohexylamine**	170 1		$1\ 4682^{20}$	$0\ 8744^{20}_{4}$			121-2			190	Chloroplatinate, 239
71	**2-Aminoethyl alcohol** (Ethanolamine)	171		$1\ 4539^{20}$	$1\ 022^{20}_{4}$						160	1-Naphthylurea, 186
72	**3-Amino-2-hydroxy-pentane**	172			$0\ 906^{18}$							N-Chloroacetyl deriv , 52 60, Monooxalate, 166, Dioxalate, 204
73	**2-Aminopropyl alcohol**	173-6										Hydrochloride, 86, Chloroplatinate, 198 9
74	**2-Amino-3-hydroxy-pentane**	174		$1\ 4458$	$0\ 9289^{24}$							Chloroplatinate, 154, Picrolonate, 215
75	**2-Fluoroaniline**	176	-35 -29			80	113					Picrate of N,N-dimethyl deriv , 131
76	**Pentamethylenediamine** (1,5-Diaminopentane, Cadaverine)	178 80			$0\ 9174^{0}_{4}$		135 (*dl*)	119		148	237	
77	***n*-Octylamine**	180			$0\ 777^{20}$						112	1 Naphthylthiourea, 72
78	**5-Methyl-2-pyrazoline**	180					156				126	Phenylurea, 127
79	**Benzyl methyl amine**	181			$0\ 945^{18}_{15}$				95		117-8	Chloroplatinate, 197
80	**Aniline**	184		$1\ 5863^{20}$	$1\ 022^{20}_{4}$	114	160	112	103	54	180	
81	**Benzylamine**	184-5		$1\ 5401$	$0\ 9826^{19}_{4}$	65	105	88	116, 185	156	194	
82	**4-Fluoroaniline**	186	-1	$1\ 5195^{20}$	$1\ 1725^{20}_{4}$	152	185					N-4-Nitrobenzoyl deriv , 181
83	**DL-α-Phenylethylamine** (α-Aminoethyl-benzene)	187, 185			$0\ 9395^{15}$	57	120					Hydrochloride, 158
84	**1,2-Diaminocyclohexane**	187				260 (*dl*)					210 5 (*dl*)	Hydrochloride, 280
85	**3-Fluoroaniline**	187-8, yel			$1\ 160^{16}$	84						
86	**Di-isoamylamine**	187-8	-44	$1\ 4229^{21}$	$0\ 7672^{21}_{4}$					72	94 5	1-Naphthylurea, 95, Methiodide, 221
87	**3-Aminopropyl alcohol**	188		$1\ 457^{26}$	$0\ 982^{26}_{4}$						222	Chloroplatinate, 199

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acetamide	Benzamide	Benzene sulfonamide	*p*-Toluene sulfonamide	Phenyl thiourea	Picrate	Miscellaneous
88	**1,2,3-Triaminopropane**	190				200–2 (*tri*)	217–8 (*tri*)				>269	
89	**4-Amino-2,6-dimethylpiperidine**	195									220	Chloroplatinate, >250
90	**N-Methylaniline**	196		$1\ 573^{16}$	$0\ 989_4^{20}$	102	63	79	94	87	145	
91	**1-Phenylisopropylamine**	196–7		$1\ 5181^{25}$	$0\ 9424_0^{20}$		159					Oxalate, 131, Hydrochloride, 236
92	**β-Phenylethylamine** (β-Aminoethylbenzene)	198			$0\ 958_4^{24}$	51	116	69		135	174, 167	
93	**Benzyl ethyl amine**	199			$0\ 935_{15}^{17}$				50		118	Hydrochloride, 184
94	**2-Methylaniline** (*o*-Toluidine)	200		$1\ 5688^{20}$	$1\ 0053_{20}^{20}$	110–1	146	124	185 6	136	213	
95	***n*-Nonylamine**	201				34–5	49				111	
96	**3-Methylaniline** (*m*-Toluidine)	203		$1\ 5686^{20}$	$0\ 990_{25}^{25}$	65	125	95	171–2		200	
97	**Di-*n*-amylamine**	205								72		2-Naphthylthiourea 126, Hydrochloride, 275
98	**DL-2-Phenylisopropylamine**	205				64 initially, 93 on standing					143	Hydrochloride 145–7
99	**N-Ethylaniline**	205		$1\ 5559^{20}$	$0\ 9625_4^{20}$	54	60		87	89	132 138	
100	**4-Methylpyrazole**	207		$1\ 4920_{He}^{20}$	$1\ 015_4^{20}$						142	1-*o*-Nitrobenzoyl deriv , 107
101	**3-Methylbenzylamine** (*m*-Xylylamine)	207			$0\ 9654_0^{20}$	235–40	150				198, 156	Hydrochloride, 208 Chloroplatinate, 214
102	**2-Chloroaniline**	209 207		$1\ 5895^{20}$	$1\ 2125_4^{20}$	87	99	129	193, 105	156	134	
103	**N,2-Dimethylaniline** (N-Methyl-*o*-toluidine)	208			$0\ 973^{15}$	56	66				90	
104	**2-Methylbenzylamine** (*o*-Xylylamine)	208	−20	$1\ 5436^{19}$	$0\ 977_0^{19}$	69	88				215	Chloroplatinate, 220–3
105	**4-Methylbenzylamine** (*p*-Xylylamine)	208	13	$1\ 5364^{20}$	$0\ 952_0^{20}$	107–8	137				204	
106	**3-Methylpyrazole**	208		$1\ 497_{He}^{16}$	$1\ 020_4^{16}$	29 30					144	N-*o*-Nitrobenzoyl deriv , 120
107	**1-Phenylpropylamine**	208		$1\ 5173^{25}$	$0\ 9347_0^{25}$		115–6	81				Hydrochloride, 190
108	**2-Phenylpropylamine**	210					85				182	Hydrochloride, 123 4
109	**N,4-Dimethylaniline** (N-Methyl *p*-toluidine)	210				83		67			131	N-Nitroso deriv , 52, Hydrochloride, 119 5
110	**2-Ethylaniline**	210–11	46 6	$1\ 5584^{22}$	$0\ 9810^{20}$	111	147				194–5	
111	**L-Menthylamine**	212, 207				145	156			135	215	$[\alpha]_D^{19}$ −34 2
112	**2,5-Dimethylaniline** (*p*-2-Xylidine)	213 5, pa yel	14 2	$1\ 5591^{21}$	$0\ 9735^{20}$	139	140	138	232–3, 119	148	171	
113	**1-Phenylisobutylamine**	214		$1\ 5123^{20}$	$0\ 920_0^{20}$						166–8	Oxalate, 120–2, Hydrochloride, 275 7
114	**3-Methylpyridazine**	215			$1\ 0486_{26}^{26}$						143–4	
115	**2,6-Dimethylaniline** (*m*-2-Xylidine)	215, 218	11 2	$1\ 5610^{20}$	$0\ 9842^{20}$	177	168		212	204	180	
116	**4-Ethylaniline**	216, 214	−6	$1\ 5550^{20}$	$0\ 9690^{20}$	94	151		104			
117	**2,4-Dimethylaniline** (*m*-4-Xylidine)	217		$1\ 561^{20}$	$0\ 9783_4^{20}$	133, 130	192	130	181	152	209	
118	**2-Chloro-N-methylaniline**	218			$1\ 1735^{11}$						133	
119	**2,4-Dimethylbenzylamine**	218–9									223	Hydrochloride, 212, Chloroplatinate, 226

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acetamide	Benzamide	Benzene sulfon amide	*p*-Toluene sulfon amide	Phenyl thiourea	Picrate	Miscellaneous
120	**2-Amino-N,N-dimethyl-aniline**	219				72	51				138 40	
121	**3,5-Dimethylaniline** (*m*-5-Xylidine)	220	9 8	1 5581^{20}	0 9706^{20}	144, 140	144-5			153	200	N-Formyl deriv , 76
122	**N-Ethyl-3-methylaniline** (N-Ethyl-*m*-toluidine)	221, 215					72					Hydrochloride, 159, Chloroplatinate, 182
123	**3,5-Dimethylbenzyl-amine**	221		1 5305^{20}	0 950$^{20}_{0}$						225	Hydrochloride, 245, Chloroplatinate, 204
124	**2,3-Dimethylaniline** (*o*-3-Xylidine)	221-2	3 5	1 5684^{20}	0 9931^{20}	135	189				221	Hydrochloride, 254, N-Formyl deriv , 102
125	**1-Aminoindane** (1-Hydrindamine)	222					142 3				207	
126	**3-Phenylpropylamine**	222			0 976$^{25}_{4}$		57 8				152 3	Hydrochloride, 218
127	**2-Methyl-4,5,6,7-tetra-hydroindole**	222			0 987$^{10}_{4}$			86-91			141	Methiodide 195, Chloroplatinate, 187
128	**N-*n*-Propylaniline**	222			0 949^{18}	47		54		104		
129	**2-*n*-Propylaniline**	222-4				104-5	119				151	Hydrochloride, 173
130	**2-Chloro-4-methylaniline**	223				113	137					
131	**α-Amino-*n*-butylbenzene**	223			0 9367$^{20}_{0}$		128					Chloroplatinate, 184, Hydrochloride, 288
132	***trans*-9-Aminodecalin**	223	−25	1 492$^{20}_{He}$	0 939$^{20}_{4}$	183	148 9					N-Formyl deriv , 172
133	**γ-Amino-*n*-butylbenzene**	223		1 5152^{20}	0 9289$^{15}_{4}$		108, lgr					Hydrochloride, 144, Chloroplatinate, 220
134	**2-Methoxyaniline** (*o*-Anisidine)	225	5-6			85, 88	60, 84	89	127	136	200	N-Formyl deriv , 84
135	**4-Isopropylaniline** (*p*-Cumidine)	225			0 953$^{20}_{4}$	102	162					
136	**4-*n*-Propylaniline**	225				93-4	115					Hydrochloride, 203 4
137	**N-Isobutylaniline**	227			0 940$^{18}_{4}$				122 3			
138	**α-Methyl-α-phenyl-hydrazine**	227		1 5824^{20}		92	153	132				
139	**4-*tert*-Butylaniline**	228	17			173	140		179-80			N-Formyl deriv , 59 Hydrochloride, 270-4
140	***cis*-9-Aminodecalin**	228	−13 5	1 498$^{21}_{He}$	0 951$^{21}_{4}$	127	147					N-Formyl deriv , 165-6
141	**2-Ethoxyaniline** (*o*-Phenetidine)	229				79	104	102	164	137		
142	**2,4,6-Trimethylaniline** (Mesidine)	229, 232				216	204	137	167	193	189-91	
143	**2-Aminoindane** (2-Hydrindamine)	230				127	155				239	Hydrochloride, 241
144	**3-Chloroaniline**	230 236		1 5931^{20}	1 2225$^{15}_{15}$	72, 78	119-20	121	138, 210	124, 116	177	
145	**2,2'-Diaminodiethyl-sulfide**	231 3									212	Dihydrochloride, 131
146	**1,2,3,4-Tetrahydro-isoquinoline**	233		1 5798^{23}	1 064$^{23}_{4}$	46	129	154			200, 195	
147	**2-*tert*-Butylaniline**	233-5		1 5453^{20}	0 977^{15}	159-61						
148	**3-Amino-4-(dimethyl-amino)toluene**	234									151	Hydrochloride, 192 3
149	**4-Isobutylaniline**	235, pa yel				127			136-7			
150	**4-Aminoindane** (4-Hydrindamine)	236	−3			126	136					
151	**2-Aminoundecane** (2-Aminohendecane, *sec*-*n*-Undecylamine)	237				58					111	Hydrochloride, 84
152	***unsym*-Ethylphenyl-hydrazine**	237			1 018^{15}							Hydrochloride, 137, Reduces warm Fehling

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D	Density g/ml	Acetamide	Benzamide	Benzene sulfonamide	*p*-Toluene sulfonamide	Phenyl thiourea	Picrate	Miscellaneous
153	***sym*-Ethylphenylhydrazine**	238 9		1 55[15]	1 004$^{15}_{15}$		100					Hydrochloride, 164, Oxalate, 167
154	**2-Bromo-4-methylaniline** (3-Bromo-*p*-toluidine)	240	26		1 51[20]	118	149					Hydrochloride, 221
155	**1-Aminoundecane** (1-Aminohendecane, *n*-Undecylamine, *n*-Hendecylamine)	240	15-6			48	60					Hydrochloride, 190
156	**4-Chloro-N-methylaniline**	240			1 169[11 5]	92-4					153	Nitrosamine, 51
157	**4-Chloro-2-methylaniline** (5-Chloro-*o*-toluidine)	241	29			140						
158	**2-Amino-*p*-cymene** (*p*-Cymidine)	241		1 543[19]	0 994[20]	71	102					Hydrochloride, 207
159	**N-Butylaniline**	241		1 5381[20]	0 9358$^{20}_{4}$		56		56			
160	**Phenylhydrazine**	243	19 23	1 6081[20]	1 0978$^{20}_{4}$	128 107 (*di*)	168, 177 (*di*)	148	151	172		
161	**α,α'-Diamino-*m*-xylene** (*m*-Xylylenediamine)	245 8				*di* 134 5, bz	N,N'-*di* 172				185-90	Dihydrobromide, 266
162	**2-Chloro-6-methoxyaniline** (3-Chloro-*o*-anisidine)	246 sl d				123	135					
163	**3-Ethoxyaniline** (*m*-Phenetidine)	248				97	103		157	138	158	
164	**4-Ethoxyaniline** (*p*-Phenetidine)	248, 254	2 3		1 065$^{16}_{4}$	137	173	143	106	136	69	
165	**1,2,3,4-Tetrahydroquinoline**	250	20	1 593[24]	1 054$^{24}_{4}$		75	67				
166	**2-Aminoacetophenone**	250 2d	20			76 7	98		148			Semicarbazone, 290, Oxime, 109, Hydrochloride, 168 d
167	**3-Bromoaniline**	251	18	1 626[20]	1 579$^{20}_{4}$	87	120 136			143	180	
168	**3-Methoxyaniline** (*m*-Anisidine)	251				81			68		169	Hydrochloride, 167 8
169	**3-Bromo-2-methylaniline** (6-Bromo-*o*-toluidine)	254				163	176-7					
170	**4-Amino-1,2,3,5-tetramethylbenzene** (Isoduridine)	255	23 4			215-7					200	
171	**Dicyclohexylamine**	255 sl d	abt 20	1 488[18]	0 925[18]	103	153				173	
172	**6-Methyl-1,2,3,4-tetrahydroisoquinoline**	256			1 0235$^{8}_{4}$						205	Hydrochloride, 195-7, Methiodide, 144 5, N-Nitroso deriv , 98
173	**4-Amino-N,N-diethylaniline**	261				104	172					
174	**4-*n*-Butylaniline**	261			0 945$^{20}_{4}$	105	126					Chloroplatinate, 200-2
175	**1-Amino-5,6,7,8-tetrahydronaphthalene**	261 3		1 5896[23]	1 0625[16]	158						Hydrochloride, 259 61
176	**7-Methyl-1,2,3,4-tetrahydroquinoline**	264					70-2				153-4	Hydrochloride, 175
177	**4-Methylindole**	267	5		1 062$^{20}_{4}$						194 5	
178	**2-Amino-4-chloro-N,N-dimethylaniline**	267 8				90					191	
179	**DL-3-Aminopropyleneglycol** (2,3-Dihydroxypropylamine)	268 part d		1 49[10]	1 175$^{20}_{4}$		O,N-*di* 109 O,O,N-*tri* 113					Chloroplatinate, 185, Picrolonate, 220, O,N-*di*-4-Nitrobenzoyl deriv , 139

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D	Density g/ml	Acetamide	Benzamide	Benzene sulfonamide	*p*-Toluene sulfonamide	Phenyl thiourea	Picrate	Miscellaneous
180	**Diethanolamine** (Di-(2-hydroxyethyl)-amine)	270	28	1 4776^{20}	1 0966$^{20}_{4}$						110	Nitrate, 69, Chloroplatinate, 160
181	**3-(Dimethylamino) aniline**	272			0 995^{25}	87 69 (*di*)	163 4				187	N-Chloroacetyl deriv , 102
182	**1-(N,N-Diethylamino) naphthalene**	290		1 5961^{20}	1 015$^{20}_{20}$						152 4	1,3,5-Trinitrobenzene add comp , 95, scar
183	**1-(Methylamino) naphthalene**	294				94 5	121		164			
184	**Dibenzylamine**	300		1 5743^{22}	1 0256$^{22}_{4}$		112	68	159			Hydrochloride, 256
185	**α-Aminodiphenylmethane** (Benzhydrylamine)	303–4		1 5963$^{21.5}$	1 0635$^{21.5}_{0}$	146 7	172 167				205 6	N-Formyl deriv , 132
186	**1,2-Diphenylethylamine**	313			1 031^{15}						212 3	Oxalate, 158, Chloroplatinate, 188
187	**2,3-Diphenylpropylamine**	315 7				85 (*di*)						Hydrochloride, 188 90, Chloroaurate, 144 5
188	**2-(Methylamino) naphthalene**	317, 309				51	84	107	78		145	Hydrochloride, 182 3
189	**2-(N,N-Diethylamino) naphthalene**	320 2										1,3,5-Trinitrobenzene add comp , 116, blk , Hydrochloride, 177, Chloroplatinate, 95

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines a) Liquids 2) (b.p. at reduced pressure only) (Listed in order of increasing m.p. of the corresponding acetyl derivative)*

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Acetamide	Benzamide	Benzene sulfonamide	*p*-Toluene sulfonamide	Phenyl thiourea	Picrate	Miscellaneous
1	**3-Aminostyrene**	112 5[12]			1 0216$^{20}_{20}$	74 5	90, bz - lgr , 126, al -w					Polymerizes readily
2	**2-Bromo-4-ethoxyaniline** (3-Bromo-*p*-phenetidine)	160[23]				97						
3	**3-Aminothiophenol**	180-90[16]				N,S-*di* 97 *di*)						Hydrochloride, 232
4	**2-*n*-Butylaniline**	122 5[12]			0 953$^{20}_{4}$	100	116 7					Hydrochloride, 137
5	**2-(2-Aminophenyl)ethyl alcohol**	147 8[3 5]		1 5849[19]		103 5						Hydrochloride, 126
6	**6-Amino-3,4'-dimethylbiphenyl**	165 7[4]				104						Hydrochloride, 216-26
7	**2,2-Diphenylpropylamine**	179-82[22]			1 027[18]	106 7	82-3					Hydrochloride, 261
8	**2-Chloro-4-methoxyaniline** (3-Chloro-*p*-anisidine)	156[31]				114						Hydrochloride, 228
9	**2-Aminostyrene**	97 8[8]		1 6130[21]	1 015$^{21}_{21}$	129						Polymerizes readily
10	**2-Aminothiophene**	77 9[11]				161 2	172-3					Oxidizes rapidly, N-2-toluenesulfonyl deriv , 183 4
11	**4,4'-Diamino-2,3'-dimethylbiphenyl**	244[12]				N N'-*di* 253, *tetra* 191	N,N'-*di* 245					

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point, °C	Acetamide	Benzamide	Benzene sulfonamide	*p*-Toluene sulfonamide	Phenyl thiourea	Picrate	Miscellaneous
1	**Di-*n*-heptylamine**	1	271						117-20	
2	**4-Aminostyrene**	23 5	98[4]	142	160-1					D_{21}^{21} 1 012 $n_D^{21.5}$ 1 625
3	**3-Bromo-4-methylaniline** (2-Bromo-*p*-toluidine)	25-6	254-7	117-8	132					
4	**2-Amino-3-methylpyridine** (2-Amino-β-picoline)	26	224	64	220				229	
5	**2-Aminothiophenol**	26	234	135 (N,S-*di*)	154 (N,S-*di*)					
6	***n*-Dodecylamine**	27-8	247-9				73			Hydrochloride, 98, Chloroplatinate, 215
7	**DL-2,6-Dimethyl-1,2,3,4-tetrahydroquinoline**	31-2	267		103-5					Hydrochloride, 180 3
8	**5-Bromo-2-methylaniline** (4-Bromo-*o*-toluidine)	32	253 part d	165						
9	**1-Amino-2-methylnaphthalene** (2-Methyl-1-naphthylamine)	32		188	180					
10	**2-Bromoaniline**	32	250	99	116			146 161	129	
11	**4,4'-Dimethyldibenzylamine** (*p*-Dixylylamine)	32 5	220[30]						153	Nitrosamine, 52, Hydrochloride, 272
12	**2-Aminodibenzyl**	33	173-83[11]	117	166				167-8	Hydrochloride, 198
13	**3-Iodoaniline**	33 27	145 6[15]	119	157		128			
14	***unsym* -Diphenylhydrazine**	34	220[40-50]	184	192					
15	**α,α -Diamino-1,4-dimethylbenzene** (*p*-Xylylenediamine)	35		194 (*tetra*)	193 (N,N'-*di*)				232	
16	**3-Bromo-5-methylaniline** (5-Bromo-*m*-toluidine)	36	255 60	171 2						
17	**4-Amino-N-methylaniline**	36	258	63	165				206	
18	**Pentadecylamine**	36, 33	300	72						Hydrochloride, 199
19	**N-Benzylaniline**	37	298	58	107	119	148-9	103	48	
20	**3-Iodo-4-methylaniline** (2-Iodo-*p*-toluidine)	37-8		130						Oxalate, 103
21	**5-Aminoindane** (5-Hydrindamine)	37-8	247-9[745]	106	137					
22	**2-Amino-5,6,7,8-tetrahydronaphthalene** (5,6,7,8-Tetrahydro-2-naphthylamine)	38	275-7[713]	107	167				204	
23	**2-Amino-5-bromonaphthalene** (5-Bromo-2-napthylamine)	38	207 10[16]	165	109				216	N-Benzal, 63
24	**2,2-Diphenylethylamine**	38	180[33]	88	144 5				212 3	Phenylurethane 191 2, Hydrochloride, 256-7
25	**2,3-Dimethyl-1,2,3,4-tetrahydroquinoline**	38-9			92				178	
26	**2-Iodo-4-methylaniline** (3-Iodo-*p*-toluidine)	40		133	161					Oxalate, 120, Hydrochloride, 188
27	**2-Chloro-4,6-dimethylaniline** (5-Chloro-*m*-4-xylidine)	40		205-6	148					2-Naphthylthiourea 154
28	**2-Amino-6-methylpyridine** (6-Amino-α-picoline)	41	208-9	90	90				202	Hydrochloride, 155, Chloroplatinate, 218
29	**4-Amino-N,N-dimethylaniline**	41, 53	262	132-3	228				188	
30	**1,6-Diaminohexane** (Hexamethylenediamine)	42	204-5	125-7 (*di*)	155 (*di*)	154 (*di*)			220	
31	**1,3-Diaminoisopropyl alcohol**	42	235						230	Hydrochloride, 185, Chloroplatinate, 240
32	**4-Amino-3-methylbiphenyl**	43	190[15]	165, 158	189					N-Benzal, 108
33	**2,4'-Diaminobiphenyl**	45	363	202 (*di*)	278 (*di*)					
34	**4-Methylaniline** (*p*-Toluidine)	45	200	147	158	120	118	141	182	
35	**4-Aminothiophenol**	46	140-5[16]	154 (N-), 144 (132) (N,S-*di*)	180 (N-)					Oxidized readily → 4,4 - diaminodiphenyl sulfide, 104 5

*Derivative data given in order m.p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Acetamide	Benzamide	Benzene sulfonamide	*p*-Toluene sulfonamide	Phenyl thiourea	Picrate	Miscellaneous
36	**4-Aminobenzyl cyanide**	46		97 (*mono*) 152-3 (*di*)	176-7				185	N-Formyl, 135
37	**2-Aminopropiophenone**	47	93[0.8]	71	130					Oxime, 88-9, Semicarbazone, 190, N-Propionyl, 51
38	**3-Bromo-4-ethoxyaniline** (2-Bromo-*p*-phenetidine)	47	189[20]	114					178 9	
39	**4-Amino-2-thiocresol**	47		95 (N-), 125 (N,S-*di*)						S-Me , 47
40	**2-Iodo-5-methylaniline** (4-Iodo-*m*-toluidine	48, 38		151, 146						N-Formyl, 129
41	**1-Amino-4-fluoronaphthalene** (4 Fluoro-1 naphthylamine)	48	162[16]		197					Hydrochloride, 280
42	**4-Aminodibenzyl**	48			170 1					Hydrochloride, 210, Chloroplatinate, 286-9
43	**3,4-Dimethylaniline** (*o*-4-Xylidine, 4-Amino-*o*-xylene)	49	224	99		118				N-Formyl, 52, Hydrochloride, 256
44	**2-Ethoxy-6-nitroaniline**	49, yel		64						N-Me , 59
45	**Heptadecylamine**	49	335-40	62	91					
46	**2-Aminobiphenyl**	49	299	121	102					N-Formyl, 75, N-Propionyl, 65
47	**4-Amino-2-methyldiphenylamine**	49 50	196[4]	139 40						Hydrochloride, 185 7
48	**2-Bromo-4,6-dimethylaniline** (5-Bromo-*m*-4-xylidine)	49 50		196 7	186				122	
49	**2,5-Dichloroaniline**	50	251	132	120				86	Hydrochloride, 191 2
50	**1-Aminooxindole**	50		186-7	189					
51	**1-Aminonaphthalene** (α-naphthylamine)	50		159	160	167	157, 147	165	163 181	
52	**1-Amino-1,2,3-triazole**	51			151				130	Hydrochloride, 114
53	**2-Amino-1-methylnaphthalene** (1-Methyl-2-naphthylamine)	51		188 9	222					
54	**1-Amino-3-methylnaphthalene** (3 Methyl-1 naphthylamine)	51-2		175 6	188 9					
55	**1-Amino-4-methylnaphthalene** (4 Methyl-1-naphthylamine)	51-2	176[12]	166 7	238-9					Hydrochloride, 233-4
56	**4-Chloro-2-methoxyaniline** (5-Chloro-*o*-anisidine)	52, 46	260	150					200	N-Formyl, 177 8, Hydrochloride, 238
57	**Indole**	52	253	157 8	68	254				N-Nitroso, 171
58	**2-Aminodiphenylmethane**	52	190[22]	135	116					Hydrochloride, 137
59	**2,2'-Ditolylamine** (Di-*o*-tolylamine)	52 3	318		114-5					
60	**4-Aminobiphenyl**	53	302	171, 120 (*di*)	230		255 160			N-Formyl, 172
61	**1,4-Bis-(methylamino)benzene** (sym-Dimethyl-*p*-phenylenediamine)	53	150[17]						186	N,N'-Dinitroso, 148
62	**Diphenylamine**	53-4		101	180	124	141	152	182	
63	**DL-α-Aminobenzyl cyanide**	55			159 60				160-1	
64	**4-Methoxy-3-nitroaniline** (2-Nitro-*p*-anisidine)	57, or		153						N-Chloroacetyl, 150, N,N-Di-Me , 46, red
65	**5-Bromo-2-ethoxyaniline** (4-Bromo-*o*-phenetidine)	57 53		133					135 7	
66	**2-Amino-5-bromobiphenyl**	57		130	162					
67	**4-Methoxyaniline** (*p*-Anisidine)	58	240	130, 127	154, 157	95	114	157, 171		
68	**1-Amino-7-methylnaphthalene** (7-Methyl-1-naphthylamine)	58-9	162[10]	182-3	204					
69	**4-Bromo-2-methylaniline** (5-Bromo-*o*-toluidine)	59	240	156-7	115					

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point C	Boiling point C	Acetamide	Benzamide	Benzene sulfon amide	*p* Toluene sulfon amide	Phenyl thiourea	Picrate	Miscellaneous
70	**2-Amino-1 chloronaphthalene** (1 Chloro 2 naphthylamine)	59		147	98	131				N Formyl 136
71	**2 Aminoazobenzene**	59		126	122					
72	**1-Amino 2-chloronaphthalene** (2 Chloro 1 naphthylamine)	59 60		191 (*mono*) 88 (*di*)						
73	**5-Methylindole**	60	267						151	
74	**2-Aminopyridine**	60 58	204	71	165 (*di*)				216 7	
75	**3-(3 Indolyl)-propylamine**	60 4							146 9 156	Hydrochloride 170
76	**2-Methylindole**	61	271 2						139	1 3 5 Trinitrobenzene add comp 152 N Formyl 75
77	**2-Iodoaniline**	61 58		109	139				112	Hydrochloride 153 4
78	**1 Naphthyl phenyl amine** (N Phenyl 1 naphthylamine)	62	226[4]	115	157					
79	**3-Chloro-4 methoxyaniline** (2 Chloro *p* anisidine)	62		94					186	
80	**1-Amino-3 chloronaphthalene** (3 Chloro 1 naphthylamine)	62		197	162					Hydrochloride 219
81	**2-Amino-4,4 -dimethylbiphenyl**	62 3		118 9	95 6					
82	**8-Amino-6-methylquinoline**	62 4		91 2						1 3 5 Trinitrobenzene add comp 139
83	**2-Amino-1 bromonaphthalene** (1 Bromo 2 naphthylamine)	63		*mono* 140 *di* 105						N Propionyl 139 N Benzal 93 4 1 3 5 Trinitrobenzene add comp 192
84	**1,3-Diaminobenzene** (*m* Phenylene diamine)	63	282 4	191 (*di*) 87 9 (*mono*)	240 (*di*) 125 (*mono*)	194	172		184	
85	**2,4-Dichloroaniline**	63	245	145	117	128	126		106	
86	**2-Amino 5 methylnaphthalene** (5 Methyl 2 naphthylamine)	63 4		123 4	155 6					
87	**3-Bromo-4-methoxyaniline** (2 Bromo *p* anisidine)	64		111						Hydrochloride 255
88	**2,5-Diaminotoluene**	64	273 4	220 (*di*)	307	2 *mono* 147	2 *mono* 150			
89	**3-Aminopyridine**	64	250 2	*mono* 133 *di* 88	119					
90	**9-Aminofluorene**	64		262	260 1					Hydrochloride 255
91	**4-Methylphenylhydrazine** (*p* Tolylhydrazine)	65	240 4d	121	1 N *mono* 68 70 2 N *mono* 146					
92	**4-Aminobenzyl alcohol**	65		188 (O N *di*)	4 *mono* 150					Hydrochloride 217
93	**2-Bromo-6-methoxyaniline** (3 Bromo *o* anisidine)	65			90					Hydrochloride 225
94	**1,3-Diamino-2,6-dimethylbenzene** (2 4 Diamino *m* xylene)	65 6		>260 (*di*)	232 (227) (*di*)					N N Diformyl 220
95	**Aminoacetamide** (Glycineamide)	65 7								Hydrochloride 186 9 Chloroaurate 197 8 Hot $H_2O \rightarrow$ glycine + NH_3
96	**2-Aminocyclohexanol**	66	219							Hydrochloride 175 N Phenyl 150
97	**2-Amino-5-methylbenzophenone**	66 yel		159	118				145	
98	**4-Bromoaniline**	66	245	168	204	134		148	180	
99	**1,8-Diaminonaphthalene**	66		311 2 (*di*)			207 (*di*)			

*Derivative data given in order m p crystal color solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Acetamide	Benzamide	Benzene sulfonamide	*p* Toluene sulfonamide	Phenyl thiourea	Picrate	Miscellaneous
100	**3-Amino-5-bromopyridine**	66–7	150[12]	76–8 (hyd) 127 (anh)					212–3	Chloroaurate, 185 7
101	**1-Amino-8-methylnaphthalene** (8-Methyl-1-naphthylamine)	67 8		183–4	195–6					
102	**4-Iodoaniline**	67–8		184	222			153		N 4-Nitrobenzoyl, 269 N-Benzal, 86
103	**1-Amino-2,4,5-trimethylbenzene** (Pseudocumidin)	68		162	167	136				
104	**2,2′-Diaminodibenzyl**	68		249 (*dl*)	255 (*dl*)				225 30	
105	**2-Amino-4-methylnaphthalene** (4-Methyl-2-naphthylamine)	68		172 3	194–5					
106	**3-Nitro-N-methylaniline**	68		95	105	83				
107	**1-Amino-3-bromonaphthalene** (3-Bromo-1-naphthylamine)	70		174	166					Hydrochloride, 247
108	**1-Amino-5-methyl-1,2,3-triazole**	70			158, 138 (*dl*)					N-Benzal, 67 8, Hydrochloride, 138
109	**8-Aminoquinoline**	70, 65, yel		103	98		154–6			Hydrochloride, 208 9
110	**2-Nitroaniline**	71, golden-yel		92, 94	98, 110	104	142		73	
111	**3,4-Diaminotriphenylmethane**	71 2		226 (*dl*)	243 (*dl*)					
112	**4-Chloroaniline**	72		179, 172	192	122	95, 119	152		
113	**8-Amino-6-Chloroquinoline**	73								Hydrochloride 208 Chloroplatinate, 212, Methiodide, 178
114	**4-Aminophenylurethane** (N-carbethoxy-1,4-diaminobenzene)	73–4		202, 181	230					Hydrochloride, 242
115	**4-Aminodiphenylamine**	75 (anh)		158	203					
116	**3,5-Dimethylindole**	75	278						180	
117	**Duridine** (3-Amino-1,2,4,5-tetramethylbenzene)	75	261	207						Hydrochloride, 260
118	**1-Amino-3,4,5-trimethylbenzene**	75	240	163 4						N-Formyl, 98
119	**2-Amino-1,4-dimethylnaphthalene** (1,4-Dimethyl-2-naphthylamine)	75	333	219–20						
120	**4-Nitromesidine** (2-Amino-4-nitromesitylene)	75		191	169	163				
121	**2-Methoxy-6-nitroaniline** (3-Nitro-*o*-anisidine)	76, yel		158–9						N-Me , 58, red
122	**2-Bromo-1,4-diaminobenzene** (2-Bromo-*p*-phenylenediamine)	76		200(*dl*)	235(*dl*)					
123	**4,6-Dimethyl-2-nitroaniline** (5-Nitro-*m*-4-xylidine)	76, 70		176, 173	185					
124	**1-Amino-5-methylnaphthalene** (5-Methyl-1-naphthylamine)	77–8		194–5	173–4				210 d	
125	**2,4,6-Trichloroaniline**	78	263	204, 206	174	152–4			83	
126	**4-Methyl-3-nitroaniline** (2-Nitro-*p*-toluidine)	78		148	172	160	164	171		
127	**2,4-Dibromoaniline**	79		146	134		134		124	
128	**1-Naphthyl 4-tolyl amine**	79		124	140					
129	**2-Aminodiphenylamine**	79–80		121 (2-N-)	136 (2-N-)					
130	**2,4-Diaminophenol** (4-Hydroxy-*m*-phenylenediamine)	79–80		220–2 (2,4-N-) 180–2 (*tri*)	253 (*dl*)				120	
131	**4-Aminopyrazole**	80–2			173 (*dl*)				193–4	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Acetamide	Benzamide	Benzene sulfon amide	*p*-Toluene sulfon-amide	Phenyl thiourea	Picrate	Miscellaneous
132	**4-Bromo-3-methylaniline** (6-Bromo-*m*-toluidine)	81	240	103-4						N,N-Di-Me , 55
133	**2,2'-Diaminodibenzyl sulfide**	81		209 (*di*)					203 4	N,N'-Diformyl, 163
134	**2,2'-Diaminobiphenyl**	81	162[4]	*mono* 89, *di* 161	159 (2-N-) 190 (*di*)					N,N'-Diformyl, 137
135	**3-Aminoacenaphthene**	81		192 3, al	209, al				221	N-Formyl, 151, Alc, $FeCl_3$ → bl -vlt col
136	**2-Aminobenzyl alcohol**	82	270 80 part d	N-*mono* 114	O- 198-9				110	Hydrochloride, 108
137	**1-Amino-1,3,4-triazole**	82 3							194-5	Hydrochloride, 153, N-Formyl, 117, Chloroplatinate, 230
138	**4-Chloro-3-methylaniline** (6 Chloro-*m*-toluidine)	83		91	119					2-Naphthylthiourea, 158
139	**2,6-Dibromoaniline**	83-4	262-4	210					123-4	
140	**5-Chloro-2-methoxyaniline** (4-Chloro-*o*-anisidine)	84		104	77 8				194	
141	**4-Aminotriphenylmethane**	84, bz	248[12]	168	198					N,N-Di-Me , 132
142	**1-Amino-3-iodonaphthalene** (3-Iodo-1-naphthylamine)	84		207	174					
143	**4-Aminobutyrophenone**	84		142						Hydrochloride, 178
144	**4,4'-Diaminodiphenyl disulfide**	85, yel , 106		205 (*di*)						N,N'-Dicarbethoxy, 136-7
145	**7-Methylindole**	85	266		84				176	
146	**2-Amino-4-bromobenzaldehyde**	85								Oxime, 194, Phenylhydrazone, 215
147	**2,2'-Diaminodiphenyl sulfide**	85 6		160 (*di*)	162 3 (*di*)					
148	**4-Aminoveratrol** (3,4-Dimethoxyaniline)	85 6	174 6	133	177					Chloroplatinate, 227
149	**2-Aminophenanthrene**	85, pa yel		225	216					
150	**4-Aminobenzonitrile**	86		205	170				150	N-Formyl, 188-9, N-Propionyl, 169
151	**4-Iodo-2-methylaniline** (5-Iodo-*o*-toluidine)	87 92		170, 162	184				189	N-Benzal, 55, Phenylurethane, 232
152	**4-Aminoacenaphthene**	87		175 6	196				190-200	
153	**3-Aminoacetanilide**	87 9		191			241			
154	**3-Aminophenanthrene**	87 5		200-1	213					
155	**4-Amino-3-methyl-1-phenylpyrazole**	88	312	94 5 (hyd), 120(anh)	181				138	N-Formyl, 112 (anh), 81 (hyd), Chloroplatinate, 226
156	**2-Hydroxy-3-methylaniline** (3-Amino-*o*-cresol)	89		N-*mono* 78-9						N-Acetyl of Me eth , 100
157	**3,4-Diaminotoluene**	89 90	265	210 (*di*), 95 (3-N), 131 (4-N)	263-4 (*di*)	178-9 (*di*)	4-*mono* 140			
158	**2-Nitrophenylhydrazine**	90, red		140 1, *di* 57 8	166					N-Formyl, 177
159	**2,2'-Diaminodibenzyl disulfide**	90-1		202-5 (*di*)						N,N'-Dipropionyl, 190-1
160	**4-Chloro-1,3-diaminobenzene**	91		242 (*di*)	178 (*di*)		215			
161	**1-Amino-2,6-dimethylnaphthalene** (2,6-Dimethyl-1-naphthylamine)	91		211	219-20					
162	**1-Amino-4-mercaptonaphthalene** (4-Amino-1-thionaphthol)	91 3		N-*mono* 173						S-Me , 54
163	**2-Methyl-3-nitroaniline** (6-Nitro-*o*-toluidine)	92 97		158	168					
164	**2-Methyl-6-nitroaniline** (3-Nitro-*o*-toluidine)	92	305d	158	167					1-Naphthylthiourea, 171

*Derivative data given in order m p , crystal color, solvent from which crystallized

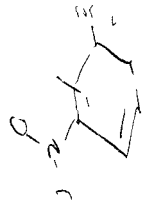


TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Acetamide	Benzamide	Benzene sulfon amide	*p*-Toluene sulfon amide	Phenyl thiourea	Picrate	Miscellaneous
165	**3-Bromo-2-hydroxy-5-methylaniline** (3-Amino-5-bromo-*p*-cresol)	93		N-*mono* 129 *di* 169	N-*mono* 185 *di* 166	N-*mono* 157 *di* 230				
166	**4-Chloro-2,6-dibromoaniline**	93		226	194					
167	**2,2′-Diaminodiphenyl disulfide**	93		156 (*di*)					141 (*di*)	
168	**1,18-Diaminooctadecane**	93			150 (*di*)					Hydrochloride >225
169	**4,4 -Diaminodiphenylmethane**	93	232[9]	236 (*di*) (228)						N,N -Dibenzal, 130
170	**3-Nitrophenylhydrazine**	93, yel		145 150 (*di*)	151 153 (*di*)					
171	**7-Aminoquinoline**	93 4 (anh), 73 (hyd)		167	189					Chloroplatinate, 225
172	**2-Aminodibenzfuran**	94		178 83 (*di*)	201					
173	**3-Aminoquinoline**	94 84		172 167					210	
174	**7-Amino-2,4-dimethylquinoline**	94 100	>300	212					215 7	
175	**Skatole** (3 Methylindole)	95	267	68					170 1	Hydrochloride, 167 8, N-Propionyl, 45
176	**2-Chloro-4,6-dibromoaniline**	95		227	192					
177	**4-Hydroxybenzylamine**	95								Hydrochloride, 195, N-Acetyl of Me ether, 96
178	**1-Amino-4,5-dimethyl-1,2,3-triazole**	95							124 5	Hydrochloride 131, Chloroplatinate, 215
179	**1-Amino-8-hydroxynaphthalene** (8 Hydroxy-1-naphthylamine 8 Amino-1-naphthol)	95–7		N-*mono* 181 N O *di* 118	N-*mono* 193, N,O-*di* 206		N *mono* 189		163 4	N-Formyl, 140 50
180	**5-Amino-2-methylpyridine** (5 Amino-α-picoline)	96		126	111				201	Dihydrochloride, 215 8
181	**4,4′-Diamino-3,3′-dimethyldiphenyl sulfide**	96		*di* 220	*di* 233				186 (*di*)	Dihydrochloride, 248–9
182	**6,6′-Diamino-3,3′-dimethyldiphenylmethane**	96		226 (*di*) 152 (*tetra*)					199	Dihydrochloride, 248 9
183	**N-Ethyl-4-nitroaniline**	96		119	98		107			
184	**2,4-Di-iodoaniline**	96		141 171	181					
185	**1-Amino-8-nitronaphthalene** (8-Nitro-1-naphthylamine)	97, red		191		194				
186	**3-Aminobenzyl alcohol**	97		N *mono* 106–7	N-*mono* 115 N,O-*di* 113 4					
187	**5-Bromo-2-methoxyaniline** (4-Bromo-*o*-anisidine)	97–8		160	108					
188	**2-Amino-4-methylpyridine** (2-Amino-γ-picoline)	98		102–3	114, 182 3 (*di*)				227	
189	**2-Aminophenacyl alcohol**	98		N-*mono* 141	N,O-*di* 167					Phenylhydrazone, 198
190	**1-Amino-4-chloronaphthalene** (4-Chloro-1-naphthylamine)	98		186						
191	**1,2-Diaminonaphthalene**	98		234 (*di*)	291 (*di*)	1-*mono* 215				
192	**4-Amino-4′-methylbiphenyl**	99	190[18]	221						Hydrochloride, 280 3
193	**3-Aminoacetophenone**	99		128–9			130			Semicarbazone, 196
194	**2,4-Diaminotoluene**	99		N,N′-*di* 224	224 (*di*)	2-*mono* 138, 2,4-*di* 192	4-*mono* 160, 2,4-*di* 192–3			

*Derivative data given in order, m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Acetamide	Benzamide	Benzene sulfon amide	*p*-Toluene sulfon-amide	Phenyl thiourea	Picrate	Miscellaneous
195	**4-Amino-3,2′-dimethylazobenzene**	100, yel		185 (*mono*), 65 (75) (*di*), lgr						N-Chloroacetyl, 171-2
196	**1,2-Diaminobenzene** (*o*-Phenylene-diamine)	102	256-8	185 (*di*)	301 (*di*)	185	260 (*di*)		208	
197	**1-Amino-4-bromonaphthalene** (4-Bromo-1-naphthylamine)	102, 95		193						N-Formyl, 172, 1,3,5-Trinitrobenzene add comp, 196
198	**2-Naphthyl 4-tolyl amine**	103		85	139					
199	**3,4-Diaminobiphenyl**	103		3-*mono* 211 4-*mono* 155, 3,4-*di* 163	3-*mono* 186, 4-*mono* 221, 3,4-*di* 248					
200	**6,6′-Diamino-3,3′-dimethyl-diphenyl sulfide**	103-4		165 (*di*)	185 (*di*)				179 (*di*)	
201	**2-Amino-8-nitronaphthalene** (8-Nitro-2-naphthylamine)	104, red		196	162					
202	**Piperazine**	104	140	*mono* 52, *di* 144	*mono* 75, *di* 196	282 (*di*)	173		280	
203	**4,4′-Diaminodibenzyl sulfide**	104-5		188 (*di*)	224 (*di*)					
204	**3-Amino-4,4′-dimethylbiphenyl**	104-5		156-7	160 1					Hydrochloride, abt 230
205	**1,3-Diamino-4,6-dimethylbenzene** (4,6-Diamino-*m*-xylene)	105		1-*mono* 165, *di* 295	258 9 (*di*)		221 (*di*)			N,N -Diformyl 182 3
206	**2-Bromo-4-nitroaniline**	105, yel		129	160					N-Me, 118
207	**Triphenylmethylamine**	105		207-8	160-2					N-Benzyl, 110
208	**4-Aminophenanthrene**	105		190	224				216	
209	**2-Aminobenzophenone**	105-6, pa yel		72, 89	80					Oxime (alkali-stable), 156, (acid stable), 127; N Propionyl, 78
210	**3-Amino-6-phenylpyridine**	105-6		148-9	201					
211	**3-Amino-4-methylpyridine** (3-Amino-γ-picoline)	106	260	84	81				179 80	Chloroplatinate, 227, Hydrochloride, 180
212	**4-Bromophenylhydrazine**	106								Acetophenone deriv, 112
213	**4-Aminoacetophenone**	106	294	167	205	128	203			Semicarbazone, 250, Oxime, 148
214	**2,4-Diaminopyridine**	107			191-2 (*di*)					Chloroplatinate, 224
215	**9-Phenanthrylmethylamine**	107		182-5	167				241	N-Benzal, 104
216	**2-Methyl-5-nitroaniline** (4-Nitro-*o*-toluidine)	107		151		172				N-Formyl, 178 9, N-4-Nitrobenzoyl, 214
217	**2,5-Diaminopyridine**	107-10		290 (*di*)	230 (*di*)					
218	**2-Naphthyl phenyl amine**	108		93	148, 136					
219	**2-(4-Aminophenyl) ethyl alcohol**	108		105	O-*mono* 59-60, N,O-*di* 136	93				Hydrochloride, 171
220	**5-Aminoacenaphthene**	108		238 (*mono*), 122 (*di*)	210, 199				190 200	N-Formyl, 172, $FeCl_3$ → bl col
221	**4,4′-Diamino-2,2′-dimethylbiphenyl** (*m*-Tolidine)	108 9		281 (275) (*di*)					225	N,N′-Dibenzal, 172-3
222	**4-Aminoantipyrine** (4-Amino-2,3-dimethyl-1-phenylpyrazolone-5)	109, yel		199					144	
223	**3-Amino-4-methylbenzophenone**	109		108						Hydrobromide, 130, dil HBr
224	**2-Aminobenzamide**	109-11		177	214-5					
225	**1,4-Diamino-2-iodobenzene** (2-Iodo-*p*-phenylenediamine)	110 5		211	254					

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Acetamide	Benzamide	Benzene sulfon amide	*p* Toluene sulfon amide	Phenyl thiourea	Picrate	Miscellaneous
226	**5-Aminoquinoline**	110	310	178			203 4			
227	**4-Amino-2-nitrostilbene**	110 1, dk red		192 3						Hydrochloride, 223
228	**3-Aminocamphor**	110 5		121	141				191	Oxime, 145, N-Formyl, 87
229	**4-Bromo-2-nitroaniline**	111, or		104	137-8					N-Me , 102, N-Et , 91
230	**3'-Amino-4-methylbenzophenone**	111		139						Oxime, 146, Hydrochloride, 198
231	**4-Amino-3-methylbenzophenone**	112, pa yel		175	158					N-Propionyl, 128
232	**2-Aminonaphthalene** (β-Naphthylamine)	112		132	162	102	133	129	195	
233	**β-Aminopropiophenone** (1-Aminoethyl phenyl ketone)	112 4 (unst)		90-1	104-5				164 5	Hydrochloride, 187, Chloroplatinate, 205
234	**2-Hydroxybenzylaniline**	113		93						Hydrochloride, 131, Chloroplatinate, 184
235	**4-Ethoxy-2-nitroaniline** (3-Nitro *p*-phenetidine)	113, 108, red		104		72	94			
236	**5-Bromo-2-hydroxy-3-methylaniline**	113		N-*mono* 119 *di* 200	N-*mono* 195					
237	**3-Nitroaniline**	114		*mono* 155, *di* 76	155, 150 (*di*)	136	138	160	143	
238	**6-Aminoquinoline**	114 (anh)		*mono* 138 *di* 75	169		193			Methiodide, 199
239	*cis*-**2,5-Dimethylpiperazine**	114	162		152 (*di*)		146-7 (*di*)			N,N'-Dinitroso, 95
240	**3-Amino-2-phenylquinoline**	115 6	223[3]	*mono* 124 *di* 173	179 80				194 5	Methiodide, 238, Ethiodide, 202
241	**5-Amino-3-methyl-1-phenylpyrazole**	116	333	110					160 2	Hydrochloride, 199 200
242	**4-Aminotriphenylcarbinol**	116		176						N,N-Dimethyl, 92-3
243	**5-Bromo-2-hydroxy-4-methylaniline**	116		N-*mono* 199, *di* 188	N-*mono* 223					
244	**4-Chloro-2-nitroaniline**	116-7, yel		104			110			
245	**4-Methyl-2-nitroaniline** (3-Nitro-*p*-toluidine)	117		99	148	102	146			Hydrochloride, 170 1
246	**5-Amino-2-methylquinoline** (5-Aminoquinaldine)	117 8 (anh), grnsh		205						N-Cinnamoyl, 257
247	*trans*-**2,5-Dimethylpiperazine**	118	162		228 9 (*di*)		225 (*di*)			N,N'-Dinitroso, 174
248	**2,3,4,6-Tetrabromoaniline**	118		228-9						1,3,5-Trinitrobenzene add comp , 108
249	**2-Methoxy-5-nitroaniline** (4-Nitro-*o*-anisidine)	118, or -red		175 6	160-1		128			N-Me , 87
250	**4-Hydroxypyrazole**	118			109 (*di*)				129	
251	**2-Amino-5,4'-dimethylazobenzene**	118-9, or -red		157	135					N-Carbethoxy, 94
252	**1-Amino-5-nitronaphthalene** (5-Nitro-1-naphthylamine)	119, red		220		183				N-Formyl, 199
253	**5-Hydroxy-2,4,6-tribromoaniline**	119		O,N,N-*tri* 136			146 7			
254	**1,4-Diaminonaphthalene**	120		303 (*di*)	*mono* 186, *di* 280		*mono* 187 8			
255	**1,9-Diaminofluorene**	120		293 (*di*)	abt 310 (*di*)				205	
256	**2-(ω-Aminoethyl)-indole** (2-(2-Indolyl)-ethylamine)	120			173 4					N-Benzal, 122
257	**2,2'-Diamino-4,4'-dimethylbiphenyl**	120		189 (*di*)	170 (*di*)					N,N'-Diformyl, 185

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Acetamide	Benzamide	Benzene sulfonamide	*p*-Toluene sulfonamide	Phenyl thiourea	Picrate	Miscellaneous
258	**2,6-Diaminopyridine**	121		203 (*di*)	176 (*di*)				240	
259	***cis*-4,4′-Diaminostilbene**	121, pa yel		172 (*di*)	253 (*di*)					
260	**4-Aminobenzhydrol**	121			145					Hydrochloride, 270 3
261	**3-Amino-6-hydroxyacetophenone**	121 110 yel		N-*mono* 165 *di* 174						Oxime, 201 Et eth , 60
262	**2-Aminotriphenylcarbinol**	121		192					122 3	
263	**3-Hydroxyaniline** (3-Amino-phenol)	122		*mono* 148 *di* 101	N-*mono* 174 198 204		157	156		
264	**2,4,6-Tribromoaniline**	122 119		232						N-Formyl 222
265	**4-Amino-2-hydroxyacetophenone**	122 3		N-*mono* 91						N,N-Di Me 120
266	**1-Aminoisoquinoline**	122 3							290 1	Hydrochloride, 233 Chloroplatinate, >300
267	**3,4,5-Tribromoaniline**	123		255 6	210					
268	**4,4′-Diamino-2,2 -dimethyl-diphenylmethane**	123		228 (*di*)					216	
269	***cis*-2,2′-Diaminostilbene**	123, 107, red		214-5 (*di*)					155-6	Hydrochloride 230
270	**2,4-Dimethyl-5-nitroaniline**	123		159	200	149	192			
271	**2-Amino-4-nitrobenzaldehyde**	124								Oxime, 193 Semicarbazone, 390 Anil, 147, red
272	**4-Aminobenzophenone**	124		153	152					N-Propionyl 139
273	**7-Amino-8-hydroxyquinoline**	124, br		N-*mono* 177					205	
274	**2-Amino-5-nitrobiphenyl**	125, yel		133			169			
275	**3-Hydroxy-4-methoxyaniline** (4-Aminoguaiacol)	125 7		N-*mono* 116 9	N,O-*di* 162 4					
276	**2-Amino-1-nitronaphthalene** (1-Nitro-2-naphthylamine)	126, or - yel		123	168	156	160			
277	**4-Aminoazobenzene**	126		146	211					N-propionyl, 170
278	**Hydrazobenzene**	126 7		*mono* 159, *di* 105	*mono* 126, bz *di* 162					
279	**5-Chloro-2-nitroaniline**	126 5 gold-yel		121						N-Me , 107 N,N-Di-Me , 49
280	**Benzidine**	127		317 (*di*) 199 (*mono*)	352 (*di*) 203 5 (*mono*)	232 (*di*)	243 (*di*)			
281	**2-Aminopyrimidine**	127 8							237-8	Chloroplatinate, 216 Hydrochloride, 196
282	**2-Amino-6-bromonaphthalene** (6 Bromo-2-naphthylamine)	128		192	218					
283	**5-Bromo-2-hydroxyaniline** (2-Amino-4-bromophenol)	128, 88		177 9						Me eth , 97 8
284	**5-Aminoisoquinoline**	128							>200	Methiodide, 228 Ethiodide, 216
285	**2-Aminovanillin** (2-Amino-4-hydroxy-3-methoxybenzaldehyde)	128 9		97						Oxime, 151 2, Phenylhydrazone, 165
286	**2-Amino-3,7-dimethylnaphthalene** (3 7-Dimethyl-2-naphthylamine)	129, 134		231						Hydrochloride, 275
287	**4-Methoxy-2-nitroaniline** (3-Nitro-*p*-anisidine)	129, 123, dk red		117, yel	140					N-4-Nitrobenzoyl, 204
288	**2-Aminotriphenylmethane**	129		154 5						N-Me , 130-2

*Derivative data given in order m p crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Acetamide	Benzamide	Benzene sulfon amide	*p* Toluene sulfon amide	Phenyl thiourea	Picrate	Miscellaneous
289	**2-Aminoquinoline**	129							255-6	Methiodide, 247, Ethiodide, 232, 1,3,5-Trinitrobenzene add comp , 186, red
290	**4,4'-Diamino-3,3'-dimethylbiphenyl** (*o*-Tolidine)	129		*mono* 103 (hyd), *di* 315 *tetra* 211	198 (*mono*), 265 (*di*)					N,N'-Diformyl, 254 1 Naphthylthiourea, 167, 3-Nitrophthalimide, 185
291	**2,4-Diaminodiphenylamine**	130		188 (*di*)	2-*mono* 213					
292	**3-Aminocoumarin**	130, yel		201 2	173					
293	**2-Methyl-4-nitroaniline** (5-Nitro-*o*-toluidine)	130		202		158	174			1-Naphthylthiourea 165
294	**2-Amino-4-chloropyridine**	130 1		115-6	*mono* 120; *di* 165				243	
295	**4-Hydroxy-3-nitroaniline**	131, 127, red		N-*mono* 157 8						N-Me , 113 Et eth , 40
296	**4-Bromo-3-nitroaniline**	131 2		146						N,N -Di-Me , 72
297	**2-Aminobenzothiazole**	132, 129		186	186				256	
298	**2-Amino-4-methylquinoline**	133	320						abt 250	N-Phenyl, 129, Chloroplatinate, 230
299	**2,2'-Diaminobenzophenone**	133, pa yel		168 (154) (*di*)					164	
300	**2,2'-Diaminoazobenzene**	134, red		271 (*di*)						
301	**3,5-Dimethyl-2-hydroxyaniline**	134-5		N-*mono* 96	154 (O,N-*di*)					N-Formyl, 68
302	**2-Hydroxy-5-methylaniline** (4-Hydroxy-*m*-toluidine)	135		N-*mono* 160, N,O-*di* 145	N-*mono* 191, N,O-*di* 190					N-Propionyl, 95 6, N,O-Dipropionyl, 91 2
303	**3-Methyl-4-nitroaniline** (6-Nitro-*m*-toluidine)	135		102						2-Naphthylthiourea, 159
304	**2-Amino-3-methylnaphthalene** (3-Methyl-2-naphthylamine)	135		181-2	190					
305	**2-Aminoacenaphthene**	135							260, yel , eth	Hydrochloride, 270
306	**DL-2,2'-Diamino-6,6'-dimethylbiphenyl**	136		205 (*di*)	182 (*di*)		162 3 (*di*)			
307	**1,4-Diamino-2-nitrobenzene** (2-Nitro-*p*-phenylenediamine)	137, blk		1-*mono* 162, 4-*mono* 189, *di* 186	4-*mono* 236					1,4-Di-4-nitrobenzoyl, >305
308	**9-Aminophenanthrene**	137 8, 104		207 8	199				190	
309	**4,4'-Diamino-3,3'-dimethoxybiphenyl** (Dianisidine)	137-8		242 (*di*)	236 (*di*)				225 (*di*)	
310	**3,5-Dimethyl-4-hydroxyaniline** (5-Amino-2-hydroxy-*m*-xylene)	137-8		160 (*di*)						Me eth , 66
311	**2,6-Dinitroaniline**	138		197						
312	**2-(4-Aminophenyl)-quinoline**	138		*mono* 189, *di* 154	234					Methiodide, 220, N-Me , 82, N-Formyl, 160
313	**2-Amino-3,6-dimethylnaphthalene** (3,6-Dimethyl-2-naphthylamine)	139		207						Hydrochloride, 283
314	**2-Methoxy-4-nitroaniline** (5-Nitro-*o*-anisidine)	139-40, pa yel		153-4	150	181	175, 170			
315	**4-Aminopropiophenone**	140		161	190					Oxime, 153
316	**4-Amino-3-nitrobenzophenone**	140, 135, yel			154 5					N,N-Di-Me , 116, N-Et , 100

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Acetamide	Benzamide	Benzene sulfon amide	*p*-Toluene sulfon amide	Phenyl thiourea	Picrate	Miscellaneous
317	**2-Amino-4-methyldiphenylamine**	140			161					Hydrochloride, 200
318	**1,4-Diaminobenzene** (*p*-Phenylenediamine)	140, 147	267	*mono* 162 3 *di* 304	*mono* 128 *di* 300	247 (*di*)	266 (*di*)			3,5 Dinitrobenzoate, 178
319	**2-Hydroxy-5-nitroaniline**	142 3 (anh) 80–90 (hyd), or		220	>200		122 (O-)			Me eth 118 Et eth , 99
320	**2-Amino-4-nitrostilbene**	142 3, red		N-*mono* 220 yel , al						Hydrochloride, 219
321	**5-Amino-8-hydroxyquinoline**	143		N-*mono* 221 2, al , N,O-*di* 206 7, al	205 (O, N-*di*)					Me eth , 156, yel
322	**1-Amino-2-nitronaphthalene** (2-Nitro-1-naphthylamine)	144, red-yel		199	175					N-Et , 77, red
323	**2-Amino-5-nitronaphthalene** (5-Nitro-2-naphthylamine)	144, red		186	182					
324	**5-Hydroxy-2-methylaniline** (4-Hydroxy-*o*-toluidine)	144		N-*mono* 178 N,O-*di* 128		183 (N-)				
325	**2,5-Dimethyl-4-nitroaniline** (5-Nitro-*p*-2-xylidine)	144–5		168–9		162	185			
326	**4-Amino-4′-bromobiphenyl**	145		247			174			
327	**1-Aminophenanthrene**	146		220					204	
328	**3,5-Dihydroxyaniline** (5-Aminoresorcinol)	146–52		119 21 (*tri*)						Di Me eth , 46 Picrate of Di-Me eth , 167–70
329	**4-Amino-2-chlorobenzaldehyde**	147, yel		152						N,N′-Di-Me , 82, N-Et , 101
330	**4-Nitroaniline**	147 8, yel		215	199, 203 (*di*)	139	191		100	1-Naphthylthiourea, 187
331	**5-Amino-3-methyl-1,2,4-triazole**	148		>270	285 90				225	
332	**2,2′-Dihydroxyhydrazobenzene**	148			186 (*di*)					Di-Me eth , 102
333	**7-Amino-2-methylquinoline**	148 (anh)			172 3				213–4	
334	**4,4′-Diamino-2,2′-dimethyl azoxybenzene**	148, gold-yel		281 (*di*)	290					
335	**4-Bromo-3-hydroxyaniline**	150		210–2			135–6 (O-)			
336	**3-Amino-1-phenyl-1,2,4-triazole**	150		3-*mono* 168, 3,3-*di* 118					220	Hydrochloride, 187
337	**4-Aminochalcone** (4-Aminobenzalacetophenone)	151, golden		179						Oxime, 139
338	**4-Aminopyrimidine**	151–2		202					226	N-Me , 74–5, N-Phenyl, 142–3
339	**Pentamethylaniline**	151–2	277–8	213						N-Formyl, 217, N-Me , 60, N,N-Di-Me , 53–4
340	**N-Methyl-4-nitroaniline**	152		153	112	121				
341	**5-Bromo-2-nitroaniline**	152, red-yel		139						N-Me , 115, N-Et , 90
342	**3-Chloro-4-hydroxyaniline**	153		N-*mono* 144, *di* 124			116–7 (O-)			Me eth , 62

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Acetamide	Benzamide	Benzene sulfon amide	*p* Toluene sulfon-amide	Phenyl thiourea	Picrate	Miscellaneous
343	**4-Chloro-2-hydroxyaniline**	154		140 (*di*)						Hydrochloride, 226 7, Benzyl eth , 46 7 Me eth , 52
344	**4-Aminoquinoline** (γ-Amino-quinoline)	154 (anh)		178					274	Methiodide, 224, Ethio-dide, 232
345	**3-Aminobenzopyrazole**	154		177 8 (*di*)	182 (*di*)					
346	**2,5-Dihydroxy-4-nitroaniline** (2-Amino-5 nitrohydroquinone)	154, red		*mono* 226 *di* 183 4						Di Me eth , 158
347	**4-Hydroxy-2-nitroaniline**	154, red		N-*mono* 218 N O-*di* 146						Me eth , 129 123
348	**3-Aminotriphenylcarbinol**	155		164						O,N,N-Trimethyl, 81
349	**L-2,2'-Diamino-6,6-dimethyl-biphenyl**	156		205 (*di*)	172 (*di*)					
350	**3,3'-Diaminoazobenzene**	156 140, or -yel		272 (*di*)	286 (*di*)					
351	**5-Amino-1-phenyl-1,2,4-triazole**	157							175	Chloroplatinate, 197
352	**4-Nitrophenylhydrazine**	157, or -red		205	193				119 20	
353	**4-Aminopyridine** (γ-Amino pyridine)	158		150 (anh)	202				215 6	
354	**4,4'-Diamino-3,3'-dimethyl-diphenylmethane**	158 9		224 (*di*) 119 (*tetra*)	215 (*di*)				192-3	
355	**2-Amino-8-nitroquinoline**	159		211	166				257	
356	**3-Amino-1,2,4-triazole**	159							231	Hydrochloride, 153
357	**2-Amino-4'-nitrobiphenyl**	159, or -red		199			163			
358	**3-Amino-2-methylquinoline**	159 60	270	165	161				235	N-Formyl, 163
359	**1-Amino-4-hydroxy-3-nitro-naphthalene** (4-Hydroxy-3-nitro-1-naphthylamine)	160, ma-roon		250, 238	330					
360	**2,4-Dihydroxy-5-nitroaniline**	160-1, red		N-*mono* 261 *tri* 176						Di-Me eth , 136 7
361	**1,3-Diamino-4-nitrobenzene** (4-Nitro-*m*-phenylenediamine)	161 157, yel red		1-*mono* 200 1,3-*di* 246	222 (*di*)		169 (*di*)			N,N,N',N'-Tetramethyl, 81
362	**3-Hydroxy-4-methylaniline** (2-Hydroxy-*p*-toluidine)	161		N-*mono* 225 *di* 132 3			111-2 (O-)			N-Chloroacetyl, 154 5
363	**2-Hydroxy-4-methylaniline** (3-Hydroxy-*p*-toluidine)	162		N-*mono* 171	N-*mono* 169, N,O-*di* 162					
364	**4-Aminoacetanilide**	162		304						
365	**3-Hydroxy-4-nitroaniline**	162, 158, or -yel		N-*mono* 221, N,O-*di* 149						Me eth , 169, 161
366	**2,4-Dimethyl-6-hydroxyaniline**	163		*mono* 186 7, *di* 87 8	N-*mono* 211, N,O-*di* 148 9					Me eth , 150
367	**2-Aminofluorenone**	163, vlt -red		227						Hydrazone, 209, N-Carbethoxy, 167 8
368	**1-(2-Aminoethyl)-4-hydroxybenzene** (4-(2-Aminoethyl)phenol, Tyramine)	164			N-*mono* 162, *di* 172				206	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Acetamide	Benzamide	Benzene sulfonamide	*p*-Toluene sulfonamide	Phenyl thiourea	Picrate	Miscellaneous
369	**4-Aminophenacyl alcohol**	165, yel		N-*mono* 176 7, O-*mono* 130 N,O-*di* 162	188 (O-)					Phenylhydrazone, 199
370	**3-Bromo-4-hydroxyaniline**	165 155, pa br		N-*mono* 157	N-*mono* 184 5, *di* 192					
371	**2,7-Diaminonaphthalene**	166		261 (*di*)	267 (*di*)				210 (*di*)	
372	**4-Amino-4′-iodobiphenyl**	166-7, 159 yel								N-Benzal, 209, N-Piperonylidine, 150 1, Hydrochloride, 295
373	**4-Amino-3-nitrobiphenyl**	167, red		132	143					N-Me , 112
374	**1,2-Diamino-4-hydroxybenzene** (3,4-Diaminophenol)	167-8		1,2-*di* 205 7	1,2-*di* 203 *tri* 225					
375	**4,4′-Diaminotriphenylcarbinol**	168 s h , 175 r h		4,4′-*di* 267						Me eth , 162
376	**4-Amino-2-phenylquinoline**	168		108, 117 (*di*)	182					Methiodide, 274, Ethiodide, 244, N-Formyl, 275
377	**2,6-Dinitro-4-methylaniline**	168, 172		195	186					
378	**4-Amino-2-methylquinoline**	168	333						197 9	N-Phenyl, 150, Chloroplatinate, 223
379	**6-Aminocoumarin**	168-70, yel		216-7	173	159				N-Formyl, 175-6
380	**Picramic acid** (3,5-Dinitro-2-hydroxyaniline)	169, red		N-*mono* 201, O- 193	N-*mono* 300 O- 218		191			
381	**3,3 -Diaminobenzophenone**	173, yel		226-7 (*di*)						Oxime, 177-8
382	**4,5-Dimethyl-2-hydroxyaniline**	173 5		N-*mono* 191, N,O-*di* 157	N-*mono* 195 6, N,O-*di* 152 3					
383	**2-Hydroxyaniline**	174		*mono* 209 201, *di* 124	N-*mono* 165 O- 185	141	146			
384	**4-Hydroxy-3-methylaniline**	175		N-*mono* 179	N,O-*di* 194		109-10 (O-)			
385	**6-Amino-5,7-dimethylquinoline**	175	>300	212					182	
386	**4,4′-Diaminodiphenyl sulfone**	175-6		286 (*di*)						N,N′-Di-Me , 179-80, N,N-Tetramethyl, 260
387	***trans*-2,2′-Diaminostilbene**	176, 168, gold-yel		304 (*di*)					209	Hydrochloride, 267
388	**6-Amino-5-nitroquinoline**	178, 174, yel					168		270	
389	**6-Aminothymol**	178 9		N-*mono* 74, *tri* 91	N-*mono* 178-9, N,O-*di* 166 7					Oxid → thymoquinone, 45 5
390	**4-Hydroxy-2-methylaniline** (5-Hydroxy-*o*-toluidine)	179		N-*mono* 130	92 (O-)					Hydrochloride, 215
391	**2,4-Dinitroaniline**	180, 188		120	202, 220		219			
392	**1-Amino-4-chloroanthraquinone**	180, red		203-4						N,N-Di-Me , 172
393	**2,6-Dimethyl-4-hydroxyaniline**	181		178-80						N-Benzal, 104-5, N-Me , 43, N-Et , 161-2
394	**4-Amino-2,6-dimethylpyrimidine**	183							214	N-Phenyl, 104
395	**4-Aminobenzamide**	183, yel		275						N-Chloroacetyl, 241 3

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Acetamide	Benzamide	Benzene sulfonamide	*p*-Toluene sulfonamide	Phenyl thiourea	Picrate	Miscellaneous
396	**4-Hydroxyaniline** (4-Aminophenol)	184, 186		150 (*dl*), 168 (*mono*)	N-*mono* 216-7, N,O-*di* 234	125	N-*mono* 252-4, O- 142	150		3,5-Dinitrobenzoate, 178
397	**1-Amino-3-hydroxynaphthalene** (3-Hydroxy-1-naphthylamine)	185		N-*mono* 179	309 (O,N-*di*)		137 (O-)			
398	**5-Hydroxy-2-nitroaniline**	185 6, or		N-*mono* 266						Me eth , 131, br , Et eth , 105, yel
399	**6,6'-Diamino-3,3'-dimethyl triphenylmethane**	185-6	430, part d	217 (*dl*)	196 (*dl*)					
400	**4-Amino-2,6-dimethylpyridine**	186	246	113					194 5	Chloroplatinate, 250
401	**4-Amino-4'-hydroxyazobenzene**	186		N-*mono* 203 *dl* 236 7						N,N-Di-Me , 203
402	**4-Amino-4'-methylbenzophenone**	186 7		155						Phenylhydrazone, 163
403	**6-Amino-2-methylquinoline**	187-8		168 9						N-Cinnamoyl, 257
404	**4-Amino-2,6-diethyl-5-methylpyrimidine** (Cyanethine)	189	280 d	59						
405	**2,4,6-Trinitroaniline** (Picramide)	190		230	196	211				
406	**1-Amino-6-hydroxynaphthalene** (6-Hydroxy-1-naphthylamine)	190 185		N-*mono* 218, N,O-*di* 187	N-*mono* 152 N,O-*di* 223				170	
407	**4,4'-Diaminoazoxybenzene**	190, yel		275						Sn + HCl → 1,4-Diaminobenzene, 147
408	**4-Amino-3-nitrobenzaldehyde**	191, yel		155						Phenylhydrazone, 202, Oxime, 207 4-Nitrophenylhydrazone, 270-2
409	**2-Amino-1,5-dinitronaphthalene** (1,5-Dinitro-2 naphthylamine)	191		201			182			
410	**DL-2,2'-Diamino-1,1'-dinaphthyl**	193		235 6 (*dl*)	235 (*dl*)				185	
411	**8-Amino-6-nitroquinoline**	194, red		224						Chloroplatinate, 180, Methiodide, 176
412	**1-Amino-4-nitronaphthalene** (4-Nitro-1-naphthylamine)	195		190	224	173, 158	185			
413	**2-Amino-4,6-dimethylpyrimidine**	197							230	Hydrochloride, 181, Chloroplatinate, 225, N-Me , 98
414	**4,6-Diamino-2-methylquinoline**	197		6-*mono* 250						6-N-Cinnamoyl, 253-4, 4-N-Et , 195, 6-N-Et , 232
415	**1,2-Diamino-4-nitrobenzene** (4-Nitro-*o*-phenylenediamine)	198, red		1 *mono* 205 2 *mono* 195	235 (*dl*)					N,N'-Di-Me , 172
416	**2,4-Dinitrophenylhydrazine**	199 200		197 8	206-7					
417	**2-Hydroxy-5-methyl-4-nitroaniline**	200, yel		N-*mono* 242						Me eth , 132, N-Acetyl of Me eth , 156
418	**4-Amino-3-nitropyridine**	200, yel							197 8	Hydrochloride, 258-9, Chloroplatinate, 256
419	**4-Amino-4'-nitrobiphenyl**	200, red		264, 240, yel		174, yel				
420	**2-Amino-5-nitrobenzaldehyde**	200, yel		160-1			181-2			Oxime, 203 N,N-Di-Me 105, yel
421	**2-Amino-7-hydroxynaphthalene** (7-Hydroxy-2-naphthylamine)	201		N-*mono* 232, N,O-*di* 156	N-*mono* 243 6, N,O-*di* 181					
422	**2-Amino-1-bromo-3-methylanthraquinone**	202, 204			*dl* 243 4, pa yel , al					

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Acetamide	Benzamide	Benzene sulfon amide	*p*-Toluene sulfon amide	Phenyl thiourea	Picrate	Miscellaneous
423	**4,4'-Diamino-1,1'-dinaphthyl**	202		363 (*di*)	320 (*di*)				147	
424	**4,4',4''-Triaminotriphenylmethane**	203		201 (*tri*)						1,3,5-Trinitrobenzene add comp , 140, blk
425	**Isatin**	204		141						Oxime, 201 2
426	**3-Amino-5-phenylacridine**	204		256	246					
427	**2-Amino-1,4-naphthoquinone**	204 5, or -red		202						N-Phenyl, 191
428	**1-Amino-2-methylanthraquinone**	205, red		*mono* 176 7, *di* 203-6			218			
429	**4,4',4''-Triaminotriphenylcarbinol** (Pararosaniline)	205		192 (*tri*)						Me eth , 135
430	**1-Amino-7-hydroxynaphthalene** (7-Hydroxy-1-naphthylamine)	205 7		N-*mono* 165	N-*mono* 208-9, N,O-*di* 208					
431	**4,6-Diaminoisophthaladehyde**	208		270 (*mono*), 280 (*di*)						Dioxime, 220, Diphenylhydrazone, 337
432	**N-4-Hydroxybenzylaniline**	208								Me eth , 65, Et eth , 65
433	**6-Aminobenzopyrazole**	210		248 (6-N-), 184-5 (*di*)						Dihydrochloride, 230
434	**4,4'-Diamino-2,5,2',5 -tetramethyltriphenylmethane**	210		217 (*di*)	250 (*di*)					
435	**3-Indolylpyruvic acid**	211, grey								4-Nitrophenylhydrazone, 153-4, Oxime, abt 175
436	**2-Amino-6-hydroxynaphthalene** (6-Hydroxy-2-naphthylamine)	212 3			N,O-*di* 228 30					Me eth , 78 Et eth , 91
437	**5-Amino-1,4-dihydroxyanthraquinone** (5-Aminoquinizarin)	212 3, br red								N-Phenyl, 223, Di-Me eth , 242-3
438	**2-Amino-4,5-dimethylpyrimidine**	214 5							250	Chloroplatinate, 227
439	**5-Bromo-4-hydroxy-2-methylaniline**	215, 205		171 2 (*di*)	229 (*di*)					
440	**4-Amino-4'-nitroazobenzene**	216 205		245						N-Me , 206 7, bl
441	**2-Hydroxy-6-nitroaniline**	216, red		N-*mono* 172			136 (O-)			Me eth , 76
442	**3,4-Diaminopyridine**	218 9			222 3 (*di*)				235-7	Chloroplatinate, 231
443	**1-Amino-5-chloroanthraquinone**	219, red		219	218					
444	**3,6-Dimethylcarbazole**	219		129					192	N-Nitroso, 106
445	**3-Aminothioxanthone**	221-2, yel -br		236 7						Hydrochloride, 230
446	**2-Amino-10-hydroxyphenanthrene**	221		182 (O, N-*di*)	225 (O, N-*di*)					
447	**5-Amino-4-nitroacenaphthene**	222, red		252	233					N-Formyl, 227
448	**5-Chloro-4-hydroxy-2-methylaniline**	223 5, 204 5		162 (*di*)	220 (*di*)					
449	**2,6-Dimethylcarbazole**	224							162	N-Nitroso, 113
450	**2-Amino-1,8-dinitronaphthalene** (1,8-Dinitro-2-naphthylamine)	226		238			221			
451	***trans*-4,4'-Diaminostilbene**	231, yel		353 (*di*)	352 (*di*)					
452	**2-Amino-3-hydroxynaphthalene** (3-Hydroxy-2-naphthylamine)	234		188 (O,N-*di*)	N-*mono* 233-5					
453	**1-Amino-2,4-dinitronaphthalene** (2,4-Dinitro-1-naphthylamine)	242		259	252		166			
454	**2,5-Dimethyl-4-hydroxyaniline**	242		177-9						Et eth , 69 70
455	**1-Amino-3-bromoanthraquinone**	243, red		214			227			
456	**4,4'-Diaminobenzophenone**	244		237 (*di*)						Phenylhydrazone, 240
457	**Carbazole**	246		69	98				185	
458	**1-Amino-2-hydroxyanthraquinone**	250, br		N-*mono* 170						Et eth , 182, red

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

1. Primary and secondary amines c) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Acetamide	Benzamide	Benzene sulfonamide	*p*-Toluene sulfonamide	Phenyl thiourea	Picrate	Miscellaneous
459	**1-Aminoanthraquinone**	252, 243		218	255		228 9			
460	**3-Aminocarbazole**	254		3-*mono* 217, *di* 200, *tri* 175	3-*mono* 250					
461	**2,7-Diaminocarbazole**	260		320 (*di*)						N,N'-Dibenzal, 290
462	**1,8-Diaminoanthraquinone**	262, red		284 (*di*)	324 (*di*)					
463	**1,4-Diaminoanthraquinone**	268, vlt		271 (*di*)	284 (*di*), 280 (*mono*)					
464	**2-Amino-3-nitrofluorenone**	269, vlt		245 6						N-Carbethoxy, 204
465	**1,1'-Diamino-2,2'-dinaphthyl**	281		230 (*di*)	278 (*di*)					
466	**1,7-Diaminoanthraquinone**	290, red		283 (*di*)	325 (*di*)					
467	**2,7-Diaminofluorenone**	290, vlt		222 (*di*)					230 (*di*)	Oxime, 255, Phenylhydrazone, 230, 4-Nitrophenylhydrazone, 280
468	**1,6-Diaminoanthraquinone**	292, red		295 (*di*)	275 (*di*)					
469	**1-Amino-5-nitroanthraquinone**	293, red		275	237					N-Me, 250 2, vlt- blk, N-Et, 238
470	**1-Amino-4-nitroanthraquinone**	296, yel - red		256 8						N-Me, 250
471	**5,8-Diaminoquinizarin** (1,4-Diamino-5,8-dihydroxyanthraquinone)	>300, br -vlt		5,8-*di* 284		5,8-*di* 275				
472	**2-Aminoanthraquinone**	305 8, 302		*mono* 262, *di* 258	228	271	304			
473	**2-Amino-3-bromoanthraquinone**	307, or -yel		259 2J7	279					N-Benzal, 174
474	**2-Aminoquinizarin** (2-Amino-1,4-dihydroxyanthraquinone)	313 4, grn -yel								N-Phenyl, 255 6, N-4-Tolyl, 220
475	**1,5-Diaminoanthraquinone**	319, red		317 (*di*)	>350 (*di*)					
476	**2,7-Diaminoanthraquinone**	>330, or		>350	300 (*di*)					
477	**2,5-Dianilino-1,4-benzoquinone**	345, red-br								Anil, 203, Dianil, 240, red
478	**2,8-Diaminoacridone**	>350		>350 (*di*)	>250 (*di*)					N,N'-Dibenzal, 370

*Derivative data given in order m p crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

2. Tertiary amines a) Liquids 1) (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point °C	Melting point, °C	n_D	Density g/ml	Methyl *p*-toluene sulfonate	Methiodide	Picrate	Chloroplatinate	Miscellaneous
1	**Trimethylamine**	3			$0\ 6709^{0}_{4}$		230	216, 225		*p*-Toluenesulfonate salt, 162
2	**Dimethyl ethyl amine**	37 5						193		Hydrochloride, 221
3	**N-Methylpyrrolidine**	78 80						221	233	
4	**Triethylamine**	89		$1\ 400^{20}$	$0\ 7255^{15}_{4}$			173		2,4-Dinitrobenzoate salt, 81 3, β-Resorcylic acid salt, 120
5	**1,2-Dimethylpyrrolidine**	96		$1\ 4252^{20}$	$0\ 7994^{20}_{4}$			235	223	
6	**1,3-Dimethylpyrrolidine**	96-7			$0\ 792^{15}_{4}$			dimorphous, 181 or 110-5	58 9	$HgCl_2$ add comp , 200
7	**Pyridine**	116		$1\ 5092^{21}$	$0\ 978^{25}_{4}$	139	117	167	241, 262 4	*p*-Toluenesulfonate salt, 160, Ethiodide, 91
8	**1,2,5-Trimethylpyrrolidine**	116		$1\ 4335^{9.2}_{\alpha}$	$0\ 815^{9}_{4}$		310	163		
9	**2-Dimethylaminodiethyl ether**	121		$1\ 406^{20}$	$0\ 806^{20}$		160 5	119-21		
10	**Dimethylaminoacetone**	123							176, s h	Oxime, 99
11	**1-Methylpyrazole**	127		$1\ 4787^{11}_{He}$	$0\ 993^{14}_{4}$		190	148	196 8	
12	**N-Ethylpiperidine**	128		$1\ 4416^{20}_{\alpha}$	$0\ 8237^{20}_{4}$			167 5	202	
13	**2-Methylpyridine** (α-Picoline)	129		$1\ 503^{17}$	$0\ 9497^{15}_{4}$	150	230	169	216, 195	*p*-Toluenesulfonate salt, 161, Ethiodide, 123
14	**β-Dimethylaminoethyl alcohol** (2-Dimethylaminoethyl alcohol)	135		$1\ 43^{20}$	$0\ 8866^{20}_{4}$			96 7		
15	**1,3-Dimethylpyrazole**	136		$1\ 467^{15}_{\alpha}$	$0\ 9628^{15}_{4}$		256	138		
16	**2-Methylpyrazine**	136-7			$1\ 029^{20}_{4}$		129 30	133		
17	**4-Methylpyrimidine**	141 2			$1\ 031^{16}_{16}$			131 4		$HgCl_2$ double salt, 198
18	**2,6-Dimethylpyridine** (2,6-Lutidine)	142 3					233	168	208	
19	**3-Methylpyridine** (β-Picoline)	143		$1\ 504^{24}$	$0\ 9515^{25}_{4}$			150	202	Styphnate, 154, Oxid → nicotinic acid, 228
20	**4-Methylpyridine** (γ-Picoline)	143		$1\ 506^{19}$	$0\ 957^{15}_{4}$			167	231	β-Resorcylic acid salt, 125
21	**4-Chloropyridine**	147 8							202	
22	**2-Ethylpyridine**	149			$0\ 9371^{17}$			187 9	165 7	
23	**3-Chloropyridine**	149						135	168	
24	**Tri-*n*-propylamine**	156 5		$1\ 4176^{20}$	$0\ 753^{20}_{4}$		207 8	116		Ethiodide, 238
25	**2,4-Dimethylpyridine** (2,4-Lutidine)	157, 159		$1\ 503^{14}$	$0\ 9273^{25}_{4}$			183	216	β-Resorcylic acid salt, 143
26	**2,5-Dimethylpyridine** (2,5-Lutidine)	160						169	192 4	
27	**1,3,4-Trimethylpyrazole**	160		$1\ 4866^{18}_{He}$	$0\ 956^{18}_{4}$			164		
28	**3-Ethylpyridine**	162-4			$0\ 954^{0}$			128-30	208-9, 196	
29	**β-Diethylaminoethyl alcohol** (2-Diethylaminoethyl alcohol)	163		$1\ 440^{25}$	$0\ 8601^{25}_{25}$					4-Nitrophenylurethane, 60
30	**Tropidine** (2-Tropene)	163		$1\ 4884^{19}_{\alpha}$	$0\ 953^{20}_{4}$		abt 300	285	217	
31	**2,3-Dimethylpyridine** (2,3-Lutidine)	164						188	195	
32	**3,4-Dimethylpyridine** (3,4-Lutidine)	164						163	205	
33	**4-Ethylpyridine**	164-5			$0\ 9417^{20}$			168	213	
34	**2,4,5-Triethylpyridine** (2,4,5-Collidine)	165-8						128-31	205	
35	**1,4-Bis-dimethylaminobutane**	167						199		
36	**Tropane**	167			$0\ 931^{20}_{4}$		>300	281	230	
37	**1-Diethylaminoisopropyl alcohol**	167 72			$0\ 8511^{20}_{0}$			89		
38	**2-Chloropyridine**	170, 166			$1\ 205^{15}$	120				
39	**3-Bromopyridine**	170		$1\ 5694^{20}$	$1\ 645^{9}_{4}$	156	165		175	
40	**3,5-Dimethylpyridine** (3,5-Lutidine)	170-1						245	255	

*Derivative data given in order. m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

2. Tertiary amines a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Methyl *p* toluene sulfonate	Methiodide	Picrate	Chloroplatinate	Miscellaneous
41	**2,4,6-Trimethylpyridine** (2,4,6-Collidine)	172			$0\ 917^{20}$			156	223	
42	**1,4,5-Triethylpyrazole**	176–7		$1\ 4848^{18}_{He}$	$0\ 9685^{18}_{4}$			175 6		
43	**2,3,6-Trimethylpyridine** (2,3,6-Collidine)	176 8						146	250 2	
44	**Benzyl dimethyl amine**	181						93	192	Picrolonate, 151
45	**2,3,5-Trimethylpyridine** (2,3,5-Collidine)	184						183, 179	227 8	
46	**N,N,2-Trimethylaniline** (N,N-Dimethyl *o*-toluidine)	185		$1\ 515^{20}$	$0\ 9286^{20}_{4}$			122, 116		1,3,5-Trinitrobenzene add comp , 113
47	**2,6-Dimethyl-4-ethylpyridine**	186			$0\ 916^{14}_{14}$			119-20	210	
48	**2,4-Diethylpyridine**	187-8			$0\ 9338^{0}$			98 100	170-1	
49	**3-Diethylaminopropyl alcohol**	190					175			
50	**Methyl 2-pyridyl ketone**	192					161	131	220	Oxime, 121 Phenylhydrazone, 155, Ethiodide, 205
51	**2,3,4-Trimethylpyridine** (2,3,4-Collidine)	192-3			$0\ 912^{15}$			163 4	259	
52	**N,N-Dimethylaniline**	193	2 2 5	$1\ 5582^{20}$	$0\ 9557^{20}_{4}$	161	228, 220	163	173	*p*-Toluenesulfonate salt, 133, 3,5-Dinitrobenzoate salt, 115
53	**2-Bromopyridine**	194			$1\ 657^{15}$	127				
54	**3-Ethyl-4-methylpyridine**	195 6			$0\ 9656^{0}$			148 50	234, 205	
55	**3,5-Dimethyl-2-ethylpyridine**	198						152	189	
56	**N,N,2,6-Tetramethylaniline** (N,N-Dimethyl-*m*-2-xylidine 2-Dimethylamino-*m*-xylene)	199-200		$1\ 513^{20}$	$0\ 912^{20}_{4}$					1,3,5-Trinitrobenzene add comp , 108
57	**N-Ethyl-N-methylaniline**	201			$0\ 919^{55}_{4}$		125	134 5		Hydrochloride, 114
58	**N,N,2,5-Tetramethylaniline** (N,N-Dimethyl-*p*-2-xylidine, 2-Dimethylamino-*p*-xylene)	204						158	196	
59	**N,N,2,4-Tetramethylaniline** (N,N Dimethyl-*m*-4-xylidine, 4-Dimethylamino-*m*-xylene)	205		$1\ 5201^{20}$	$0\ 9164^{20}_{4}$			123 4	219	1,3,5-Trinitrobenzene add comp , 114
60	**N,N-Diethyl-2-methylaniline** (N,N-Diethyl-*o*-toluidine)	206, 210					224	180		
61	**2-Chloro-N,N-dimethylaniline**	207					152	132		
62	**N,N,4-Trimethylaniline** (N,N-Dimethyl-*p*-toluidine)	210		$1\ 536^{20}$	$0\ 929^{20}_{4}$	85	219	129		1,3,5-Trinitrobenzene add comp , 124, vlt
63	**3,4-Diethylpyridine**	211						139	221	
64	**Tri-*n*-butylamine**	211, 216			$0\ 778^{20}_{20}$		180	106		*β*-Resorcylic acid salt, 121
65	**N,N,3-Trimethylaniline** (N,N-Dimethyl-*m*-toluidine)	212		$1\ 5492^{20}$	$0\ 941^{20}_{4}$		177			
66	**Methyl 4-pyridyl ketone**	212-4						130	205	Oxime, 142, Phenylhydrazone, 150, $HgCl_2$ double salt, 183-4
67	**N,N-Diethylaniline**	218, 216			$0\ 9351^{20}_{4}$		102	142		
68	**Methyl 3-pyridyl ketone**	220								Oxime, 133, Phenylhydrazone, 137, $HgCl_2$ double salt, 158
69	**N,N-Diethyl-4-methylaniline** (N,N-Diethyl-*p*-toluidine)	229			$0\ 924^{16}$		184			
70	**2,3,4,5-Tetramethylpyridine**	232 4						170 2	210	
71	**Quinoline**	239	−15 6	$1\ 6268^{20}$	$1\ 0929^{20}_{4}$	126	133	203	227, 218	*p*-Toluenesulfonate salt, 155, Ethiodide, 159, Styphnate, 207 8
72	**Isoquinoline**	243	26, 24	$1\ 615^{20}$, $1\ 622^{25}$	$1\ 0986^{20}_{4}$	163	159	222	263	Ethiodide, 148

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

2. Tertiary amines a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Methyl *p*-toluene sulfonate	Methiodide	Picrate	Chloro platinate	Miscellaneous
73	**DL-Nicotine** (DL-1-Methyl-2-(3-pyridyl)-pyrrolidine)	243			$1\ 008_4^{20}$		219	218	abt 280	
74	**2-Dimethylaminobenzaldehyde**	244, yel					164		205 6	Oxime, 87, *p*-Nitrophenylhydrazone, 191
75	**Tri-isoamylamine**	245, 237			$0\ 786_4^{20}$			125		
76	**N,N-Dipropylaniline**	245			$0\ 9104^{20}$		156	261		
77	**2-Ethylquinoline** (α-Ethylquinoline)	245-6		$1\ 598^{23}$	$1\ 050^{17}$		180	148	188	
78	**2-Methylquinoxaline**	245-7						215	>250	
79	**1-Methylindole**	247, 239			$1\ 0707^{0}$			150		
80	**2-Methylquinoline** (Quinaldine)	247		$1\ 6126^{20}$	$1\ 0585_4^{20}$	161, 134	195	191, 195	228	β-Resorcylic acid salt, 145 Ethiodide, 233
81	**8-Methylquinoline**	248		$1\ 616^{20}$	$1\ 072_4^{21}$			200		
82	**L-Nicotine** (L-1-Methyl-2-(3-pyridyl)-pyrrolidine)	248		$1\ 528^{20}$	$1\ 0097_4^{20}$			218	275	$[\alpha]_D^{20}$ −167-8
83	**1-Ethylisoquinoline**	250						207 10	200	
84	**2,4-Dimethyl-5,6,7,8-tetrahydroquinoline**	250	20	$1\ 5415^{20}$	$1\ 0043_4^{20}$		157	144		Hydrochloride, 195
86	**N-Methyl-2-pyridone**	255						145	141	Styphnate, 162
87	**4,6-Dimethylquinoline**	255 6, 280						236-7	238	
88	**3-Ethylisoquinoline**	257						171 2	180	
89	**Tri-*n*-amylamine** (Tri-*n*-pentylamine)	257, 245				80				
90	**3-Methylquinoline** (β-Methylquinoline)	257 9	16 7	$1\ 6171^{20}$	$1\ 0673_4^{20}$		221	187	249	Ethiodide 220
91	**6-Methylquinoline**	258		$1\ 6157^{20}$	$1\ 0654_4^{20}$	154	219, 216	229		
92	**3-Chloroquinoline** (β-Chloroquinoline)	258 60					276 subl	182	>300	
93	**3-Bromo-N,N-dimethylaniline**	259	11					135		
94	**5-Methylquinoline**	260					105	210 3		
95	**4-Methylquinoline** (γ-Methylquinoline)	261-3	-		$1\ 0862^{20}$		173 4	210-1	226 30	Ethiodide, 141 3
96	**2,4-Dimethylquinoline**	264-5			$1\ 061^{15}$		263 5	193-4	229	Ethiodide, 214
97	**2-Phenylpyridine**	268-9						175	204	
98	**6,8-Dimethylquinoline**	269			$1\ 066^{4}$			288-9	235	
99	**N,N-Di-*n*-butylaniline**	271				180		125		
100	**4-Ethylquinoline** (γ-Ethylquinoline)	272-4					149	178-80	204	
101	**N,N-Dimethyl-1-aminonaphthalene** (N,N-Dimethyl-α-naphthylamine)	273		$1\ 624^{15}$	$1\ 0446_{15}^{15}$			145		1,3,5-Trinitrobenzene add comp , 105 7
102	**5,8-Dimethylquinoline**	273 5	4 5		$1\ 07^{21}$			198	234	
103	**3-Bromoquinoline** (β-Bromoquinoline)	274 6	12					190		Oxalate, 107
104	**3,5-Dimethyl-1-phenylpyrazole**	275					190	103	186	
105	**6-Bromoquinoline**	278	19, 24				278	217		
106	**2,4,7-Trimethylquinoline**	280-1		$1\ 5973^{24}$	$1\ 0337^{20}$		322	232	272	
107	**4,7-Dimethylquinoline**	283						224	227	
108	**3,4-Dimethyl-1-phenylpyrazole**	285		$1\ 5724^{20}$	$1\ 0574_4^{20}$			122 5	180	
109	**8-Chloroquinoline**	288					165		235	
110	**2,3'-Bipyridyl**	289, 298						150, *di* 165-8		
111	**8-Bromoquinoline**	302-4					281		230	
112	**6-Methoxyquinoline**	305d	20, 28				236	305		
113	**N-Benzyl-N-methylaniline**	306		$1\ 601^{30}$	$1\ 0422_{26}^{26}$		164	127		

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

2. Tertiary amines a) Liquids (b.p. at reduced pressure only)

2) (Listed in order of increasing m.p. of the corresponding picrate derivative)*

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Methyl *p*-toluene sulfonate	Methiodide	Picrate	Chloroplatinate	Miscellaneous
1	**N,N-Dimethyl-2-nitroaniline**	151 3^{30-3}, or -yel		1 6102				102 3		Hydrochloride, 174, 1,3,5-Trinitrobenzene add comp , 112
2	**2,6-Diethylpyridine**	71 3^{17}					142	115	211 2	
3	**2-Iodopyridine** (α-Iodopyridine)	93^{13}		$1\ 6366^{20}$	$1\ 9735_0^{40}$		207	120	210	
4	**1,3-Dimethyl-1,2,3,4-tetrahydroquinoline**	130 2^{17}					204	131		
5	**β,β-Diethylphenylhydrazine**	110 2^{14}						131		Reduces Fehling's and Tollen's reagent Zn + AcOH → aniline, b p 184 + diethylamine b p 56
6	**3-Dimethylaminobenzaldehyde**	138^{9}, yel					185 6	147	168 r h	Oxime, 75-6, Semicarbazone, 229 *p*-Nitrophenylhydrazone, 188
7	**4-Methyl-5,6,7,8-tetrahydroquinoline**	122^{11}					183	170		Hydrochloride, 203
8	**3-Methyl-5,6,7,8-tetrahydroquinoline**	126 7^{17}					162	171	219	
9	**3-Ethylquinoline** (β-Ethylquinoline)	135 8^{12}		$1\ 603^{18}$	$1\ 0508_4^{20}$		191	197		Hydrochloride, 173
10	**4-Bromopyridine** (γ-Bromopyridine)	27 5 $30^{0\ 3-0\ 5}$	0-1	$1\ 5679^{20}$				223		Decomposes to yel -br solid on standing

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES

2. Tertiary amines b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Methyl *p*-toluene sulfonate	Methiodide	Picrate	Chloroplatinate	Miscellaneous
1	**Pyrimidine**	21	123 4			156		Chloroaurate, 226
2	**4,6-Dimethylpyrimidine**	25	160			12 34	103 4	
3	**2,8-Dimethylquinoline**	27	252		221	180		n_D 1 6022, Ethiodide, 229
4	**4-Bromoquinoline** (γ-Bromoquinoline)	29 30, 25	270d		265 70			
5	**Quinoxaline** (Benzopyrazine)	30	230		176			D_4^{48} 1 1334, n_D^{48} 1 6231, Oxalate, 169, Ethiodide, 146
6	**5-Methylpyrimidine**	30 5	154			141		$HgCl_2$ double salt, 246, Chloroaurate, 209
7	**4-Chloroquinoline** (γ-Chloroquinoline)	31	263			212	278	
8	**7-Chloroquinoline**	31-2	267-8		250		253	
9	**8-Iodoquinoline**	36			200		251	
10	**1,3,5-Trimethylpyrazole**	37	170			147	187 91	n_{He}^{68} 1 4589
11	**2-Chloroquinoline** (α-Chloroquinoline)	38	267			122		
12	**2,3-Dimethyl-5,6,7,8-tetrahydroquinoline**	38	125[14]		117	169		
13	**7-Methylquinoline**	39	252			237	223-4	
14	**4-Bromoisoquinoline**	40	280 5		233			
15	**6-Chloroquinoline**	41	262	143	248			Ethiodide, 168 9
16	**4-(Diethylamino)benzaldehyde**	41, yel						Oxime, 93, Semicarbazone, 214 Phenylhydrazone, 103, Anil, 108-9
17	**3-Nitropyridine**	41	216				254	Hydrochloride, 154
18	**2,4,8-Trimethylquinoline**	42	270		229	193		
19	**4-Chloro-2-methylquinoline** (4-Chloroquinaldine)	42 3			212	178		
20	**5-Chloroquinoline**	45	256		231, 172		255	
21	**2,6,8-Trimethylquinoline**	46	264 5			187-9	206-7	Hydrochloride, 207
22	**2-(Dimethylamino)naphthalene** (N,N-Dimethyl-β-naphthylamine)	47	305			206		
23	**2,4,5,8-Tetramethylquinoline**	48, pa yel	168-72[12]			161		Hydrochloride, 254
24	**5-Bromoquinoline**	48, 52	280		205			Hydrochloride, 225
25	**2-Bromoquinoline** (α-Bromoquinoline)	49			210			
26	**8-Methoxyquinoline**	50	283		160	143		
27	**7-Bromoquinoline**	52, 34	290		240, yel			Hydrochloride, 213
28	**2-Iodoquinoline** (α-Iodoquinoline)	52-3			211-2			Ethiodide, 220
29	**3-Iodopyridine** (β-Iodopyridine)	53, 50					211	Clinice cold $CHCl_3$ → chloride, 128 30, yel
30	**4,8-Dimethylquinoline**	54 5	258 9			216 7	226	
31	**2,3,8-Trimethylquinoline**	55-6	281			242 5		Hydrochloride, 260
32	**2,6-Dimethylquinoline**	60	266	175	236-7	186, 178		Styphnate, 200
33	**N,N-Dimethyl-3-nitroaniline**	60, red			205	119		
34	**3,4'-Bipyridyl**	62	297			215		
35	**2,4,6-Trimethylquinoline**	65 5 (anh), 39 5 (hyd)	281 2		245-7, 225	200-1		Hydrochloride, 268-72
36	**3,3'-Bipyridyl** (β,β-Bipyridyl)	68	291-2			232		
37	**2,3-Dimethylquinoline**	68 9	263		218	230 1	230	
38	**2,2'-Bipyridyl** (α,α'-Bipyridyl)	69				158		
39	**5-Nitroquinoline**	72 (anh)			215			Hydrochloride, 214
40	**N,N-Dibenzylaniline**	72, 70			135	131		
41	**2,2'-Bis-(dimethylamino)-biphenyl**	72-3			190-2			Hydroiodide, 256-7
42	**3,4-Dimethylquinoline**	73-4, 65	293		191	215, 205		Hydrochloride, 290
43	**8-Hydroxy-2-methylquinoline** (8-Hydroxyquinaldine)	74	266					Me eth, 125, b p 282
44	**4-Dimethylaminobenzaldehyde**	74						Semicarbazone, 222, *p*-Nitrophenylhydrazone, 182, 2,4-Dinitrophenylhydrazone, 325, Anil, 100, grn -yel
45	**8-Hydroxyquinoline**	75			143	204		Benzoate, 120, 1,3,5-Trinitrobenzene add comp, 124
46	**N,N-Dimethyl-4-aminophenol** (N,N-Dimethyl-4-hydroxyaniline)	76						Acetate, 78, Me eth, 49, *p*-Toluenesulfonyl, 130
47	**8-Bromoisoquinoline**	80 5			274			Nitrate, 193

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE XVIII. ORGANIC DERIVATIVES OF AMINES
2. Tertiary amines b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Methyl *p*-toluene sulfonate	Methiodide	Picrate	Chloroplatinate	Miscellaneous
48	**3,4'-Biquinolyl**	83-4				244		Diethiodide, 198
49	**2,2'-Dipyridylamine**	84, 95 after resolidification	307-8			227-8	160	
50	**N,N-Dimethyl-4-nitrosoaniline** (4-Nitroso-N,N-dimethylaniline)	85				140		Hydrochloride, 177
51	**N,N-Dimethyl-3-aminophenol** (N,N-Dimethyl-3-hydroxyaniline)	85						Benzoate, 95, Me urethane, 87
52	**2,3,6-Trimethylquinoline**	86-7	285			212		
53	**6,6'-Dimethyl-2,2'-bipyridyl**	89-90				170 1		$HgCl_2$ add comp , 238
54	**4,4'-Bis-(dimethylamino)-diphenylmethane**	91	390		214 (*dl*)	185 (*mono*), 178 (*dl*)		1,3,5-Trinitrobenzene add comp , 114, vlt
55	**6-Iodoquinoline**	91			>300		265	Hydrochloride, 210
56	**Tribenzylamine**	91			184	190		Ethiodide, 190, β-Resorcylic acid salt, 141
57	**2,3,4-Trimethylquinoline**	92	285		260	216	215	Hydrochloride, 274
58	**4-Dimethylaminobenzophenone**	92			188-90			Anil, 151, Phenylhydrazone, 105
59	**N-Methyl-4-pyridone**	92-4 hyg					176 (anh)	$HgCl_2$ double salt, 177-80
60	**1,5-Dimethylbenzimidazole**	95	300			255		Hydrochloride, 215
61	**1-Phenylisoquinoline**	95-6	300			165	242	Hydrochloride, 235
62	**6-Bromo-2-methylquinoline** (6-Bromoquinaldine)	96 7			237			Ethiodide, 218
63	**4-Iodoquinoline** (γ-Iodoquinoline)	97			251		185	
64	**4,4'-Bis-(dimethylamino)-benzhydrol**	98, 102, grn			195 (*dl*)			Me eth , 71 2, 1,3,5-Trinitrobenzene add comp , 76
65	**5-Iodoquinoline**	100			245		263	
66	**4,4'-Bis-(dimethylamino)-triphenylmethane** (Leuco-malachite green)	102, bz , 93, al			231 (220) (*dl*)			1,3,5-Trinitrobenzene add comp , 89
67	**2,2'-Biquinolylmethane**	103			205	239, 210 (*dl*)		
68	**2-Hydroxypyridine** (α-Hydroxypyridine, α-Pyridone)	106-7	280-1					Benzoate, 42, $HgCl_2$ comp with Me eth , 200, $HgCl_2$ comp with Et eth , 141-2
69	**Acridine**	111			224	208		
70	**3,5-Dibromopyridine**	112	222	219	274			
71	**1,2-Dimethylbenzimidazole**	112 (anh), 65(hyd)	290		254	238		
72	**Antipyrine** (2,3-Dimethyl-1-phenyl-5-pyrazolone)	113	319			188		Salicylate, 92
73	**4,4'-Bipyridyl**	114 (anh), 73 (hyd)				257		Nitrate, 256
74	**4-Dimethylaminoazobenzene**	117, yel			174, al			Methochloride, 194
75	**Triphenylamine**	127	365					Hydrochloride, 214, Fuming HNO_3 in ac a → trinitro deriv , 280
76	**3-Hydroxypyridine** (β-Hydroxypyridine)	129						Oxalate, 177, Chloroplatinate of Et eth , 192
77	**Methyleneaminoacetonitrile**	129	210			127		Acid hydrolysis → glycine
78	**7-Nitroquinoline**	132 3			231-2			Ethiodide, 220
79	**6,8'-Biquinolyl**	148			126 (*mono*)	268		
80	**4-Hydroxypyridine** (γ-Hydroxypyridine)	149 (anh)						Acetate, 140 50, Benzoate, 81, Zn → pyridine, b p 116
81	**6-Nitroquinoline**	154, 149			245			Styphnate, 190, Hydrobromide, 245
82	**Quinuclidine**	158 (sealed tube)				275-6	238-40	Ethiodide, 270-1
83	**2,7'-Biquinolyl**	160			263	240		

*Derivative data given in order m p , crystal color, solvent from which crystallized

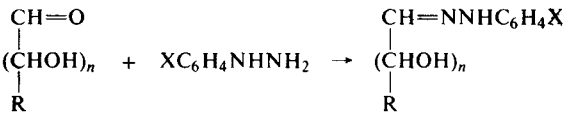
TABLE XVIII. ORGANIC DERIVATIVES OF AMINES
2. Tertiary amines b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Methyl *p*-toluene sulfonate	Methiodide	Picrate	Chloroplatinate	Miscellaneous
84	**2,2'-Biquinolyl ketone**	164				179		Oxime, 201, Phenylhydrazone, 199
85	**6-Hydroxypyrimidine**	164–5				190		Acetyl, 180, 215–20 after resolidification
86	**7,7'-Biquinolyl**	171–2			310 (*mono*)	300		
87	**4,4'-Bis-(dimethylamino) benzophenone** (Michler's ketone)	174			105	156		Oxime, 233
88	**5,5'-Biquinolyl**	175			272	>300		Hydrochloride, 292
89	**2,3'-Biquinolyl**	176			286		278	
90	**6,6'-Biquinolyl**	181			>290 (*dl*)			Diethiodide, 270
91	**6-Hydroxyquinoline**	193				236		1,3,5-Trinitrobenzene add comp, 193–5
92	**2,2'-Biquinolyl** (α,α'-Biquinolyl)	196				210, 215		
93	**3-Hydroxyquinoline** (β-Hydroxyquinoline)	198				240–5		
94	**1,2-Di(2-pyrrolyl)ethanedione** (2,2'-Bipyrroyl)	200, pa yel						*o*-Phenylenediamine → dipyrrylquinoxaline, 158, Monoxime, 147, Diphenylhydrazone, 146
95	**4-Hydroxyquinoline** (γ-Hydroxyquinoline)	201 (anh)						Hydrochloride, 187 (anh), $KMnO_4$ → kynuric acid, 200 (anh)
96	**6-Hydroxy-2-methylquinoline** (6-Hydroxyquinaldine)	213						Et eth, 71, Picrate of Et eth, 192, Ethiodide of Et eth, 182
97	**5-Hydroxyquinoline**	224			224		230	Hydrochloride, 240
98	**4-Hydroxy-2-methylquinoline** (4-Hydroxyquinaldine)	232 (anh)			201 (anh)	200	215	Me eth, 82
99	**7-Hydroxyquinoline**	235			251	244–5		Benzoate, 88–9
100	**5-Hydroxy-2-methylquinoline** (5-Hydroxyquinaldine)	246, 232–4						Picrate of Me eth, 217, Picrate of Et eth, 213, 206
101	**4,4'-Dipyridylamine**	273–5				235, 174	>280	Hydrochloride, > 300
102	**Hexamethylene tetramine**	280		205	190	179		Dil acid → formaldehyde, semicarbazone, 169

*Derivative data given in order m p, crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLE XIX

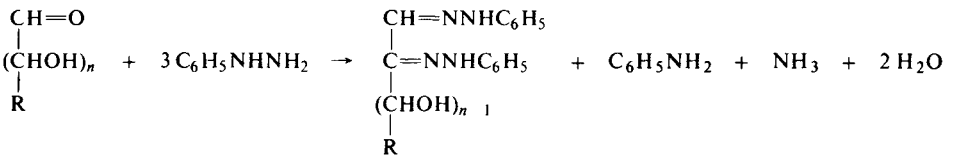
Substituted phenylhydrazones *



Substituted phenylhydrazone

From the carbohydrate and one equivalent of phenylhydrazine in aqueous acetic acid
For directions and examples see Cheronis, p 520, Wild, p 77
From the carbohydrate, phenylhydrazine hydrochloride and sodium acetate in water
See Wild, p 77
From the carbohydrate with *p*-nitrophenylhydrazine hydrochloride and sodium acetate in methanol
See Cheronis, p 523
From the carbohydrate and *p*-nitrophenylhydrazine in alcohol
See Vogel, p 456
From the carbohydrate and benzylphenylhydrazine in aqueous alcohol
See Shriner, p 77

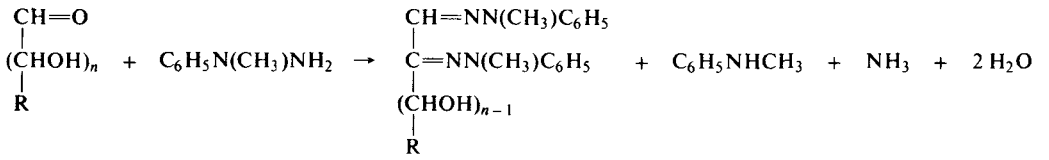
Phenylosazone *



Phenylosazone

From the carbohydrate and excess of phenylhydrazine in glacial acetic acid
For directions and examples see Cheronis, pp 523, 524
From the carbohydrate, excess of phenylhydrazine hydrochloride and sodium acetate in aqueous acetic acid
See Cheronis, pp 524, 525 Linstead p 38 Shriner, p 132 Vogel, p 455
From the carbohydrate and excess of phenylhydrazine in methyl cellosolve-glacial acetic acid mixture
See W T Haskins, R M Hann and C S Hudson, *J Amer Chem Soc*, **68**, 1766 (1946)

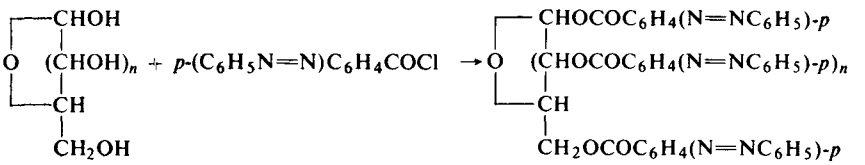
Methylphenylosazone



Methylphenylosazone

From the carbohydrate and *as*-methylphenylhydrazine in aqueous alcohol
For directions and examples see Vogel, p 456

p-Phenylazobenzoate (azoate) *



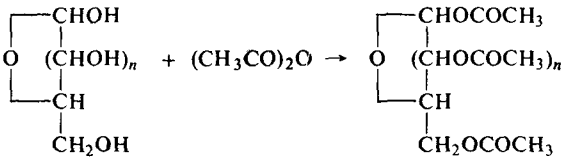
Azoyl chloride Carbohydrate azoate

From the carbohydrate and azoyl chloride (*p*-phenylazobenzoyl chloride) in anhydrous pyridine
For directions and examples see Cheronis, p 526, G H Coleman, A G Farnham and A Miller, *J Amer Chem Soc*, **64**, 1501 (1942), G H Coleman and C M McClosky, *J Amer Chem Soc*, **65**, 1588 (1943)

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

EXPLANATIONS AND REFERENCES TO TABLE XIX (Continued)

Acetate



Carbohydrate acetate

From the carbohydrate, acetic anhydride and sodium acetate
For directions and examples see Linstead, p 39, Shriner, p 212, Vogel, p 451, Wild, p 78

Specific rotation

Specific rotation can be used as means for identification
For directions and examples see Cheronis, p 578, Wild, p 78

General references

C A Browne and F W Zerban, *Physical and Chemical Methods of Sugar Analysis*, 3rd edition, John Wiley and Sons, New York, 1941, J Stanek, M Carny, J Kocourek and J Pacak, *The Monosaccharides*, Academic Press, New York, 1963, pp 865 955, G R Pigman in *The Carbohydrates*, (Ed W Pigman), Academic Press, New York, 1957, pp 602 640

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE XIX. ORGANIC DERIVATIVES OF CARBOHYDRATES

a) Liquids (Listed in order of increasing m.p. of the corresponding phenylosazone derivatives)*

No	Name	Melting point, °C	Specific rotation			Rf-Values in *n*-butanol-acetic acid-water (4 1 5)	Phenylosazone		Azoate (*p*-Phenyl-azobenzoate)		*p*-Nitro-phenyl-hydrazone	*p*-Bromo-phenyl-hydrazone	Miscellaneous
			$[\alpha]_D$	T, °C	Conc, Solvent		M P	$[\alpha]_D^T$ Solvent	M P	$[\alpha]_{438}^{25}$, chl			
1	**DL-Methyl-tetrose**						140-2						Phenylbenzylhydra-zone, 99 100
2	**Apiose**		+3 8, +5 6	20 15	c = 3 4, water		156						*p*-Bromophenyl-osazone, 210 2
3	**DL-Gulose**						157 9						Phenylhydrazone, 143, *p*-Bromophenyl-osazone, 183
4	**L-Erythrose**		+11 5 → +15 2 → +30 5	24	c = 3, water		164						Benzylphenylhydra-zone, 105, $[\alpha]_D^{20}$ +32 8, c = 5, 95% al, Triacetyl, 134
5	**D-Erythrose**		−14 5	20	c = 11, water		164, 166	0 5, pyr - al					Benzylphenylhydra-zone, 105 6 $[\alpha]_D^{20}$ +32 8, c = 5, 95% al, *p*-Bromophenylosa-zone, 195 Phenyl-hydrazone, 116
6	**DL-Erythrose**						164, 166 8						Benzylphenylhydra-zone, 83
7	**DL-Erythrulose**						164						Methylphenylosazone, 158 9
8	**L-Erythrulose**		+12	20	water		164						*p*-Bromophenyl osazone, 195
9	**L-Idose**		+52 7	20	c = 6 2, water		168, 160						
10	**D-Gulose**		−20 4 → +61 6	20	water		168, 160	+6, c = 0 4, me al					Phenylhydrazone, 143 *p*-Bromophenyl osazone, 186 Benzylphenylhydra-zone, 124, $[\alpha]_D$ −24, c = 0 5, me al
11	**β-Methylglycer-aldehyde**						171						Benzylphenylhydra-zone, 116
12	**L-Methyltetrose**		−30 5 → −16 5	20	c = 9 47, 96% al		172-3						Benzylphenylhydra-zone, 96 7 Diethyl mercaptal, 109
13	**D-Rhamnose** (6-Desoxy-D-mannose)		−8 25	16 5	c = 10, water		185, 191	−95 2, pyr					*p*-Bromophenylosa-zone, 225, 222-3
14	**3-Amino-3-desoxy-D-glucose**		−61 → −78	18	water		207						N-Benzoyl, 128 30
15	**DL-Xylulose** (DL-Xylo-ketose)						210 5						Methylphenylosazone, 173

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIX. ORGANIC DERIVATIVES OF CARBOHYDRATES

b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Specific rotation			Rf-Values in *n*-butanol-acetic acid-water (4 1 5)	Phenylosazone		Azoate (*p*-Phenylazobenzoate)		*p*-Nitrophenylhydrazone	*p*-Bromophenylhydrazone	Miscellaneous
			$[\alpha]_D$	T, °C	Conc, Solvent		M P	$[\alpha]_D^T$ Solvent	M P	$[\alpha]_{6438}^{25}$, chl			
1	**1,3-Dihydroxyacetone**	65–71 (*monomer*), 80 (*dimer*)					132				156, 160		Phenylhydrazone, 115, Me phenylosazone, 127 130 Diacetate, 46 7 Dibenzoate, 120, Di-*p*-nitrobenzoate, 198, Oxime, 84
2	**β-Melibiose dihydrate** (6-[α-D-Galactosido]-D-glucose)	82–5	+111 7 → +129 5	20	c = 4, water		176–8	+43 2, pyr	280	+172			*p*-Bromophenylosazone, 181 2, Phenylhydrazone, 145 160 Oxime, 186, Octaacetate, 177 5, $[\alpha]_D^{20}$ +102 5
3	**D-Ribose**	87, 95	−21 5, −23 7	20	c = 4, water	0 31	164 160					170, ($[\alpha]_D^{20}$ −5 7, al)	*p*-Bromophenylosazone, 180 5, β-Me glucoside, 83 4, $[\alpha]_D^{20}$ −113 6
4	**L-Ribose**	87	+20 3 → +20 7	20	c = 4, water		166					164 5	Phenylhydrazone, 154 5
5	**2-Desoxy-D-ribose**	90	+2 88 → +2 13	23	water								Benzylphenylhydrazone, 127 9
6	**Glycollic aldehyde** (Glycoaldehyde)	95 7					179						*p*-Nitrophenylosazone, 311, Diphenylosazone, 207, Benzylphenylosazone, 198, Monoacetate, 157 8, Phenylhydrazone, 162
7	**D-Fructose**	102 4	−132 2 → −92 4	20	c = 4, water	0 23	210		125	−440	176, ($[\alpha]_D$ +16, pyr -al)		*o*-Nitrophenylhydrazone, 156 7 α-Me phenylosazone, 161 2, Pentaacetate α-form, 70, $[\alpha]_D^{20}$ +34 7, chl β-form, 108–9, $[\alpha]_D^{20}$ −120 5, chl
8	**Lactic aldehyde** (Lactaldehyde)	105					154, 145				128 9		Phenylhydrazone, 93
9	**α-L-Rhamnose** (6-Desoxy-L-mannose)	105, 93–4 (hyd)	−8 6 → +8 2	20	c = 4, water	0 37	222, 182	+94, pyr			186 191		*p*-Nitrophenylosazone, 208, 2-Naphthylhydrazone, 170, $[\alpha]_D$ +8 4, me al , Semicarbazone, 183, $[\alpha]_D^{20}$ +75 → +57, w
10	**L-Altrose**	105, 107–9	−32 3	20	water		165 178						Benzylphenylhydrazone, 148
11	**D-Altrose**	105	+32 6	20	c = 7 6, water		178						Benzylphenylhydrazone, 148–50
12	**2-Amino-2-desoxy-D-glucose** (Glucosamine)	105–10	+48, +44		water		210						Phenylurea, 210, N-Acetyl, 190, Oxime, 127, Semicarbazone, 165
13	**α-D-Lyxose**	106–7, 101	+5 5 → −14 0		c = 8, water		164				172	162, 156 7	Benzylphenylhydrazone, 116, 128, $[\alpha]_D^{20}$ +26 4, c = 4 9, abs al

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIX. ORGANIC DERIVATIVES OF CARBOHYDRATES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Specific rotation			Rf Values in *n*-butanol-acetic acid-water (4 1 5)	Phenylosazone		Azoate (*p*-Phenyl azobenzoate)		*p* Nitro phenyl-hydrazone	*p*-Bromo phenyl-hydrazone	Miscellaneous
			$[\alpha]_D$	T °C	Conc Solvent		M P	$[\alpha]_D^T$ Solvent	M P	$[\alpha]_{643.8}^{25}$ chl			
14	**Raffinose** (2-[6-(α-D Galactosido)-α-D-glucoside] β-D-fructose)	118 9, (anh) 80 (hyd)	+123, +105 2	20	water c = 4, water	0 05			145	+146			Tritrityl, 130, α-Methylphenylhydrazone, 190, Emulsin → sucrose + galactose
15	**β-L-Rhamnose**	122 6	+9 1	20	water		222 185	+94 pyr			190 1, ($[\alpha]_D^{20}$ +21 4)		α-Methylphenylhydrazone, 124, *p*-Bromophenylosazone, 222
16	**D-Tagatose**	124	+1 0	22	c = 1, water		196 7 201						Diacetone deriv , 65 6, $[\alpha]_D^{20}$ +71 8, w
17	**D-Threose**	126 32	+29 → +19 6	22	water		164						Benzylphenylhydrazone, 194, bz , Acetone deriv , 84, Triacetate, 113 4, $[\alpha]_D^{20}$ +35 5, chl
18	**D-1-Amino-fructose**	127 8					210						
19	**β-D-Allose**	128	+0 58 → +14 41	20	c = 5, water		178, 174					145, ($[\alpha]_D^{20}$ −6 7, al)	
20	**β-L-Allose**	128 9	−1 9	20	water		165					141 5, ($[\alpha]_D^{20}$ +6 4, al)	
21	**D-Talose**	128 30	+30 → +20 6	21	water		201 197					205	Phenylhydrazone, 178, Benzylphenylhydrazone, 199
22	**DL-Xylose**	129 31					210 5						
23	**α-D-Mannose**	133	+29 3 → +14 2	20	c = 4 water	0 20	210				194 5, ($[\alpha]_D^{20}$ +56, pyr -al (1 1))	208 10	Phenylhydrazone, 199 200, $[\alpha]_D^{20}$ +26 3 → +33 8, pyr , α-Methylphenylhydrazone, 178, $[\alpha]_D$ +8 6, c = 0 5, me al , Benzylphenylhydrazone, 165
24	**β-D-Mannose**	132	−17 0 → +14 2	20	c = 4, water		210				194 5	208 10	Phenylhydrazone, 199 200, α-Methylphenylhydrazone, 178, $CaCl_2$ add comp , 101 2
25	**L-Mannose**	132	+14 0 → −14 0		water		208						Phenylhydrazone, 195, $[\alpha]_D$ +1 2, HCl
26	**DL-Mannose**	132 3					217 9						Phenylhydrazone, 195
27	**α-D-Manno-heptose**	134 5	+85 05 → +68 64	20	c = 11 water		200					207-8	Phenylhydrazone, 197, Hexaacetate, 106, 50% al , 139 40, eth
28	**DL-Glyceraldehyde** (*dimer*)	139, 142					132						*p*-Bromophenylosazone, 168, Dibenzoate, 231, Di-*p*-nitrobenzoate, 247, Semicarbazone, 160, 2,4-Dinitrophenylhydrazone, 166-7
29	**D-Isorhamnose** (6-Desoxy-D-glucose	139-40	+72 3 → 29 7	20	c = 10, water		185, 187 9						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XIX. ORGANIC DERIVATIVES OF CARBOHYDRATES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Specific rotation			Rf-Values in *n*-butanol-acetic acid water (4 1 5)	Phenylosazone		Azoate (*p*-Phenyl-azobenzoate)		*p*-Nitro phenyl hydrazone	*p* Bromo-phenyl-hydrazone	Miscellaneous
			$[\alpha]_D$	T, °C	Conc., Solvent		M P	$[\alpha]_D^T$ Solvent	M P	$[\alpha]_{643s}^{25}$ chl			
30	**α-L-Glucose**	141 3	−95 5 → −51 4	20	c = 4, water		208						Diphenylhydrazone, 162
31	**L-Xylose**	144, 141 3	−79 3 → −18 6	20	c = 9 94, water		159 61						Tetraacetate, 126 (β-form)
32	**α-D-Xylose**	145, 143	+93 6 → +18 8	20	c = 4, water	0 28	164 155	−40 9, al	157	+244	155	128	Me phenylhydrazone, 108, Benzylphenyl-hydrazone, 95, $[\alpha]_D$ −33, c = 0 57, al 2-Naphthylhydra-zone, 124, $[\alpha]_D$ +18 6, me al
33	**D-Fucose** (6-Desoxy-D-galactose, D-Rhodeose)	145	+89 3 → +75 7	22	water		177						Methylphenylosazone, 181, Oxime, 188 9, $[\alpha]_D$ +13 2, w
34	**L-Fucose** (6-Desoxy-L-galactose, L-Rhodeose)	145	−152 6 → −75 9	20	c = 4 water	0 27	178				210 1	181 4	Phenylhydrazone, 170, α-Methylphenylhy-drazone, 174, $[\alpha]_D^{20}$ −17 0, pyr Oxime, 188 9, α-Me gluco-side, 158, $[\alpha]_D^{20}$ −197 5, w β-Me glucoside, 119, $[\alpha]_D^{20}$ +16 04, w
35	**α-D-Glucose**	146 (anh.), 83 (hyd.)	+112 2 → +52 7	20	c = 4, water	0 18	210	−1 5, c = 2, pyr -al (1 1)	266	+223	88, 196 ($[\alpha]_D$ +21 5, me al)	164 6, ($[\alpha]_D$ −43 6 → +18 9 c = 4, pyr)	2-Naphthylhydrazone, 178 *p*-Nitrophenyl-osazone, 257, 2,4-Dinitrophenylosa-zone, 256 7, α-Penta-acetate, 112
36	**2-Desoxy-D-glucose**	148	+46 6	18	water								Benzylphenylhydra-zone, 158 9
37	**β-D-Glucose**	148 50	+18 7 → +52 7	20	c = 4, water		210						*p*-Nitrophenylosa-zone, 257 2,4-Di-nitrophenylosazone, 256 7 β-Penta-acetate, 132
38	**Melezitose** (2-[3-(α-D-Glucosido)-D-fructosido]-α-D-glucose)	153-4 (+2 H_2O)	+88 2	20	c = 4, water				130 (sin-teres)	+188			
39	**Turanose** (3-[α-D-Glucosido]-D-fructose)	157 (anh.), 60 5 (hyd.)	+27 3 → +75 8	20	c = 4, water		215 20						Heptaacetate, 140 1, eth., $[\alpha]_D^{20}$ +37, chl
40	**β-D-Arabinose**	158-9	−175 → −105		c = 9 45, water	0 21	162 3, 160						Oxime, 136, Benzyl-phenylhydrazone, 173
41	**β-L-Arabinose**	160	+190 6 → +104 5	20	water		166		262	+755	186	155	Benzylphenylhydra-zone, 174, Me phenylhydrazone, 165, Oxime, 139, Tetraacetate, α-form 94 6, eth., β-form 86, w., Tetraben-zoate, 160 1, 173, Semicarbazone, 190, 163

*Derivative data given in order m p., crystal color, solvent from which crystallized

TABLE XIX. ORGANIC DERIVATIVES OF CARBOHYDRATES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Specific rotation			Rf Values in *n*-butanol-acetic acid-water (4 1 5)	Phenylosazone		Azoate (*p*-Phenylazobenzoate)		*p*-Nitrophenylhydrazone	*p*-Bromophenylhydrazone	Miscellaneous
			$[\alpha]_D$	T, °C	Conc, Solvent		M P	$[\alpha]_D^T$ Solvent	M P	$[\alpha]_{4358}^{25}$, chl			
42	**β-D-Galacturonic acid**	160	(+55 3)	20	water							151 ($[\alpha]_D$ +11 5, me al)	Phenylhydrazone, 140, Brucine salt, 180
43	**β-Maltose** (4-[α-D-Glucosido]-β-D glucose)	160 5, 102 3 (+1 H_2O)	+111 7 → +130 4	20	c = 4, water	0 11	205-6		275	+2			Phenylhydrazone, 130, *p*-Nitrophenylosazone, 261, *p*-Bromophenylosazone, 198, 2-Naphthylhydrazone, 176, Octaacetate, 160 1, $[\alpha]_D^{20}$ +62 59, chl
44	**DL-Fucose** (6-Desoxy-DL-galactose, DL-Rhodeose)	161					187						Diacetone deriv, 41
45	**DL-Sorbose**	162 3				0 20	169 70						
46	**L-Galactose**	162-3	−120 → −73 6 →		c = 10, water		192 5						Phenylhydrazone, 158 60, $[\alpha]_D$ +21 6, w
47	**DL-Galactose**	163, 144					206						Phenylhydrazone, 158 60, α-Methylphenylhydrazone, 183
48	**β-D-Glucuronic acid**	163	+36 3	20	water						225		Semicarbazone, 188, Cinchonine salt, 204, $[\alpha]_D^{20}$ +139 9, w
49	**DL-Arabinose**	164					169					160	Diphenylhydrazone, 204, *p*-Bromophenylosazone, 200-2
50	**L-Sorbose**	165, 159 61	−43 7 → −43 4	20	c = 12, water	0 20	156, 168	−6, me al					*p*-Bromophenylosazone, 181 *o*-Nitrophenylosazone, 211 2, β-Me glucoside, 120-2, $[\alpha]_D^{20}$ −88 5, w, Pentaacetate, 97, $[\alpha]_D$ +2 9, chl
51	**D-Sorbose**	165	+42 9	20	c = 1, water		168, 160						β-Me glucoside, 119, $[\alpha]_D$ +88 5, w
52	**3-(β-D-Galactosido)-D-arabinose**	166-8	−50 3 → +63 1	19	water		242						Benzylphenylhydrazone, 223-5
53	**α-D-Galactose**	167	+150 7 → +80 2	20	c = 5, water	0 16	196, 201		276	+436	154, 197	168	α-Methylphenylhydrazone, 190-1, Benzylphenylhydrazone, 157, Diphenylhydrazone, 157, α-Pentaacetate, 95
54	**Stachyose** (α-Galactosyl 1→6′ α-galactosyl 1′→4 α-glucosyl 1→2′ β-fructoside)	167-70	+148	20	water								Tetradecaacetate, 95-6, $[\alpha]_D^{22}$ +120, al, Tetradeca-*p*-nitrobenzoate, 166
55	**Sucrose** (2-[α-D-Glucosido]-β-D-fructose)	169 70, me al, 185, w-al	+66 53	20	c = 26, water	0 14			125	+35			Nonreducing, Octaacetate, 72, 69, $[\alpha]_D^{20}$ +59 6, chl, Tritrityl, 128

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE XIX. ORGANIC DERIVATIVES OF CARBOHYDRATES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Specific rotation			Rf Values in *n*-butanol-acetic acid-water (4 1 5)	Phenylosazone		Azoate (*p*-Phenylazobenzoate)		*p*-Nitrophenylhydrazone	*p*-Bromophenylhydrazone	Miscellaneous
			$[\alpha]_D$	T, °C	Conc, Solvent		M P	$[\alpha]_D^T$ Solvent	M P	$[\alpha]_{435as}$, chl			
56	**D-Glucoheptulose**	171	+67 4	20	water		209-10						Hexaacetate, 112, $[\alpha]_D^{20}$ +87 0, α-Me glucoside, 138 40, $[\alpha]_D^{22}$ +108 5 w
57	**4-[β-D-Glucosido]-β-D-mannose**	176 (anh), 139 40 (hyd)	+15 1 → +10 7	16	water		198						
58	**α-L-Rhamnohexose**	180 1	−80 → −61 4	20	c = 9 67, water		200						Benzylphenylhydrazone, 183 4
59	**L-Ascorbic acid**	190, 187	+49	18	me al	0 38					262 (*dl*)	170 (*dl*)	Diphenylhydrazone, 187 Di-2,4 dinitrophenylhydrazone, 282
60	**Gentiobiose** (6-[β-D-Glucosido] D-glucose)	190-5 (anh), 86 (hyd)	+21 4 → +8 7	20	c = 5, water		163 4, 170, 179	−42 9^{20}, 95% al					Octaacetate (α) 188 9, $[\alpha]_D^{20}$ +52 3, chl, (β) 192 3, $[\alpha]_D^{20}$ −5 3, chl
61	**α-D-Glucoheptose**	193	−20	20	water		194-5						β-Me glucoheptoside, 169, $[\alpha]_D$ −75, w, Hexaacetate, 164 (α form), 135 (β-form)
62	**α,α-Trehalose** (1-[α-D-Glucosido]-α-D-glucose)	210 203 (anh) 97 (+2 H_2O)	+178 3	20	c = 7, water				134 5	+210			Nonreducing Octanitrate, 124 Octaacetate, 100 2, $[\alpha]_D^{20}$ +162, chl Hexaacetate, 93-6, $[\alpha]_D^{19}$ +158 3, chl
63	**Primeverose** (6-[β-D-Xylosido]-D-glucose)	210, 208	+24 1 → −3 3		c = 2 5, water		220						β-Heptaacetate, 216, $[\alpha]_D^{20}$ −23 5, chl
64	**Lactose** (4-[β-D-Galactosido]-D glucose)	α-form, 223 (anh), 201 (hyd), β-form, 252 (anh)	+90 → +55 3 (+52 3)	20	c = 4, water	0 09	200, 210-2						*p*-Nitrophenylosazone, 258, Octaacetate, 100 Benzylphenylhydrazone, 128, 2-Naphthylhydrazone, 203
			+35 → +55 3 (+52 3)	20	c = 4, water								
65	**β-Cellobiose** (4-[α-D-Glucosido]-β-D-glucose)	225	+14 2 → +34 6	20	c = 8, water		208 10, 198	−6 5^{20}, pyr-al (1 1)	273	+105			Phenylhydrazone, 90, Octaacetate, (α) 229 30, $[\alpha]_D^{20}$ +42, chl, Semicarbazone, 183 5, Octaacetate (β), 192, 202, $[\alpha]_D^{20}$ −14 5, chl, Oxime, 123 5
66	**6-[β-Cellobiosido]-α-D-glucose**	247-52 (anh), 200 (hyd)	+15 0 → +8 4		water		224						
67	**6-[-β-Lactosido]-α-D-glucose**	257	+34 7 → +22 6	24	water		233						

*Derivative data given in order m p, crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLE XX

Formation of amine by reduction *

$$RNO_2 + 6[H] \rightarrow \underset{\text{Amine}}{RNH_2} + 2\,H_2O$$

From the nitro compound and tin in hydrochloric acid

For directions and examples see Cheronis, p 625, Linstead, p 69, Shriner, p 262, Vogel, p 529, Wild, p 247

From catalytic hydrogenation (Raney nickel, platinum oxide and palladium on charcoal) of the nitro compound in ethanol, methanol or dioxane

See Cheronis, p 626, Linstead, p 70, N D Cheronis and M Koeck, *J Chem Ed*, **20**, 488 (1943), K Johnson and E F Degering, *J Amer Chem Soc*, **61**, 3194 (1939), S V Voris and P E Spoerri, *J Amer Chem Soc*, **60**, 935 (1938), E R Blout and D C Silverman, *J Amer Chem Soc*, **66**, 1442 (1944)

From the nitro compound and lithium aluminum hydride in ethers

See N G Gaylord, *Reduction with Complex Metal Hydrides*, Interscience, New York, 1956, pp 762–773

For partial reduction of polynitro compounds with sodium or ammonium polysulfide *see* Linstead, p 71, Vogel, p 551

NOTE For directions and examples for the preparation of the derivatives of the amine formed on reduction of the nitro compounds see explanations and references to Table XVIII, p 291, 292, 293, 294

Polynitro derivative *

$$ArNO_2 \xrightarrow{HNO_3} Ar(NO_2)_n \qquad n > 1$$

From the aromatic nitro compound with concentrated or fuming nitric acid and sulfuric acid

For directions and examples see Cheronis, pp 580, 627, Shriner, p 249, Vogel, pp 526, 527

From fuming nitric acid in acetic acid or acetic anhydride

See Wild, pp 24, 247, 248, J Reilly and W J Hickinbottom, *J Chem Soc*, **117**, 135 (1920), O L Brady and W H Gibson, *J Chem Soc*, **119**, 102 (1921)

Molecular compounds of aromatic polynitro compounds with aromatic hydrocarbons

$$Ar(NO_2)_n + Ar'H \rightarrow \underset{\substack{\text{Molecular}\\ \text{compound}}}{Ar(NO_2)_n \cdot Ar'H} \qquad n > 1$$

Molecular addition compounds are formed from the aromatic polynitro compound and aromatic hydrocarbons

For directions and examples see Table IV, p 32, 33, 34 Wild, p 248, T Asahina and C Shinomiya, *J Chem Soc Japan*, **59**, 341 (1938), O C Dermer and R B Smith, *J Amer Chem Soc*, **61**, 748 (1939)

Nitroaromatic acids from side-chain oxidation

$$Ar(NO_2)R \rightarrow \underset{\substack{\text{Nitroaromatic}\\ \text{acid}}}{Ar(NO_2)COOH}$$

From the alkylaromatic nitro compound and basic aqueous potassium permanganate

For directions and examples see Cheronis, p 627, Vogel, p 629

From the alkylaromatic nitro compound and sodium bichromate and sulfuric acid in water

See Cheronis, p 628, Vogel, p 629

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE XX. ORGANIC DERIVATIVES OF NITRO COMPOUNDS

a) Liquids (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	Melting point °C	n_D	Density g/ml	Data for the corresponding amine obtained on reduction of *all* nitro groups						Nitration product		Miscellaneous
						Amine		Acet amide	Benz amide	Benzene sulfon amide	Picrate	Melting point, °C	Position of nitro groups	
						Boiling point, °C	Melting point, °C							
1	**Nitroethylene**	98 9			$1\ 073^{14}$	16 5			71	58	165			Polymerizes readily on contact with base
2	**Nitromethane**	101	−17	$1\ 3797^{25}$	$1\ 1297^{25}_{4}$	−6		28	80	30	207 215			
3	**Nitroethane**	114		$1\ 392^{20}$	$1\ 0497^{20}_{4}$	16 5			71	58	165			
4	**2-Nitropropane**	120		1 394	$1\ 024^{0}$	33			26					Phenylthiourea deriv of amine, 101, 1-Naphthylurea deriv of amine, 200
5	**3-Nitropropylene** (3 Nitropropene)	125 30			$1\ 051^{21}$	58				39	140			
6	**1-Nitropropane**	132		$1\ 4002^{24}$	$1\ 008^{24}_{4}$	49			84	36	135			
7	**DL-2-Nitrobutane**	140		1 4013	$0\ 9877^{0}$	63			76	70	139-40			
8	**2-Methyl-1-nitropropane**	140 1			0 987 ?	69			57	53	150			*p* Toluenesulfonamide deriv of amine, 78
9	**2-Methyl-2-nitrobutane**	150				78					183			
10	**DL-2-Nitropentane**	152 4				92								Hydrochloride of amine, 168, Oxalate, 226 131 Chloroaurate, 82 3
11	**1-Nitrobutane**	153		$1\ 4103^{20}$	$0\ 9710^{20}_{4}$	77					151			Phenylthiourea deriv of amine, 65, 1-Naphthylurea deriv of amine, 149
12	**1-Nitroisobutylene** (1-Nitroisobutene)	154-8			$1\ 052^{0}_{0}$	69			57	53	150			
13	**3-Methyl-1-nitrobutane**	164				96					138			Phenylthiourea deriv of amine, 102, 1-Naphthylurea deriv of amine, 132
14	**1-Nitropentane**	173		1 4175	$0\ 9525^{20}_{4}$	104					139			Phenylthiourea deriv of amine, 69, 2-Naphthylthiourea deriv of amine, 114
15	**2-Nitrohexane**	176			$0\ 9357^{20}_{0}$	116-8								
16	**1-Nitrohexane**	193		1 4234	$0\ 9396^{20}_{4}$	130			40	96	126			
17	**1-Nitroheptane**	193 5			$0\ 9476^{17}$	155					121			Phenylthiourea deriv of amine, 75
18	**2-Nitroheptane**	194 8			$0\ 9466^{0}$	142								Hydrochloride of amine, 133 Oxalate, 204 5, Chloroaurate, 63-4
19	**Nitrocyclohexane**	205 6	−34	$1\ 4612^{19}$	$1\ 068^{19}_{4}$	134		104	147					$SnCl_2 + HCl \rightarrow$ Cyclohexanone oxime 89 90
20	**1-Nitrooctane**	206 10 part d			$0\ 9346^{20}$	180					112			1 Naphthylthiourea deriv of amine, 72
21	**Nitrobenzene**	210 1		$1\ 553^{20}$	$1\ 20314^{20}_{4}$	184		114	160	112		90	1,3	
22	**2-Nitrotoluene**	222		$1\ 5474^{20}$	$1\ 1622^{19}_{15}$	200		110 11	146, 143	124	213	70 1	2,4	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XX. ORGANIC DERIVATIVES OF NITRO COMPOUNDS

a) Liquids (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Data for the corresponding amine obtained on reduction of *all* nitro groups						Nitration product		Miscellaneous
						Amine		Acet-amide	Benz-amide	Benzene sulfon-amide	Picrate	Melting point, °C	Position of nitro groups	
						Boiling point, °C	Melting point, °C							
23	**1-Ethyl-2-nitrobenzene**	224		$1\ 5407^{19}$	$1\ 126^{24}$	210 11; 214		111-2	147		194 5			
24	**1,3-Dimethyl-2-nitrobenzene** (2-Nitro-*m*-xylene)	226	13		$1\ 112^{15}$	215 218		177	168		180	182	1,3,5	*p*-Toluenesulfonamide deriv of amine, 212
25	**Phenylnitromethane**	226d		$1\ 5323^{20}$	$1\ 1598_0^{20}$	184-5		60	105	88	194			
26	**3-Nitrotoluene**	233	16	$1\ 5470^{21}$	$1\ 1571_4^{20}$	203		65	125	95	200			Oxid → 3-nitrobenzoic acid, 140
27	**1,4-Dimethyl-2-nitrobenzene** (2-Nitro-*p*-xylene)	241 2			$1\ 132^{15}$	213-5		139	140	138	171	139	1,2,4	
28	**1-Ethyl-4-nitrobenzene**	241		$1\ 5458^{19}$	$1\ 124^{25}$	216 214		94	151			37	2,4,6	*p*-Toluenesulfonamide deriv of amine, 104
29	**1,3-Dimethyl-4-nitrobenzene** (4-Nitro-*m*-xylene)	246	2		$1\ 126^{17.5}$	217		133 130	192	129-30	209	182	1,3,5	
30	**1,2-Dimethyl-3-nitrobenzene** (3-Nitro-*o*-xylene)	250	15			221-2		135	189		221	82	1,2	
31	**2-Nitro-*p*-cymene**	264		$1\ 5309^{20}$	$1\ 0744_4^{20}$	241		71	102			54	2,6	
32	**2-Nitroanisole**	265	10	$1\ 5620^{20}$	$1\ 2540_4^{20}$	225	5-6	85 88	60 84	89	200	68	2,4,6	
33	**1-*tert*-Butyl-4-nitrobenzene**	267				230	17	169-70	134-6					Dil HNO_3 → 4-nitrobenzoic acid, 240
34	**2-Nitrophenetole**	268	5-6	$1\ 5425^{20}$	$1\ 1903^{15}$	229		79	104	102		86	2,4	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XX. ORGANIC DERIVATIVES OF NITRO COMPOUNDS

b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point, °C	Data for the corresponding amine obtained on reduction of *all* nitro groups						Nitration product		Miscellaneous
				Amine		Acet-amide	Benz-amide	Benzene sulfon-amide	Picrate	Melting point °C	Position of nitro groups	
				Boiling point, °C	Melting point, °C							
1	**2-Methyl-2-nitropropane** (*tert*-Nitrobutane)	25 6	127	46			134		198			Phenylthiourea deriv of amine, 120
2	**4-Fluoro-1-nitrobenzene**	25–7		184 6		152	185					N-*p*-Nitrobenzamide deriv of amine, 181
3	**1-Nitro-2,3,6-trimethyl-benzene**	30		235		186						
4	**3,4-Dimethyl-1-nitro-benzene** (4-Nitro-*o*-xylene)	30		226	51, 47 8	99				82	1,2	N-Formyl deriv of amine, 52 N-Chloroacetyl, 109
5	**2-Chloro-1-nitrobenzene**	32		209		87	99	129	134	50 52	2,4	
6	**2,4-Dichloro-1-nitro-benzene**	33	258		63	143–6	115	128	106			N-Formyl deriv of amine, 154
7	**4-Bromo-3-nitrotoluene**	33		136[16]		121, 114						
8	**3-Nitrophenetole** (3-Ethoxy-1-nitro-benzene)	34		248		97	103		158			*p*-Toluenesulfonamide deriv of amine, 157
9	**2-Nitrobiphenyl**	37, 33			49–50	121	102					N-Formyl deriv of amine, 75
10	**6-Chloro-2-nitrotoluene**	37	238		245	157-9 136	173					Oxid → 6-chloro-2-nitro-benzoic acid, 161
11	**3-Iodo-1-nitrobenzene**	38, 35			33, 27	119	157					*p*-Toluenesulfonamide deriv of amine, 128
12	**3-Nitroanisole** (3-Methoxy-1-nitro benzene)	38	258	251		81			169	106	3,5	*p*-Toluenesulfonamide deriv of amine, 68
13	**4-Chloro-2-nitrotoluene**	38	240		21–2	139 40, 131						Oxid → 4-chloro-2-nitro-benzoic acid, 142
14	**5-Nitroindane**	40, yel	152[14]	250	37–8	106	137					
15	**2-Bromo-1-nitrobenzene**	43		250	32	99	116		129	72	1,3	
16	**4-Nitroindane**	44	139[10]	236	−3	126	136					
17	**Nitromesitylene**	44		232 3		216–7	204		189 91	86	*di*	*p*-Toluenesulfonamide deriv of amine, 167
18	**3-Chloro-1-nitro-benzene**	45		230		72, 78	119 20	121	177			
19	**2-Nitroazoxybenzene**	49, yel			98	156						
20	**2-Iodo-1-nitrobenzene**	49			61, 58	109	139		112			
21	**4-Nitrotoluene**	52	234	200	45	147	158	120	182	70	2,4	
22	**4-Chloro-1,3-dinitro-benzene** (1-Chloro-2,4-dinitrobenzene)	52			91	142 (*di*)	178 (*di*)			183	2,4,6	NaOH → 2,4-Dinitrophenol, 114, Hydrazine → 2,4-di-nitrophenylhydrazine, 199
23	**4-Nitroanisole** (4-Methoxy-1-nitro-benzene)	53		240	58	130, 127	154	95		89	2,4	
24	**2,5-Dichloro-1-nitro-benzene**	54			50, lgr	132	120			104	1,3	
25	**4-Iodo-3-nitrotoluene**	55			48, 38	151, 136						N-Formyl deriv of amine, 129, NaOH → 3-Nitro-*p*-cresol, 36–7
26	**3-Bromo-1-nitrobenzene**	56		251	18	87	120, 136		180	59	1,2	
27	**1-Nitronaphthalene**	57, 60			50	159	160	167	163, 181			
28	**β-Nitrostyrene**	58, yel	250–60d									Irradiation → dimer, 180–7
29	**1-Methyl-2-nitro-naphthalene**	58–9, yel			51	188–9	222					

*Derivative data given in order m p , crystal color, solvent from which crystallized.

TABLE XX. ORGANIC DERIVATIVES OF NITRO COMPOUNDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Data for the corresponding amine obtained on reduction of *all* nitro groups						Nitration product		Miscellaneous
				Amine		Acet-amide	Benz amide	Benzene sulfon-amide	Picrate	Melting point, °C	Position of nitro groups	
				Boiling point, °C	Melting point, °C							
30	**4-Nitrophenetole** (1-Ethoxy-4-nitro-benzene)	60 58		248 254	3 4	137	173	143	69	86	2,4	
31	**3,4-Dinitrotoluene**	61		265	89 90	4 *mono* 131 2, *di* 210	3-*mono* 193 4 *di* 263 4	178 9 (*di*)				Oxid → 3,4-dinitrobenzoic acid, 165, 161
32	**3-Nitrobiphenyl**	61, 59			30	148						
33	**2,3-Dinitrotoluene**	63		255	63 4							$(NH_4)_2S$ → 2-Nitro-*m*-toluidine, 108, red HNO_3 → 2,3-Dinitrobenzoic acid, 201
34	**1-Methyl-8-nitro-naphthalene**	63 4			67 8	183-4	195 6					
35	**2,6-Dinitrotoluene**	66			105	202 3				80, 82	2,4,6	Oxid → 2,6 Dinitrobenzoic acid, 202 3
36	**2,4,6-Trinitroanisole** (1-Methoxy-2,4,6-trinitro-benzene)	68										Naphthalene adduct, 69-70, NH_3 in al → picramide, 188
37	**2,4-Dinitrotoluene**	70, 72		292	99	224 (*di*)	224 (*di*)	2 *mono* 138 *di* 191		80 82	2,4,6	Naphthalene adduct, 60, Oxid → 2,4-dinitrobenzoic acid 182-3 $SnCl_2$ + HCl → 4-Nitro-*o*-toluidine, 107 vel
38	**2-Nitroazobenzene**	71, or-red			59	126	122					
39	**1-Methyl-4-nitro-naphthalene**	71-2, pa yel			51 2	166 7	238 9					Dil HNO_3 → 4-nitro-1-naphthoic acid, 220-1
40	**4-Bromo-1,3-dinitro-benzene** (1-Bromo-2,4-dinitrobenzene)	75, 72										NaOH → 2,4-Dinitrophenol, 114 Al NH_3 → 2,4-dinitro-aniline, 180 188, yel Sn + HCl → 1,3-Diaminobenzene 63, Hydrazine → 2,4-dinitro-phenylhydrazine, 199
41	**3,5-Dimethyl-1-nitro-benzene**	75	273	220-1		144, 140						N-Formyl deriv of amine, 76 7
42	**4,5-Dimethyl-1,3-dinitrobenzene**	76										$(NH_4)_2S$ → 1-Amino-3,4-dimethyl-5-nitrobenzene, 75 Acetyl deriv of this, 209-10, Benzoyl deriv of this, 223-4
43	**5-Methyl-2-nitro-naphthalene**	76 7			63 4	123-4	155-6					
44	**2-Nitronaphthalene**	78			112	132	162	102	195			
45	**2,4,6-Trinitrophenetole** (1-Ethoxy-2,4,6-tri-nitrobenzene)	78										Naphthalene adduct, 39, NH_3 in al → picramide, 188
46	**2,4,6-Trinitrotoluene** (T N T)	80, 82										Naphthalene adduct, 97; CrO_3/conc H_2SO_4 → 2,4,6-trinitrobenzoic acid, 220
47	**2-Methyl-1-nitro-naphthalene**	81, yel			32, pet eth	188	180					
48	**4-Nitrophenanthrene**	81			105	190	224					
49	**3,4-Dimethyl-1,2-dinitrobenzene**	82										Reduct → 1-amino-3,4-dimethyl-2-nitrobenzene, 66, red , Acetyl deriv of this, 115 6, Benzoyl deriv of this, 199-200

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XX. ORGANIC DERIVATIVES OF NITRO COMPOUNDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Data for the corresponding amine obtained on reduction of *all* nitro groups						Nitration product		Miscellaneous
				Amine		Acet-amide	Benz-amide	Benzene sulfon-amide	Picrate	Melting point °C	Position of nitro groups	
				Boiling point, °C	Melting point, °C							
50	**5-Methyl-1-nitro-naphthalene**	82 3			77 8	194 5	173 4					
51	**Picryl chloride**	83				208 (*tri*)		211				NaOH → Picric acid, 122 NH_3 → 2,4,6-Trinitroaniline, 188 192 5
52	**4-Chloro-1-nitrobenzene**	84			72	179 172	192	122				NaOH → 4 Nitrophenol, 114
53	**2,5-Dibromo-1,4-dinitro-benzene**	127										2,5-Dibromo-*p*-nitroaniline, 175, yel
54	**2,4-Dimethyl-1,3-dinitrobenzene**	84 82			65 6, lgr	>260 (*di*)	232 (227) (*di*)					Reduct → 1 amino-2,4-dimethyl 3-nitrobenzene 84 N N Diformyl, 219 20
55	**2,4-Dinitromesitylene**	85								232	2,4,6	Reduct → 2-amino-4 nitro mesitylene, 75 Acetyl deriv of this 191 Benzoyl deriv of this, 169 Benzenesulfonyl deriv of this, 163
56	**2,5-Dibromo-1-nitro-benzene**	85			51 2	171 2						
57	**4-Bromo-1-nitro-naphthalene**	85			102	193						N-Formyl deriv of amine, 172
58	**2,4-Dinitrophenetole** 1 3-Dinitro-4-ethoxybenzene	86			67 8	193 (*di*)				78	2,4,6	Reduct → 2-nitro *p*-phenetidine, 40
59	**4-Chloro-1-nitro-naphthalene**	87 85			98	186						
60	**1,3-Dinitrobenzene**	90			63	191 (*di*), 87 9 (*mono*)	240 (*di*), 125 (*mono*)	194	184			$(NH_4)_2S$ → 3 Nitroaniline, 114 Naphthalene adduct, 52
61	**2,3-Dimethyl-1,4-dinitrobenzene**	90			116	275 6 (*di*)						1-amino-2,3-dimethyl-4-nitrobenzene, 114
62	**3,5-Dinitrotoluene**	92		283 5		235 6 (*di*)						Oxid → 3,5-dinitro-benzoic acid 204 5 $(NH_4)_2$ S → 5-Nitro-*m* toluidine 98
63	**3,6-Dimethyl-1,2-dinitrobenzene**	93			75							Oxid → 2,3-dinitro-*p*-toluic acid, 249
64	**4,6-Dimethyl-1,3-dinitrobenzene**	93			105	1-*mono* 165 *di* 295	258 9 (*di*)			125	4,5,6	N,N'-Diformyl deriv of amine, 182 3
65	**2,4'-Dinitrobiphenyl**	93		363	45	202 (*di*)	276 8 (*di*)					
66	**8-Chloro-1-nitro-naphthalene**	94			88 9 96	137						
67	**2,4-Dinitroanisole** 1,3-Dinitro-4 methoxybenzene	95										2,4 Dinitrophenol, 114, Naphthalene adduct, 50, Reduct → 2 amino-4-nitroanisole, 118, or -red, Acetyl deriv of this, 175 6
68	**3-Nitroazobenzene**	96, or			56 7	130–1						
69	**4-Chloro-2-nitroanisole** (5-Chloro-2-methoxy-1-nitrobenzene)	98			84	104	77 8		194			
70	**2-Nitrophenanthrene**	99, pa yel			85, pa yel	225	216					CrO_3 → 2-Nitrophenanthraquinone, 260, golden yel
71	**8-Bromo-1-nitro-naphthalene**	99–100			90	138 9						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XX. ORGANIC DERIVATIVES OF NITRO COMPOUNDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Data for the corresponding amine obtained on reduction of *all* nitro groups						Nitration product		Miscellaneous
				Amine		Acet-amide	Benz-amide	Benzene sulfon-amide	Picrate	Melting point, °C	Position of nitro groups	
				Boiling point, °C	Melting point, °C							
72	**3,5-Dimethyl-1,4-dinitro-benzene**	101			104							Reduct → 1-amino-2,6-dimethyl-4-nitrobenzene, 158
73	**1,2-Dinitronaphthalene**	102–3, br			98	234 (*dl*)	291 (*dl*)	1-*mono* 215				
74	**5-Nitroacenaphthene**	106, 101, yel			108	238	210, 199		190 200			
75	**2,β-Dinitrostyrene**	106–7, yel										Alk $KMnO_4$ → 2-nitro-benzoic acid, 146–8
76	**5-Chloro-1-nitro-naphthalene**	111			85	128						
77	**3-Nitrodurene** (3-Nitro-1,2,4,5-tetramethyl-benzene)	112 3		261 2	75	207						
78	**4-Nitrobiphenyl**	114		302	53	171	230					N-Formyl deriv of amine, 172
79	**9-Nitrophenanthrene**	116–7			137 8, 104	207–8	199		190			Picrate, 78–9
80	**1,2-Dinitrobenzene**	118			102	185 (*dl*)	301 (*dl*)	185				$(NH_4)S$ → 2-Nitroaniline, 71, Hot aq NaOH → 2-nitro-phenol, 45
81	**2,4'-Dinitrodiphenyl-methane**	118, yel			88–9	224 5 (210) (*dl*)						Oxid → 2,4'-dinitrobenzo-phenone, 197
82	**4,5-Dimethyl-1,2-dinitro-benzene**	118, 115			126	227–8 (*dl*)						Reduct → 1-amino-4,5-dimethyl-2-nitrobenzene, 140
84	**3-Methyl-2-nitro-1,4-naphthoquinone**	121–2, 125, yel										Dil $KMnO_4$ → phthalic acid, 200–6, Na_2SO_3 Reduct or Fe + ac a → 2-amino-3-methyl-1,4-naphthoquinone, 167, red
85	**1,3,5-Trinitrobenzene**	122										Anthracene adduct, 164, Naphthalene adduct, 156, Fluorene adduct, 105
86	**5-Bromo-1-nitro-naphthalene**	122			69, 63–4	215						
87	**Picric acid**	122										Naphthalene adduct, 149, Fluorene adduct, 84, Anthracene adduct, 138, *n*-Butylammonium picrate, 151
88	**2,5-Dimethyl-1,3-dinitro-benzene**	123 4			102–3							Reduct → 1-amino-2,5-dimethyl-3-nitrobenzene, 98
89	**1-Nitro-2,4,6-tribromo-benzene**	125			122	232	198					Formyl deriv of amine, 222
90	**4-Bromo-1-nitrobenzene**	126			66	168	204	134	180			NaOH → 4-Nitrophenol, 114
91	**2,2'-Dinitrobiphenyl**	124, 128			81	*mono* 89 90, *dl* 161	*mono* 158–60, *dl* 190 1					N,N'-Diformyl deriv of amine, 137
92	**1,4-Dinitronaphthalene**	131–2, yel			120, yel	303 4 (*dl*)	280 (*dl*)					
93	**3,5-Dimethyl-1,2-dinitro-benzene**	132			78							Reduct → 1-amino-2,4--dimethyl-6-nitrobenzene, 76
94	**4-Nitroazobenzene**	135, or		>360	126	144–6	211, 205					

*Derivative data given in order m.p , crystal color, solvent from which crystallized

TABLE XX. ORGANIC DERIVATIVES OF NITRO COMPOUNDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Data for the corresponding amine obtained on reduction of *all* nitro groups						Nitration product		Miscellaneous
				Amine		Acet amide	Benz-amide	Benzene sulfon amide	Picrate	Melting point, °C	Position of nitro groups	
				Boiling point °C	Melting point °C							
95	**4-Chloro-1,5-dinitro-naphthalene**	138										NaOH → 4 8-Dinitro-1-naphthol, 235 Sn + HCl → 1,5-Diaminonaphthalene, 190, PCl_5 → 1,4,5-Trichloronaphthalene, 131
96	**2-Nitroindene**	141										Zn + Ac a → 2-indanone oxime, 155
97	**4-Bromo-1,5-dinitro-naphthalene**	143										NaOH → 4,8 Dinitro-1-naphthol, 235, HNO_3 At 180 → 3-nitrophthalic acid, 218
98	**2,4-Dinitrostilbene**	143 5, yel			119 20, pa yel							
99	**1,3-Dinitronaphthalene**	144 5, yel			96	263 5 (*dı*)						
100	**9-Nitroanthracene**	146, yel			145 50	273 4						CrO_3 Oxid of amine → anthraquinone 273 286, yel
101	**4-Chloro-1,3-dinitro-naphthalene**	146 7										Warm dil NaOH → 2,4 dinitro 1 naphthol, 140
102	**2,5-Dimethyl-1,4-dinitrobenzene**	147, 142			150							Reduct → 1 amino 2 5 dimethyl-4-nitrobenzene, 144 5
103	**3-Nitroacenaphthene**	151–2, yel			81 2	192 3	209 10		221			
104	**4-Nitroazoxybenzene**	153, pa yel			138	151 172						
105	**3,8-Dinitroacenaphthene**	155–6, br -yel			167 8, yel							
106	**2-Nitrofluorene**	156, 154			129	191						
107	**3-Nitro-1,2-naphtho-quinone**	156, red										$SnCl_2$ + HCl → 3-Amino 1,2-naphthohydroquinone, 164 Dil HNO_3 → phthalic acid, 200 6
108	**2,2′-Dinitrodiphenyl-methane**	159			160							Oxid → 2,2′-dinitrobenzophenone, 188 9
109	**1,6-Dinitronaphthalene**	161 2, 166, pa yel			85–6, 77	257 (263) (*dı*)	265 (*dı*)					
110	**1,8-Dinitronaphthalene**	170, 173			66		311 2 (*dı*)			218	1,3,8	
111	**4-Bromo-1,8-dinitro-naphthalene**	170, yel										NaOH → 4,5-Dinitro 1 naphthol, 235, HNO_3 At 180 → 3-nitrophthalic acid, 218, Al NH_3 → 4-amino-1,8-dinitronaphthalene, 246, red, Acetyl deriv of this, 245
112	**3-Nitrophenanthrene**	170–1			87 8	200 1	213					
113	**4-Iodo-1-nitrobenzene**	173			67 8	184	222					
114	**1,4-Dinitrobenzene**	173, 171			140, 147	304 (*dı*), 162 3 (*mono*)	300 (*dı*), 128 (*mono*)	247 (*dı*)				Aq NaOH → 4-nitrophenol, 114
115	**3,3′-Dinitrodiphenyl-methane**	175			53–4	193 (*dı*)						Oxid → 3,3′-dinitrobenzophenone, 155

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XX. ORGANIC DERIVATIVES OF NITRO COMPOUNDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Data for the corresponding amine obtained on reduction of *all* nitro groups						Nitration product		Miscellaneous
				Amine		Acet amide	Benz amide	Benzene sulfon amide	Picrate	Melting point °C	Position of nitro groups	
				Boiling point °C	Melting point °C							
116	**4-Nitrophenanthrene-quinone**	179 80, pa yel										CrO_3 → 6-Nitrodiphenic acid, 248 50, *o*-Phenylene diamine → quinoxaline deriv, 217-8, Monoxime, 169-70, Dioxime, 210, Monosemicarbazone, 210-11
117	**4-Chloro-1,8-dinitro-naphthalene**	180, pa yel										NaOH → 4,5-Dinitro-1-naphthol, 235, PCl_5 → 1,4,5-Trichloronaphthalene, 131
118	**9-Nitrofluorene**	181 2			64 47	262	260-1					
119	**4,4'-Dinitrodiphenyl-, methane**	183			93	236 7 (*di*)						Oxid → 4,4'-dinitrobenzophenone, 189
120	**4-Chloro-3-nitro-1,2-naphthoquinone**	184, red										Aniline → 2-anilino-3-nitro-1,4-naphthoquinone-4-anil, 250
121	**2-Nitroanthraquinone**	185			303-6	262	227-8					
122	**2,2'-Dinitrostilbene**	196, yel			176, golden yel	304 (*di*)			209			
123	**4,β-Dinitrostyrene**	199, yel										Acid $K_2Cr_2O_7$ → 4-nitrobenzoic acid, 240
124	**3,3'-Dinitrobiphenyl**	200, yel			94	257 8 (*di*)						
125	**2,5-Dinitrofluorene**	207, yel			175	289 (*di*)						
126	**2,2'-Dinitroazobenzene**	209-10, 194-5 yel			134, red	271 (*di*), or						
127	**1,5-Dinitronaphthalene**	214 217			190	360 (*di*)				154	1,4,5	
128	**4,4'-Dinitroazobenzene**	222 3 216, or -red			250-1	212 (*mono*)						
129	**2,5-Dinitrophenanthrenequinone**	228, yel - red										Monoxime, 190 1, *o*-Phenylenediamine → quinoxaline deriv, 262-4
130	**1-Nitroanthraquinone**	230			252, 243	218	255					
131	**2,7-Dinitronaphthalene**	234, yel			166 159	261 (*di*)	267 (*di*)		210 (*di*)			
132	**4,4'-Dinitrobiphenyl**	237 240			128	317 (*di*), 199 (*mono*)	352 (*di*), 203-5 (*mono*)					
133	**1,3-Dinitroanthraquinone**	240, yel			290		>300					
134	**1,6-Dinitroanthraquinone**	255-7, yel			262, red	295 (*di*)	275 (*di*)					
135	**2-Nitrophenanthrenequinone**	258-60, yel			205-10, dk vlt							CrO_3 → 4-Nitrodiphenic acid, 217, Monoxime, 213, Monothiosemicarbazone, 234 5
136	**3-Nitrophenanthrenequinone**	279-80, or										CrO_3 → 5-Nitrodiphenic acid, 268, Monoxime, 240, Dioxime, 200, Monosemicarbazone, 254, red
137	**2,7-Dinitroanthraquinone** (Fritzsche's reagent)	280, 262, pa yel			>330	>350 (*di*)	300 (*di*)					

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XX. ORGANIC DERIVATIVES OF NITRO COMPOUNDS

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Data for the corresponding amine obtained on reduction of *all* nitro groups						Nitration product		Miscellaneous
				Amine		Acet amide	Benz amide	Benzene sulfon amide	Picrate	Melting point °C	Position of nitro groups	
				Boiling point °C	Melting point °C							
138	*trans*-4,4 -Dinitro-stilbene	288, yel			231, yel	353 (*dl*)	352 (*dl*)					
139	**9,10-Dinitroanthracene**	294 263 yel										Oxid → anthraquinone, 273 286 yel
140	**1,7-Dinitroanthra-quinone**	295			290, red	283 (*dl*)	325 (*dl*)					
141	**2,7-Dinitrophenanthrene-quinone**	301 3, pa yel			>360, dk vlt							CrO_3 → 4,4 Dinitrodiphenic acid, 257 8, Monoxime, 246–8, *o*-Phenylenediamine → quinoxaline deriv , 356, Fluorene adduct, 270, red -yel
142	**1,8-Dinitroanthra-quinone**	311 2			262, red	284 (*dl*)	324 (*dl*)					
143	**1,5-Dinitroanthra-quinone**	384–5, pa yel			319, red	317 (*dl*)	>350 (*dl*)					Monoxime, 253

* Derivative data given in order m p , crystal color, solvent from which crystallized

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EXPLANATIONS AND REFERENCES TO TABLE XXI

Hydrolysis to the corresponding acid *

$$RCN + 2H_2O \xrightarrow{H_2SO_4} \underset{\text{Acid}}{RCOOH} + NH_4HSO_4$$

$$RCN + H_2O \xrightarrow{NaOH} \underset{\substack{\text{Sodium salt}\\ \text{of the acid}}}{RCOONa} + NH_3$$

From the nitrile and 75% sulfuric acid, or 4 1 phosphoric acid-sulfuric acid

For directions and examples see Cheronis, pp 618, 619, Linstead, p 65, Shriner, p 258, Vogel, p 410, Wild, p 250

From the nitrile and potassium hydroxide in aqueous methanol, ethanol or benzyl alcohol

See Linstead, p 65, Vogel, pp 410, 805, Wild, p 250, L Palfray, S Sabetai and S Rovira, *Compt Rend*, **209**, 483 (1939)

From the nitrile and potassium hydroxide in ethylene glycol or glycerol

See Cheronis, pp 618, 620, S Rovira and L Palfray, *Compt Rend*, **211**, 396 (1940)

NOTE For the directions and examples for the preparation of the derivatives of the carboxylic acid formed on hydrolysis see the explanations and references to Tables XII, XIII and XIV, pp 186, 187, 188, 189

Partial Hydrolysis to the corresponding amide *

$$RCN + H_2O \xrightarrow{H_2SO_4} \underset{\text{Amide}}{RCONH_2}$$

From the nitrile with sulfuric acid

For directions and examples see Cheronis, pp 619, 620 Vogel, p 411

Reduction to the corresponding amine *

$$RCN + 4[H] \rightarrow \underset{\text{Amine}}{RCH_2NH_2}$$

From the nitrile and sodium in absolute ethanol

For directions and examples see Cheronis, p 621, Shriner, p 259, Vogel, p 411, Wild, p 254, H B Cutter and M Taras, *Ind Eng Chem, Anal Ed*, **13**, 830 (1941)

From the nitrile and lithium aluminum hydride in ether

See W G Brown in *Organic Reactions*, Vol 6 (Ed R Adams), John Wiley and Sons, New York, 1951, p 469, N G Gaylord, *Reduction with Complex Metal Hydrides*, Interscience, New York, 1956, pp 731-750

For summary of reduction methods see V Migrdichian, *Organic Cyanogen Compounds*, Reinhold Publishing Corp, New York, 1947, pp 151-172

NOTE For directions and examples for the preparation of the derivatives of the amine formed on reduction of the nitrile see explanations and references to Table XVIII, pp 291, 292, 293, 294

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point, °C	Melting point °C	n_D	Density g/ml	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2					Miscellaneous
						Acid		Amide	Anilide	S-Benzyl thiuronium chloride	Amine	Benzamide	Benzene sulfonamide	Phenyl thiourea	Picrate	
						B P , °C	M P °C				B P °C					
1	**Cyanoacetylene**	42 5	5	1 38699[1]	0 8159[1]	144d , 83 4 [0]	18	61 2	87							$HgNO_3$ → Wh precipitate, Dimer, 64 5-5 0
2	**Cyanoacetaldehyde**	71 2			0 881[1]						45 6[1]					HNO_3 → Cyanoacetic acid, 66, 2,4-Dinitro phenylhydrazone, 170 1, aq al , *p*-Nitrophenylhydrazone, 153-4
3	**Acrylonitrile**	77 8		1 393[20]	0 797$_4^{20}$	140	13	85	105							Gives solid polymer on addition of conc NaOMe sol
4	**Fluoroacetonitrile**	80				165	33	77								
5	**Acetonitrile** (Cyanomethane)	81-2		1 3442[20]	0 7828$_4^{20}$	118		82	114	135	16 5	71	58	106, 135	165	
6	**Trichloroacetonitrile**	86, 83 4			1 439[12]	196 7	58	141	95-7							
7	**Methacrylonitrile** (α-Methylacrylonitrile)	90 1		1 399[25]	0 7991[18]	160	15 6	102 6								Gives solid polymer on heating with benzoyl peroxide
8	**Propionitrile** (Cyanoethane)	97, 103 5		1 3659[25]	0 777$_4^{25}$	141		79	106	151	49	84	36	63	135	
9	**Isobutyronitrile**	104, 107 8			0 773	154 3	−47	129	109 10	143	69	57	53	82	150	
10	**Trimethylacetonitrile** (*tert*-Butylcyanide)	106	15-6	1 3792			35	153 4	127-9							
11	**2-Ethylacrylonitrile**	111		1 4132		180		84, bz								
12	**Dichloroacetonitrile**	113			1 374[11 5]	194	5 6	98								Me ester of acid, 143-4
13	**α-Chloroisobutyronitrile**	116		1 4045[25], 1 435[14]	1 064$_{14}^{14}$		31		69 70							
14	***n*-Butyronitrile** (1-Cyanopropane)	117		1 3812[24]	0 796[1]	162		116	96	146	77			65	151	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES
a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2					Miscellaneous
						Acid		Amide	Anilide	S-Benzyl thiuronium chloride	Amine	Benzamide	Benzene sulfonamide	Phenyl thiourea	Picrate	
						B.P., °C	M.P., °C				B.P., °C					
15	*trans*-**Crotononitrile**	119		1.4217		189	72	158	115		83.4			109.5–10.5	131.5–2.5	n_D^{29} of amine 1.4263, 1-Naphthylthiourea of amine, 129–30
16	**Allylcyanide**	119		1.4060^{20}	0.835^{15}	169, 163		73	58	75.7				123.7, 56.7	136.8 7.4	n_D^{25} of amine 1.4191, Al KOH → crotonic ac., 72 1-Naphthylthiourea of amine, 109–10
17	**Methoxyacetonitrile**	120		1.380^{28}	0.9373_4^{28}	203–4		96	58							
18	**2-Hydroxyisobutyronitrile** (Acetone cyanohydrin)	120d	−19	1.3996^{20}	0.93_4^{20}		79	98	136							
19	**3-Hydroxy-4-methoxybenzonitrile**	124 131.5–2.0					255.7									Acetate, 116, Acetate of acid, 206–7, Me ester of acid, 83.4, 66–7
20	**2-Methylbutyronitrile**	125.6		1.380^{25}	0.8061_4^0	177		112	110		95.5–6.0					HCl salt of amine, 176, H_2PtCl_6 salt of amine, 240
21	**Chloroacetonitrile**	127			1.193^{20}	189	63	120	137						142–3	Addition comp with $AlCl_3$, 38, HCl salt of amine, 144
22	**Isovaleronitrile**	130			0.7884_0^{20}	176		136	113, 109–10	153	96			102	138	3-Nitrohydrogen phthalate of amine, 108
23	**2,4-Pentadienonitrile**	135–8		1.4880	0.8444		72	124								Me ester of acid, 50 2^{20}

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2					Miscellaneous
						Acid		Amide	Anilide	S-Benzyl thiuronium chloride	Amine	Benzamide	Benzenesulfonamide	Phenylthiourea	Picrate	
						B.P., °C	M.P., °C				B.P., °C					
24	**2-Chlorocrotononitrile**	136				212, 85 95^{10}	99	212			128 31				191	Me ester of acid, 161, HCl salt of amine, 220
25	**Ethoxyacetonitrile**	136 7^{753}				156 7^{16}		80 2			108^{750}				121 3	n_D^{25} of amine 1 4108, Et ester of acid, b p 152
26	**2-Methylcrotononitrile**	138		1 4319	0 8313	198 5	64	75 6	77							*p*-Toluidide of acid, 70 5–1 5
27	**2-Bromoisobutyronitrile**	139–40		$1\ 445^{25}$			48–9	148	83							
28	**4-Pentenonitrile**	140		$1\ 4213^{14}$	$0\ 848^{14}_{15}$	188–9		94		91 4, 98						H_2PtCl_6 salt of amine, 166, Thiourea deriv of amine, 43 5–4 0
29	**Thiophene-2,3-dicarbonitrile** (2,3-Dicyanothiophene)	140					272–4	*dt* 228								Di-Me ester of acid, 32 3
30	**3,3-Dimethylacrylonitrile**	140 2			$0\ 8292^{14}$	199	70	107–8, 65 6	126 7		105 8			105 0 5 5	139–40d	HCl salt of amine, 193–4
31	**Valeronitrile** (1-Cyanobutane)	141		$1\ 3991^{15}$	$0\ 8035^{15}_4$	186		106	63		104			69	139	
32	**2-Chlorobutyronitrile**	143				189^{627}		75 5 6 0	74 5						142, 124	
33	**Diethylacetonitrile**	145				190		107			71 5				168–9	
34	**2-Furanecarbonitrile** (α-Furonitrile, 2-Cyanofuran)	147		$1\ 4798^{20}$	$1\ 0822^{20}_4$		133 4	142	124	211	145 6				150	
35	**2-Methylacetoacetonitrile**	147, 145 6		$1\ 4239^{20}$	$0\ 9794^{20}_4$	224^{34}	73	138–40								Semicarbazone, 153, *p*-Nitrophenylhydrazone, 147
36	**Cyclobutanecarbonitrile** (Cyanocyclobutane)	150				195		152–3, 155	112 5–3 0		110^{753}					HCl salt of amine, 235 5

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES
a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2					Miscellaneous
						Acid		Amide	Anilide	S-Benzyl thiuronium chloride	Amine	Benz amide	Benzene sulfonamide	Phenyl thiourea	Picrate	
						B P , °C	M P , °C				B P , °C					
37	**2-Chloro-3-methylbutyronitrile**	154–5			$0\ 9922^{12}$	210–2, 126^{32}	37 9							-	137–8, 160	Et ester of acid, b p 178–9, HCl salt of amine, 190d , H_2PtCl_6 salt of amine, 193 5
38	**Isocapronitrile** (4-Methylpentanonitrile)	155		$1\ 4085^{14}$	$0\ 807_4^{14}$	199 4	−33	119, 121	111–2		125				123 5	
39	**2,2-Dimethylacetoacetonitrile**	163 4			$1\ 008^{13}$	103^{1}		121								Oxime, 99–100
40	**2-Methylhexanonitrile**	165		1 4070	0 7985	210		72	98		45–54^{15}					
41	**3-Methoxypropionitrile**	165		1 4032	$0\ 9367_4^{25}$	107^{10}		50			120					
42	***n*-Capronitrile** (*n*-Hexanonitrile)	165	−80 31	$1\ 4115^{20}$	$0\ 8093_{20}^{20}$	205		100	95		130	40	96	77	126	HCl salt of amine 219
43	**(Ethylamino)acetonitrile** (N-Ethylglycinonitrile)	166 7 81 3^{29}					180–2				126–9	*dl* 117–8			*dl* 194 5	HCl salt, 141 2
44	***d,l*-3-Methylhexanonitrile**	$171–2^{749}$		1 4143	0 8109	212 3 55		99 100			148 9^{706}					*p*-Toluidide of acid, 73 4, n_D^{20} of amine, 0 7787
45	**Chlorofumaronitrile**	172 64^{10}		$1\ 49571^{20}$	$1\ 2499^{20}$		191 2		*dl* 186							Di-Me ester of acid, b p 113 4^{1}
46	**2-Acetoxypropionitrile** (O-Acetyl lactonitrile)	172 3				167 70^{28}	57 60									H_2PtCl_6 salt of amine, 207 9
47	**3-Ethoxypropionitrile**	173		1 4068	$0\ 9189_4^{25}$	119^{19}		50			138					n_D^{20} of amine, 1 4242, D_4^{20} of amine, 0 8697
48	**3-Chlorobutyronitrile**	176			$1\ 0772^{9}$	101^{13}	43 4 5		89 90						147	H_2PtCl_6 salt of amine, 212
49	**3-Chloropropionitrile**	178			$1\ 1443^{18}$	204	41		119, w							*p*-Toluidide of acid, 121 HCl salt of amine, 146–8

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D	Density g/ml	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2					Miscellaneous
						Acid		Amide	Anilide	S Benzyl thiuronium chloride	Amine	Benz amide	Benzene sulfonamide	Phenyl thiourea	Picrate	
						B P °C	M P °C				B P °C					
50	**Indole-3-carbonitrile** (3 Cyanoindole)	178 rose				208 10										N Acetyl deriv 202 Et ester of acid 82 M p of amine 84
51	**5-Methylhexanonitrile**	178 80				216		104	75	149 5						Me ester of acid, b p 166 7
52	**Thiophene-3-carbonitrile** (3 Cyanothiophene)	179 203 5		1 5565[21]	1 1956$_{20}^{20}$		138	180								
53	***d l*-4-Methylhexanonitrile**	180		1 4144	0 8141	217 8		98			152 3[50]					n_D^{20} of amine, 1 4238, D_4^{20} of amine, 0 7802
54	***d l*-Lactonitrile** (Acetaldehyde cyanohydrin)	182 4		1 4058[18]	0 9877$_4^{20}$	122[1]	18	79 75 6	59	153	161 2				142	
55	**Glycolonitrile** (Formaldehyde cyanohydrin)	183 sl d					80	120	97	141 146 7	171				160	Benzoyl deriv 195 6
56	**Heptanonitrile**	183 187			0 8107$_6^{20}$	223		95	71		155			75	121	
57	**4-Cyanoheptane**	183-4				221 2		123 4			167					Et ester of acid b p 183 H_2PtCl_6 salt of amine, 211 d
58	**Benzonitrile**	190	−13	1 5289[20]	1 0102$_{15}^{15}$		122	129	162	167	184 5	105	88	156	194	
59	**Thiophene-2-carbonitrile** (2-Cyanothiophene)	192		1 5641[15]	1 1800$_4^{15}$		129 30 192	180	140		58[5]				181 2	HCl salt of amine, 193 4
60	**2-Octynonitrile**	194 6				148 9[19]	f p 2 5	91	44							
61	**4-Chlorobutyronitrile**	196 7			1 162[10]	196[22]	16	88 9	60 70, bz - pet eth							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point, °C	n_D	Density g/ml	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2					Miscellaneous
						Acid		Amide	Anilide	S-Benzyl thiuronium chloride	Amine	Benzamide	Benzene sulfonamide	Phenyl thiourea	Picrate	
						B P , °C	M P , °C				B P , °C					
62	**Methyl cyanoacetate**	200, 115^{36}	−22 5	$1\ 4170^{25}$	$1\ 0962_4^{25}$						58^{15}					Hydrolysis → malonic acid, 135, HCl salt of amine, 102 5, H_2PtCl_6 salt of amine, 192, NH_3 → Cyanoacetamide, 118
63	**Dibenzyl acetonitrile**	200 15					89	128 9	155							
64	**2-Tolunitrile** (2-Methylbenzonitrile)	205	−13	$1\ 5272^{45}$	$0\ 9912_{45}^{45}$		104	140	125	146	208	88			215	Acetyl deriv of amine, 69
65	**2,3,3-Trimethyl-1-cyclopentene-1-carbonitrile** (β-Campholytonitrile)	205, 225			$0\ 9127^{15}$	255-6	135	130, al	104, aq al		205 5 6 5				178	Et ester of acid, 222 5, HCl salt of amine, 175-6
66	**Caprylonitrile** (Octanonitrile)	206, 199		$1\ 4224_{He}^{15}$	$0\ 8172_4^{15}$	239	16	110	57		180				112	
67	**1,1-Dicyanopropane** (Ethyl malononitrile)	206^{756}, $90-1^{20}$			$0\ 9515^{11}$		111 5	*dl* 216								Dihydrazide of acid, 168, al
68	**Ethyl cyanoacetate**	207		$1\ 4179^{20}$	$1\ 056_4^{25}$				198 9							NH_3 → Cyanoacetamide, 118
69	**1,1-Dicyanobutane** (Propyl malononitrile)	210^{750}			$0\ 9224^{18}$		96	*dl* 184	*dl* 198							
70	**3-Tolunitrile** (3-Methylbenzonitrile)	212	−23		$1\ 0316^{20}$		113, 110	95	126	140	207				198, 156	Acetyl deriv of amine, 150
71	**Cyclohexylacetonitrile**	215		$1\ 457^{18}$	$0\ 913^{18}$	244 6	33	171-2			188-9	79-81			155 6	HCl salt of amine, 252-3, n_D^{25} of amine, 1 4625
72	**4,4-Dicyano-1-butene** (Allyl malononitrile)	217-8	f p −12				105, eth									Di-Et ester of acid, b p 222 3, *p*-Nitrobenzyl ester of acid, 46, al

*Derivative data given in order: m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES
a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point °C	n_D	Density g/ml	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2					Miscellaneous
						Acid		Amide	Anilide	S-Benzylthiuronium chloride	Amine	Benzamide	Benzenesulfonamide	Phenylthiourea	Picrate	
						B P °C	M P °C				B P, °C					
73	**3-Isopropylidene-1-methylcyclopentane-1-carbonitrile** (β-Fencholenonitrile)	217 9			0 9203[1]	259	72 3	86 5 7 5								Me ester of acid, 97 9
74	**3-Hydroxypropionitrile**	220			1 059[a]	d	syrup				188				222	Sodium salt of acid, 143, P_2O_5 → acrylonitrile, b p 77
75	**1,1-Dicyano-3-methylbutane** (Isobutyl malononitrile)	222					108, bz	*di* 195 6, al								
76	**Nonanonitrile**	224	−34 2	1 42522	0 8221[4]	255	15	99	57		201	49			111	Acetyl deriv of amine, 34 5
77	**2-Phenylcrotononitrile**	224 6		1 5555	1 013		136	98 9								
78	**Ethylenecyanohydrin**	229 7 220			1 059[a]						107 8 [ab]				130, 222	Me ester of acid, b p 177 84 H_2PtCl_6 salt of amine, 199
79	**2-Phenylpropionitrile**	232				265 8		97 5		210					182	Me ester of acid, 221, M p of amine, 85 HCl salt of amine, 123 4, H_2PtCl_6 salt of amine, 229d
80	**Phenylacetonitrile** (Benzyl cyanide)	234		1 5211[4]	1 0214[4]		76 7	157	118	163	198	116	69	135	174, 167	
81	**Phenoxyacetonitrile**	239 40			1 09[1]	285	98 9	101 5			228 9 [1]				167 8	HCl salt of amine, 215, HBr salt of amine, 192-3

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D	Density g/ml	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2					Miscellaneous
						Acid		Amide	Anilide	S-Benzyl thiuronium chloride	Amine	Benz amide	Benzene sulfonamide	Phenyl thiourea	Picrate	
						B P °C	M P , °C				B P , °C					
82	**4-Hydroxybutyronitrile**	240			1 029[25]	204					205 6					Acid forms readily butyrolactone, b p 204, CrO_3 + butyrolactone → succinic acid, 186
83	**(3-Tolyl)acetonitrile** (*m*-Xylylcyanide)	240 1			1 0022[22]	120-3[26]	61	141			214 5[33]				176	Et ester of acid, b p 237 8, HCl salt of amine, 159
84	**(4-Tolyl)acetonitrile** (*p*-Xylylcyanide)	242 3	18	1 5153[2]	0 9922[22]	265-7	94	185			214 5	95 6			155	Et ester of acid, b p 240, HCl salt of amine, 216-7
85	**4-Isopropylbenzonitrile**	243-4[34]					117 8, al	153, 133			227[23]					Et ester of acid, b p 263 4 HCl salt of amine, 239-40
86	**(2-Tolyl)acetonitrile** (*o*-Xylyl cyanide)	244			1 0156[22]		88 9	161			215 5 7 0				177	HCl salt of amine, 227-8
87	**Decanonitrile**	245		1 4320$^{t}_{He}$	0 8294$^{t}_{4}$	269	31	100, 108	70							
88	**3-Methyl-2-phenylbutyronitrile**	245 9[4]		1 5038[2]	0 967[1]	159 60[14]	61 2	111 2	132 3		155-6[24]					HCl salt of amine, 128
89	**1,2-Dicyanopropane** (Methyl succinonitrile)	252 4	12				115	*dl* 225	*dl* 200		172 3	154				HCl salt of diamine, 144 5
90	**1-Undecanonitrile** (1-Hendecanonitrile)	253 4				164[1]	28 2 6	98 0 7	71							Hydrazide of acid, 101-2, Phenylhydrazide of acid, 110
91	**2-Phenylvaleronitrile**	254-5[30]		1 5000	0 960[15]	280	58	83 5			90[3]					
92	**10-Undecenonitrile** (10-Hendecenonitrile)	257, 129-30[14]		1 4442[20]	0 8443$^{20}_{4}$	274	24 5	87								

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D	Density g/ml	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2					Miscellaneous
						Acid		Amide	Anilide	S-Benzylthiuronium chloride	Amine	Benzamide	Benzenesulfonamide	Phenylthiourea	Picrate	
						B P °C	M P °C				B P °C					
93	**3-Phenylpropionitrile**	261			1 0014[18]	280[754]	48 5	105	98		221 5[755]	57 8			152–3	HCl salt of amine, 218, H_2PtCl_6 salt of amine, 233
94	**2-Cyanobenzal chloride** (α,α-Dichloro-*o*-tolunitrile)	261					155, bz	117								
95	**N-Methylanilinonitrile** (N-Cyano-N-methylaniline)	266	13				95 100	163								Picrate, 195
96	**3-(2-Chlorophenyl)propionitrile**	267 8		1 5390	1 1390[20]		96 5, w	119 bz								Me ester of acid, 255 HCl salt of amine, 167
97	**1,3-Dicyano-2-methylpropane** (2-Methylglutaronitrile)	269 71				205 8[12]	79	*dl* 175 6			78[11]					Di-*p*-toluidide of acid, 174 5, n_D^{45} of amine, 1 4585
98	**O-Benzoyl lactonitrile** (Lactonitrile benzoate)	269–70					112	124								Di-*p*-nitrobenzyl ester of acid, 119 5
99	**3-Cyanobenzal chloride** (α,α Dichloro-*m*-tolunitrile)	272 5					132									
100	**4-Cyanobenzal chloride** (α,α-Dichloro-*p*-tolunitrile)	273 6[770]					151 8									Et ester of acid, 45 6
101	**Dodecanonitrile** (Lauronitrile)	276 7	4	1 43595	0 8273[15]	225	44	110 102, aq al	78	141	247 9					M p of amine, 28 3 Acetyl deriv of amine, 68 5 9 5, bz , *p*-Toluenesulfonyl deriv of amine, 73
102	**1,3-Dicyanopropane** (Glutaronitrile)	286		1 4365[25]	0 9951[15]		97	175	224		178 80	*dl* 135	119	148	237	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES

a) Liquids 1) (Listed in order of increasing atmospheric b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D	Density g/ml	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2					Miscellaneous
						Acid		Amide	Anilide	S-Benzyl thiuronium chloride	Amine	Benz amide	Benzene sulfon amide	Phenyl thiourea	Picrate	
						B P °C	M P °C				B P °C					
103	**4-Methoxyhydrocinnamonitrile** (3-(4-Methoxyphenyl)-propionitrile)	290–300					104–5	125			118 20^2					Me ester of acid, 38, M p of amine, 65 7–6 3, HCl salt of amine, 220 5
104	**1,4-Dicyanobutane** (Adiponitrile)	295	0–1	1 4597^{20}	0 951$^{19}_{19}$		153, 150	220	239		204 5	*dl* 155	*dl* 154		220	M p of amine, 42

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES

a) Liquids 2) (b.p. at reduced pressure only) (Listed in order of increasing m.p. of the corresponding acid)*

No	Name	Boiling point, °C	Melting point, °C	n_D	Density g/ml	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2					Miscellaneous
						Acid		Amide	Anilide	S-Benzylthiuronium chloride	Amine	Benzamide	Benzenesulfonamide	Phenylthiourea	Picrate	
						B.P., °C	M.P., °C				B.P. °C					
1	**1,2,2,3-Tetramethyl-3-cyclopentene-1-acetonitrile** (5-Methyl-α-camphelenonitrile)	115 9^{18}		1.47221[18]	0.9217[18]$_4$	150–1 5^{12}	35.6 7.0	99 100, lgr								
2	**1-Cyanocyclohexene**	81^{12}		1.4818[25]	0.954[25]	238 40^{638}	38	127.8			55 7^{12}				181	
3	**2-Hydroxybutyronitrile** (Propanal cyanohydrin)	102–3^{23}		1.4150	0.9621	225 60d	43.4		89–90		172^{755}	112.1 3.1				N,O-Di-*p*-nitrobenzoyl deriv of amine, 119.2, Acetate, 43, CS_2
4	**Hydnocarponitrile**	155 6^{2-3}		1.4559[25]	0.8580[25]		59–60	108.5d								
5	**α-Chloro-α-phenylacetonitrile**	131–5^{13}					60.1	116								
6	**Butyl cyanoacetate**	115^{15}		1.4243[25]	0.998[25]		66	119–20	198–9							
7	**3-Bromopropionitrile**	69^{7}		1.4789[25]			62								154, yel	Nitrile + alkali → acrylic acid, *p*-toluidide of which, 141
8	**2,4-Diphenylbutyronitrile**	152 6^{1}				190[1]	72.3, 76	96								
9	**Thiophene-2-acetonitrile**	115 20^{22}		1.5399[25]	1.153[25]$_4$		76, 63–4	146.7			72–4[3]	61, bz-lgr		109.5 10		HCl salt of amine, 202.4, N-Acetyl deriv of amine, 45.5 6.5
10	***trans*-4-Chlorocrotononitrile**	61–1.4[11]		1.4705	1.1207	117 8^{13}	83	130–2								
11	**2-Cyanopentanoic acid**	125–30^{9J}					96	*di* 184	*di* 198							Amide of nitrile, 124.5, Anilide of nitrile, 88–9
12	**Azelaonitrile** (1,7-Dicyanoheptane)	183[11], 160^{3}		1.4426[25]			106	*di* 175	*di* 186–7		258–9					M.p. of amine, 37
13	**3-Chloro-2-hydroxy-2-methylpropionitrile** (Chloroacetone cyanohydrin)	110^{22}		1.4520	1.2027[15]	230–5	110									
14	**1,11-Dicyanoundecane** (1,11-Dicyanohendecane)	189 90^{7}					111–2	*di* 175.6	*mono* 112.5–3.0, *di* 160.1							M.p. of amine, 58 HCl salt of amine, 254.5, al

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES

a) Liquids 2) (b.p. at reduced pressure only) (Listed in order of increasing m.p. of the corresponding acid)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D	Density g/ml	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2					Miscellaneous
						Acid		Amide	Anilide	S-Benzylthiuronium chloride	Amine	Benzamide	Benzenesulfonamide	Phenylthiourea	Picrate	
						B P °C	M P °C				B P °C					
15	**2-Cyanobutyric acid**	153[15]					111 5	212 4								Hydrazide of acid, 95 6, Amide, 113
16	**2-Cyanobiphenyl**	172[15]					114	177								Acid + conc H_2SO_4 → fluorenone, 83
17	**1,12-Dicyanododecane** (α,ω-Dodecane dicyanide)	225 8[17]					129, w	*dl* 189	*dl* 191, 170 1							Di-*p*-toluidide of acid 165 M p of amine, 61 5 HCl salt of diamine, 309 10
18	**1-Cyano-4-isopropenylcyclohexene**	116 8[11]		1 4978	0 9439	164-5[10]	132 3	164 5								
19	**Sebaconitrile** (1,8-Dicyanooctane)	201 3[16]					134	*dl* 210	*dl* 198							M p of amine 60
20	**Suberonitrile** (1,6-Dicyanohexane)	180[12]		1 4448[22]			141	*dl* 216 7	*dl* 186 7		240 1 225 6	*dl* 121 2			*dl* 180	M p of amine, 52
21	**3-Cyanoindene** (Indene-3-carbonitrile)	140 2[13]					161, 156-7	180	158							Hydrazide of acid, 186
22	**Aminoacetonitrile** (Glycinonitrile)	58[15], part d					262 d	65-6	62 (+2 H_2O)		116 5	*dl* 244	*dl* 168		*dl* 233 5	HCl salt, 165 5 6 5, M p of amine, 8 5

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES

b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point C	Boiling point C	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2				Miscellaneous
				Acid		Amide	Anilide	S Benzyl thiuronium chloride	Amine	Benz amide	Ben zene sulfon amide	Picrate	
				B P C	M P °C				B P C				
1	**2 Cyanodiphenyl-methane**	19	313 4		117	163							
2	**N Piperidinoacetonitrile**	19	210		215 7				182 3 58 61			*di* 225 220 1	Methiodide 192 3 HCl salt of acid 215 6 Phenylthiourea deriv of amine 92 3
3	**3-Chloro-2-tolunitrile**	19	107^{28}		159 154								
4	**Tetradecanonitrile**	19 20			54	103	82						M p of amine 37
5	**Cinnamonitrile**	20	255 6		133	153 109	147	175 179				181 yel aq al	HCl salt of amine 235
6	**Trichloroacrylonitrile**	20			76	97 8 87	98						n_D^4 1 5100
7	**DL-Mandelonitrile** (Benzaldehyde cyano hydrin)	22			118 9	133 4	151 2 146		116 7	148 9		153 4 al	M p of amine 56 5 8 0 O Benzoyl deriv 63 4 3 Nitrobenzoyl deriv 83 4 *p* Toluidide of acid 174 HCl salt of amine 208 19 acet
8	**Pentadecanonitrile**	23	322		52	102	78		299 301				M p of amine 34 0 6 5 HCl salt of amine 199 N Acetyl deriv of amine 72
9	**2-Methoxybenzonitrile**	24 5	255 6		00 1	129	131		226 8				H $PtCl_6$ salt of amine 187
10	**(2-Chlorophenyl) aceto-nitrile** (2 Chlorobenzyl cyanide)	25	251		95	175 w	138 9		105 8 [4]			187 bz	
11	**1,1-Dicyanoethane** (Methylmalononi trile)	26			135 138 d	*di* 217	*di* 182					*di* 252 d	Di *p* toluidide of acid 227 8 Di HCl salt of amine 201
12	**2-Cyanopyridine** (2 Pyridinecarbonitrile Picolinonitrile)	26	212 5		136 7	106 7	76		95 8[4]			159 60 d	HAuCl, salt 190 N Acetyl deriv of amine 59 60 bz pet eth Oxalate salt of amine 166 7 d
13	**4-Tolunitrile** (4 Methyl benzonitrile)	27 29	217		179 80	155 165	147 8		208	137		205 15 d	D^1 0 9805 M p of amine 13 N Acetyl deriv of amine 107 8
14	**D-Mandelonitrile**	28 9	170 d		133	123							$[\alpha]_{5461}^{25}$ +46 9 in bz
15	***d l*-(2-Bromophenyl) acetonitrile** (2 Bromo benzyl cyanide)	29	242 d		84	143 4 144 8						150 1	Et ester of acid b p 150 2 [3] M p of amine 163 4 HBr salt of amine 163 4
16	**(4-Chlorophenyl) aceto nitrile** (4 Chlorobenzyl cyanide)	30	265 7		105	175	164 5		114 6[19]			212	HCl salt of amine 218 0 8 5 *p* Toluene sulfonate deriv of amine 235
17	**Malononitrile** (Methyl ene cyanide)	30	218 9		135	170			136	140	96	250	n_D^{33} 1 4146 N Acetyl deriv of amine 126
18	**Hexadecanonitrile**	31			63	106 7	90						D_4^{31} 0 8224
19	**Maleonitrile** (*cis* 1 2 Dicyanoethylene)	31			130	181	187	163 173	163 70	*di* 178 5- 9 5	*di* 155 al	*di* 250 d	
20	**2,2-Dicyanopropane** (Dimethylmalono nitrile)	31 2	169 5 subl		192 3 subl part d >130	*di* 269	203 4	159 60	153	*di* 152			Di Me ester of acid b p 177^{755} HCl salt of amine 256 7

*Derivative data given in order m p crystal color solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2				Miscellaneous
				Acid		Amide	Anilide	S-Benzyl thiuronium chloride	Amine	Benzamide	Benzene sulfonamide	Picrate	
				B P , °C	M P °C				B P , °C				
21	*tert*-**Butylacetonitrile** (Neopentyl cyanide)	32-3	138	186 8		132	131						HCl salt of amine, 158 60, subl
22	**1-Naphthylacetonitrile**	33			131	154, 180							
23	**4,4-Dicyanoheptane** (Dipropylmalononitrile)	33 4 (*anh*) 49 50 (*hyd*)	223-4, 135-40$^{0\ 2}$		161	*di* 214	*di* 168 0 5, me al		132^{25}	*di* 154			
24	**Heptadecanonitrile**	34			61	106			335-40	91			M p of amine, 49, N-Acetyl deriv of amine, 62
25	**1-Naphthonitrile** (1-Cyanonaphthalene)	34, 37	299		162	202			155^{12}		148	223	N-Acetyl deriv of amine, 134, lgr Methiodide deriv of amine, 213, al
26	**2-Cyanopropionic acid**	35	142 5^{11}		135, 120	*di* 206	*di* 182, 214						Amide, 105 81 Mono-*p*-toluidide of acid, 145 d Di-*p*-toluidide of acid, 227 8 245
27	**4-Fluorobenzonitrile**	35	189-90		183	154-5			183			203	
28	**Coumarilonitrile** (Coumarin-2-carbonitrile)	36		310-5, sl d	192-3, w	159	159						Et ester of acid, 27 Ph ester of acid, 101
29	**Indole-3-acetonitrile**	36 0 5	157$^{0\ 2}$		164-5 199	150 1	149 5 50			137 8		247 d	Me ester of acid, 135 M p of amine, 116 7, 146 HCl salt of amine, 248 9 N-Acetyl deriv of amine, 77, pet eth
30	**3-Bromobenzonitrile**	38	225		155	155			244-5	135 6		205	
31	**2-(N-Anilino)-butyronitrile**	39			141	123, w	92, al						Et ester of acid, 26 b p 278
32	*trans-o*-**Chlorocinnamonitrile**	40			212, yel , al	168	176						Me ester of acid, b p 278 9
33	**Octadecanonitrile**	41 43			70	109	95 88						
34	**3-Chlorobenzonitrile**	41			158, 155	134	122-5		110-2^{17}	214		203	
35	**2-Chlorobenzonitrile**	43	232		141	142	118		103-4^{11}	116 7		217	N-Acetyl deriv of amine, 79-80
36	**4-Chloromandelonitrile**	43			119-22, 112-3	122-3							O-Benzoyl deriv , 57-8 Me ester of acid, 85 8, bz -pet eth
37	**Nonadecanonitrile**	43			69	109 5 8	95 5-6 5						Me ester of acid, 39 5 40
38	**2-Bromo-4-tolunitrile**	44			204								
39	**3,3-Dicyanopentane** (Diethylmalononitrile)	44-5	195, 92^{24}		125, w	*mono* 146, *di* 224							
40	**4-Cyanobutyric acid**	45			97 8	182-3	*di* 221 2			105			Amide, 69 70 Et ester of acid, b p 245 M p of amine, 157 8, HCl salt of amine, 92-4 $HAuCl_4$ salt of amine, 86 7, 106
41	**5-Chloro-2-tolunitrile**	45-6			169								Me ester of acid, 30-1
42	**(4-Aminophenyl)acetonitrile** (4-Aminobenzyl cyanide)	46	312		199	161 2							N-Benzoyl deriv , 176-7, Picrate, 185
43	*meso*-**2,3-Dimethylsuccinonitrile**	46			209, 198 d	*di* 310-3	*di* 235						Di-Me ester of acid, b p 198 9

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2				Miscellaneous
				Acid		Amide	Anilide	S-Benzyl thiuronium chloride	Amine	Benzamide	Benzene sulfon amide	Picrate	
				B P , °C	M P , °C				B P , °C				
44	**3-Bromo-4-tolunitrile**	47			140	137							
45	**(4-Bromophenyl)aceto-nitrile** (4-Bromobenzyl cyanide)	47			114, subl	192 4							Et ester of acid, 30, HCl salt of amine, 240–3
46	**N-Anilinoacetonitrile**	48 lgr			127 8	136	113						
47	**3-Cyanopropionic acid**	48 50			235	185	*mono* 157, *di* 269 d	*mono* 148 5, *di* 230		79 80			Amide, 97, Me ester of acid, b p 215, Di-*p*-toluidide of acid, 256, M p of amine, 193 203 d , HCl salt of amine, 135–6, 95–6
48	**3-Chloro-4-tolunitrile**	48 50			200 2								Me ester of acid, 28
49	**3,3-Diphenylacrylo-nitrile** (*β*-Phenyl cinnamonitrile)	49			162, 167		130 1						
50	**3-Bromo-2-hydroxy benzonitrile**	49–50			184	165							
51	**4,4-Dicyanoheptane** (Dipropylmalono-nitrile)	49-50 (*hyd*), 33 4 (*anh*)			161	*di* 214	*di* 168 0–5, me al		132^{25}	*di* 154			
52	***trans*-2,3-Diphenyl-acrylonitrile**	49–51	213 4^{23}		172	127, acet	141, al						
53	**Eicosanonitrile**	49 5			77, 75 2	108 9	92		196 $2^{4\ 0}$				M p of amine, 57 8, n_D^{70} of amine, 1 4341
54	**3-Cyanopyridine** (Nicotinonitrile)	50	240–5		232	122	85, w , 132, bz - lgr		88–90^{2}	132		*tri* 206 8	$HAuCl_4$ salt of amine, 196–8, Di-HCl salt of amine, 224
55	**(4-Iodophenyl)aceto-nitrile** (4-Iodobenzyl cyanide)	50–1			135								HCl salt of amine, 294 6 d
56	**4-Cyanodiphenyl-methane**	51			157 8								Acid $\xrightarrow{CrO_3}$ 4-Benzoyl-benzoic acid, 197–200, al
57	**2-(N-Anilino)-valero-nitrile**	51, pet eth			147–8, al	99, eth - pet eth							
58	**2-Aminobenzonitrile** (Anthranilonitrile)	51, yel , CS_2	267 8^{777}		147	109–11	130–1			167			Et ester of acid, b p , 266–8, *p*-Toluidide of acid, 151
59	**2-Bromobenzonitrile**	53	253		150	155–6			118^{9}				HCl salt of amine, 241, 208
60	**5-Cyanothiazole**	53			218	186							Me ester of acid, 68–9, N-Acetyl deriv of amine, 159–60
61	**3-Aminobenzonitrile**	53–4, aq al	288–90		174	78 9	114						N-Acetyl deriv , 248, Me ester of acid, 36–8, Et ester of acid, b p 294, Fe/AcOH → Benzonitrile, b p 190 + NH_3
62	**2-Quinolinoacetonitrile**	53 4	140^{1}		274–5				138–40^{7}			*di* 202	Picrate, 176–7d , Me ester of acid, 72, lgr
63	**2-Iodobenzonitrile**	55			162	184				154			HCl salt of amine, 248–50, N-Acetyl deriv of amine, 134–5

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point °C	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2				Miscellaneous
				Acid		Amide	Anilide	S Benzyl thiu ronium chloride	Amine	Benz-amide	Ben-zene sulfon amide	Picrate	
				B P °C	M P °C				B P °C				
64	**2,4,6-Trimethylbenzo-nitrile**	55, bz	225 30		155, lgr	187 8			98 5 100[b]	153 4			Me ester of acid, b p 241 2[718]
65	**α-Aminobenzyl cyanide**	55			256	130 2, al			135[19]	*dl* 223 5			N-Acetyl deriv , 130-8, et ac pet eth N Benzoyl deriv , 151 Picrate, 160-1, yel
66	**Cyanoform** (Tricyano methane)	55 6 pet eth											NH_4 salt, 183
67	**Succinonitrile**	56 6	265 7		186 8	260	230	149	159	177		250 5	M p of amine, 27 N-Acetyl deriv of amine 137
68	**2-Iodo-4-tolunitrile** (2-Iodo-4-methylbenzo-nitrile)	57-8			205 6	167							
69	**2,6-Dinitrobenzonitrile**	58 (145)			202 3								Me ester of acid, 147 M p of amine, 88, HCl salt of amine, 185, H_2PtCl_6 salt of amine, 193
70	***d,l*-2,3-Dimethyl-succinonitrile**	58 9	.....		135	*mono* 148 9, *dl* 244	*dl* 222						Di-Me ester of acid, b p 200
71	**2-Chloro-4-tolunitrile**	61 2			155 6	182							
72	**4-Methoxybenzonitrile**	61 2	256 7		184 6	162 3	169	177 184 5	236 7				N-Acetyl deriv of amine, 96, H_2PtCl_6 salt of amine, 210
73	**2,4-Dichlorobenzonitrile**	61-2			164 160	194			140[122]				Me ester of acid, b p 132[15], n_D^{25} of amine 1 5738, HCl salt of amine, 281 2 4 3
74	**4-Methoxycinnamo-nitrile**	64			170	186							Me ester of acid, 90 Et ester of acid, 49 50
75	**3,5-Dichlorobenzo-nitrile**	65, subl			188				254[6]			241	Me ester of acid, 58, n_D^{26} of amine 1 5690, HCl salt of amine, 300
76	***cis*-1,4-Dicyanocyclo-hexane**	65			168 9								Acid + conc HCl at 180 → *trans* isomer, 300
77	**Bromomalononitrile**	65 6			113d	181							Di-*p*-toluidide of acid, 217
78	**2-Naphthonitrile** (2-Cyanonaphthalene)	66 62	305		184	192, 195						226	M p of amine, 60 N Acetyl deriv of amine, 126, Methiodide deriv of amine, 168, al
79	**Cyanoacetic acid**	66			135 6	170	226 7			120 w			Amide, 119 20, Anilide, 198 9, Warming with benzaldehyde → α-cyanocinnamic ac , 180, M p of amine, 200, HCl salt of amine, 123
80	**2-Cyano-2-ethylbutyric acid** (Diethylcyano-acetic acid)	66 57	240 5, 164[8]		125, w	*mono* 146, *dl* 224							NH_3 → Diethylcyano-acetamide, 121

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2				Miscellaneous
				Acid		Amide	Anilide	S-Benzyl thiuronium chloride	Amine	Benzamide	Benzene sulfon amide	Picrate	
				B P , °C	M P °C				B P , °C				
81	**2,4-Diphenylglutaronitrile**	66, 70 1	220-7[5]		2 forms (a) 164-5, w , (b) 185-6, chl - pet eth								Di-HCl salt of amine, 319 20, iso-PrOH
82	**α-Chloro-3-tolunitrile**	67, al	258 60		132, w	124						173	HCl salt of amine, 169, H_2PtCl_6 salt of amine, 219
83	**4-Chloro-2-tolunitrile**	67			172	183							
84	**1-Cyanoacenaphthene** (Acenaphthene 1-carbonitrile)	68			161								
85	**Phenylmalononitrile** (α-Cyanobenzyl cyanide)	69			152 3	233							
86	**6-Nitro-2-tolunitrile**	69 70			184	163							Me ester of acid, 66
87	**(4-Hydroxyphenyl) acetonitrile** (4-Hydroxybenzyl cyanide)	69 70, w	330		148-50	175						200	Acetate, 49 50 M p of amine, 160 1
88	**5-Bromo-2-tolunitrile**	70			187	180							
89	**α-Bromo-2-tolunitrile** (2-Cyanobenzyl bromide)	71 2	124[4]		147								Me ester of acid, 32 0- 5
90	**2,2-Diphenylglutaronitrile**	71 2 5			195-7, 183	1-*mono* 142-4							Anhydride of acid, 134, Imide of acid, 158 9
91	**(2-Aminophenyl)acetonitrile** (2-Aminobenzyl cyanide)	72			119	93							N-Acetyl deriv , 120, Benzamide, 175-9, N-Acetyl deriv of acid, 158
92	**3,4-Dichlorobenzonitrile**	72			208 9	133			139 40[17]			228	Me ester of acid, 46 5 7 5, HCl salt of amine 240 2
93	**1,2,2,3-Tetramethylcyclopentene-1-carbonitrile** (Camphoric nitrile)	73	217 9	255	106	80	91, al		210	98			
94	**Dicyanodimethyl amine** (Bis(cyanomethyl) amine)	75, 77			247 5, 225d	*di* 143	*di* 140 5		208	*tri* 166, chl		*tri* 212d	N-Nitroso deriv , 43, N-Benzoyl deriv , 131 2, Tri-HCl salt of amine, 233
95	**Diphenylacetonitrile** (α-Phenylbenzyl cyanide)	75			148	168	180	145	134[2]	144-5		211 2 d	M p of amine, 42 3 5, HBr salt of amine, 205 7
96	**4-Cyano-N,N-dimethylaniline**	75 6	318		242 5-3 5	206	182-3						Me ester of acid, 102, HCl salt of amine, 212
97	**1-Cyanoisoquinoline**	78, 93			161								
98	**4-Cyanopyridine**	78, 83			315	155-6			120 5[12]			179-80, al	HCl salt, 199, $HAuCl_4$ salt, 208 10
99	**α-Chloro-4-tolunitrile** (4-Cyanobenzyl chloride)	78-80, al	263		203	173						185	H_2PtCl_6 salt of amine, 226
100	**2,5-Diphenylvaleronitrile**	79			80-1, lgr								
101	**3-Cyanobenzaldehyde** (3-Formylbenzonitrile)	79-81			175, w	190d							Oxime, 99-101, w , Semicarbazone of acid, 265, Phenylhydrazone of acid, 164

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point °C	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2				Miscellaneous
				Acid		Amide	Anilide	S-Benzyl thiuronium chloride	Amine	Benzamide	Benzene sulfonamide	Picrate	
				B P, °C	M P, °C				B P, °C				
102	**6-Nitro-3-tolunitrile**	80			219	151							Me ester of acid, 81-2, Et ester of acid, 55, al
103	**Benzoylacetonitrile**	81			103-4d	113	108					155d	Carbazone of acid, 125, HCl salt of amine, 128
104	**6-Chloro-2-tolunitrile**	82 3			102	167							Me ester of acid, 104
105	**8-Cyanoquinoline**	84, 50% al			187	171-3, w							Et ester of acid, 38 b p 175-7[7]
106	**2-Nitro-3-tolunitrile**	84			223	192							Me ester of acid, 74, me al
107	**2,3,4,5-Tetrachloro-benzonitrile**	84			194 5	207 8, acet - al	197, al						M p of amine 90 1
108	**4-Cyanobiphenyl**	85 6			228	223			195-200[15]				Me ester of acid, 117 8, M p of amine, 128 HCl salt of amine, 308 10 282
109	**2-Naphthylacetonitrile**	86, 81			142	200							
110	*cis*-**2,3-Diphenylacrylo-nitrile**	86	228 30[23]		137-8	167-8, chl - lgr	179, chl - pet eth						
111	**4-Aminobenzonitrile** (4-Cyanoaniline)	86			188	182 9			268 70				N-Acetyl deriv , 205, N-Benzoyl deriv , 170 Picrate, 150
112	**1-Cyano-2-phenylacrylo-nitrile** (Benzalmalono-nitrile)	87			195-6d	*di* 189-90							Di-Me ester of acid, 44 Di-Et ester of acid, 32
113	**5-Bromo-2,4-dimethyl-benzonitrile**	88 90			180-1	197 5-8 5							
114	**2-Cyanotriphenyl-methane**	89	270-85[20-30]		162								Me ester of acid, 98, me al
115	**5-Cyanoquinoline**	89 (*anh*), 70 (+1 5 H_2O)			342								Picrate, 241, Styphnate, 241d , yel HCl salt 248, yel , Me ester of acid, b p 128-32[0 2]
116	**2,6-Dimethylbenzo-nitrile**	90 1			116	138 5-9 0, 120-5			96-8				Me ester of acid, b p 94[9]
117	**Phenylcyanoacetic acid**	92											Amide, 147, Anilide, 136
118	**2-(N-Anilino)-propio-nitrile**	92, al			162, w	144	127, al						Et ester of acid, b p 272
119	**2,4-Dibromobenzonitrile**	92			174	198							Me ester of acid, 33
120	*β*-**(2-Nitrophenyl)-acrylonitrile**	92, w	194-6[7-8]		*cis* 146-7, yel , *trans* 240	185							Et ester of acid, 60
121	**5-Chloro-2-nitro-4-tolunitrile**	93			180-1								
122	*α*-**Bromo-3-tolunitrile** (3-Cyanobenzyl bromide)	93, al			155-6								
123	**4-Nitro-3-tolunitrile**	93-4			134	176-7							Me ester of acid, 78 9, me al
124	**2-(N-Anilino)-isobutyro-nitrile**	93-4, al			184-5, w	136	155, al						
125	**2-Cyanoquinoline**	94			157	133, 123							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2				Miscellaneous
				Acid		Amide	Anilide	S-Benzyl thiuronium chloride	Amine	Benzamide	Benzene sulfonamide	Picrate	
				B.P., °C	M.P., °C				B.P., °C				
126	**4-Cyanovaleric acid** (2-Methylglutaromononitrile)	95.6, w		205–8[12]	79	*di* 175.6							Di-*p*-toluidide of acid, 74.5, H_2PtCl_6 salt of amine 202.3
127	**Fumaronitrile**	96			295, 300	266	313–4	178, 182					
128	**4-Chlorobenzonitrile**	96, 94.6	223, 95[5]		240	179, 170	194		217	140		210	
129	**9-Phenanthrylacetonitrile**	96.5–7.0			224.5	250–2							
130	**3,5-Dibromobenzonitrile**	97, subl			219.20	187							Me ester of acid, 63
131	**2-Chloro-3-nitrobenzonitrile**	97–101, pa yel			185								Me ester of acid, 70 Et ester of acid, b.p. 314d
132	**2-Hydroxybenzonitrile** (2-Cyanophenol)	98		211[20]	159	133	135						$D_4^{99.6}$ 1.1052, $n_\alpha^{99.6}$ 1.53716 O-Benzoyl deriv., 106, pet. eth., M.p. of amine, 125, 129, H_2PtCl_6 salt of amine 197d HI salt of amine, 184
133	**4-Chloro-2-nitrobenzonitrile**	98			142	172							Me ester of acid, 42–3
134	**4-Cyanotriphenylmethane**	100, me al			165, ac a		196, ac a						
135	**4-Chloro-3-nitrobenzonitrile**	100.1			181–2	156	131					210d	Me ester of acid, 83 HCl salt of amine, 227.8
136	**3-Nitro-4-tolunitrile**	101			164.5	153							
137	**2-Cyano-3-phenylpropionic acid**	101.2, 75			120–1	225							Amide, 130, Di-Me ester of acid, 35.6
138	**3-Cyanophenanthrene**	102			269	233.4, 227–8	216.7						
139	**2,3,3-Triphenylpropionitrile**	102, me al			222–3, al	213							Me ester of acid, 162, HCl salt of amine, 269.72
140	**4-Cyanoquinoline**	102			253.4	181							Methiodide, 216, $HAuCl_4$ salt, 232 Di-HCl salt of amine, 255d
141	**4-Bromo-1-naphthonitrile** (1-Bromo-4-cyanonaphthalene)	102–3			212, 220								Me ester of acid, 42
142	**4-Bromo-2,5-dimethylbenzonitrile**	103–4			171.5–2.5	209–10							
143	**5-Nitro-3-tolunitrile**	104.5			174	164–5							Me ester of acid, 84–5
144	**2,4-Dinitrobenzonitrile**	104.5, al			182–3	203–4							Me ester of acid, 70, Hydrazide of acid, 231.3
145	**4-Nitro-2-tolunitrile**	105			179	173.4							Me ester of acid, 69
146	**6-Chloro-3-nitrobenzonitrile**	105–6			165	178							Me ester of acid, 73.
147	**5-Bromo-3-nitro-2-tolunitrile**	106–7			226	235							
148	**2-Nitro-4-tolunitrile**	107, pa yel			190	166							
149	**9-Cyanophenanthrene**	107, 111.0–3			256.5–7.0	232–3, 226	218			167		241	M.p. of amine, 108.5 HCl salt of amine, 294, N-Acetyl deriv. of amine, 182.3
150	**3-Cyanoquinoline**	108			275	198–9, 195							Picrate of acid, 217–8

* Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2				Miscellaneous
				Acid		Amide	Anilide	S Benzyl thiuronium chloride	Amine	Benzamide	Benzene sulfonamide	Picrate	
				B P , °C	M P °C				B P , °C				
151	**2-Cyanophenanthrene**	109			259 60	242 3	217 8						
152	**3-Nitro-2-tolunitrile**	109 10			151 2 pa yel	158							Me ester of acid, 50
153	**2-Nitrobenzonitrile**	110			146	174 6	155						HCl salt of amine, 248 50
154	**4-Chloro-1-naphthonitrile** (1-Chloro-4-cyanonaphthalene)	110			223-4, 210	235 6							
155	**5-Cyanoacenaphthene** (Acenaphthene-5-carbonitrile)	110 1			219, bz	198				182-4	148-9		
156	**4-Bromobenzonitrile**	112	235 7		251	189 90			250	143		221	M p of amine, 20 N-Acetyl deriv of amine 113
157	**2,4,5-Trimethoxybenzonitrile**	112 4, al		*ca* 300	144, bz - pet eth	184 5	154 5						Me ester of acid, 97 5 Et ester of acid, 72
158	**4-Hydroxybenzonitrile** (4-Cyanophenol)	113			213-4	162 (+1 H_2O)	196 7						M p of amine, 109 (anh), 95 (+1H_2O) HCl salt of amine 195 HI salt of amine 198 200
159	**2,3-Diphenylvaleronitrile** (2 forms)	(a) 115 al	(a) 235 40^{20} (b) 210 2^{20}		(a) 152-3 (b) 178 lgr								
160	**α-Bromo-4-tolunitrile** (4-Cyanobenzyl bromide)	115 6 al			229 30								Me ester of acid, 54 Et ester of acid, 35 6
161	**(4-Nitrophenyl)acetonitrile** (4-Nitrobenzyl cyanide)	116			153	197 8 191	198						
162	**6-Bromo-3-nitrobenzonitrile**	117			180	197 8	166						
163	**(2-Hydroxyphenyl) acetonitrile** (2-Hydroxybenzyl cyanide)	117 9		240 3	147 9	116 8, al		163					O-Benzoyl deriv 50, lgr HCl salt of amine, 155
164	**3-Nitrobenzonitrile**	118			140	141-3	153 4						HCl salt of amine 224
165	**4-Bromo-3-nitrobenzonitrile**	120			203 4	156							
166	**4-Cyanoazobenzene**	120 1, br , bz			241, red, al	224-5, red							Me ester of acid, 123 4, or , me al , Et ester of acid, 86-7, red, al
167	**Dipicolinonitrile** (2,6-Dicyanopyridine)	123 113			252d 228	*di* 302							Di-Me ester of acid, 124 5 Di-Et ester of acid, 41 2
168	**2-Cyanohexanoic acid**	123-6 5			101	*di* 200	*di* 193						
169	**Dibromomalononitrile** (Bromodicyanomethane)	124			147d 136-7d	*di* 200, 206d							Di-Me ester, 67
170	**1-Cyanoanthracene**	126			245, yel , al	260							Me ester of acid, 108, yel , ac a
171	**2,2,3-Triphenylpropionitrile**	126			162 132	111, al							Me ester of acid, 127
172	**1-Cyanophenanthrene**	128			232-3	284	245						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Boiling point, °C	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2				Miscellaneous
				Acid		Amide	Anilide	S Benzyl thiuronium chloride	Amine	Benzamide	Benzene sulfonamide	Picrate	
				B P , °C	M P °C				B P , °C				
173	**2,3-Diphenylbutyronitrile** (2 forms)	(a) 129-30	210 2[16]		133-4	173 4							
			(b) 188 92[13]		186	193							Et ester of acid, 91 2
174	**5-Bromo-3-nitro-4-tolunitrile**	130			206	171							
175	**2,5-Dichlorobenzonitrile**	130		301	154	155			135[9]			230	HCl salt of amine, 151 2, n_D^{53} of amine 1 5885
176	**2,5-Dibromobenzonitrile**	132			157								Me ester of acid 40 1, *p*-Nitrophenyl ester of acid, 183 4
177	**5-Bromo-2-nitro-4-tolunitrile**	132			203 200	191							Et ester of acid, 61
178	**2-Hydroxy-3-nitrobenzonitrile** (2 Cyano-6-nitrophenol)	132 3			148	155 145 6							Me ester of acid, 132 (94) al
179	**4-Nitro-1-naphthonitrile** (1-Cyano-4-nitro naphthalene)	133			220 1	218							Me ester of acid 107 8
180	**4-Acetamidobenzonitrile**	133, w			185, ac a	177, al	167 8, al						N-Methylamide of acid, 172, al
181	**6-Cyanoquinoline**	135, bz - lgr			291 2	174, bz - al			158-9[2]				Me ester of acid, 90 HCl salt of amine, 239, n_D^{20} of amine 1 6390
182	**Apiolonitrile** (2,5-Dimethoxy-3,4-methylenedioxybenzonitrile)	135 5, al			175, w								Me ester of acid, 71 2, al
183	**1-Nitro-2-naphthonitrile** (2-Cyano-1-nitronaphthalene)	138			239								Hot aq $Ba(OH)_2$ → 1-hydroxy-2 naphthoic acid, 191 2 al
184	**3,5-Dichloro-2-hydroxybenzonitrile**	139			219 5 223	209							Me ester of acid 147
185	***trans*-1,4-Dicyanocyclohexane**	140			300								Di-Me ester of acid, 71
186	**3,3,3-Triphenylpropionitrile**	140, al			177	198							Me ester of acid, 120-1 5
187	**4-Cyano-2-phenylquinoline** (2-Phenyl-4-quinolinonitrile)	140, al	*ca* 365		218	196	198						M p of amine >287 HCl salt of amine 232 5
188	**Phthalonitrile** (*o*-Dicyanobenzene)	141			200 6	*di* 219	*di* 253	*di* 151, 157		*di* 184		170	N,N -Diacetyl deriv of diamine, 146
189	**8-Nitro-2-naphthonitrile** (2-Cyano-8-nitronaphthalene)	143			295, 288	218							Et ester of acid, 121 lgr
190	**5-Chloro-2-naphthonitrile** (5-Chloro-2-cyanonaphthalene)	144			270	186-7	202						Me ester of acid 81 Et ester of acid 45
191	**5-Chloro-1-naphthonitrile** (5-Chloro-1-cyanonaphthalene)	145			245, 241 2	239							Et ester of acid, 42
192	**3,5-Dichloro-4-hydroxybenzonitrile**	146			269, 265								Acetate, 93 Me ester of acid, 122
193	**4-Nitrobenzonitrile**	147, 149			241	200	211, 204					184 5	HCl salt of amine, 235-40
194	**5-Bromo-1-naphthonitrile** (1-Bromo-5-cyanonaphthalene)	147			261, 256	241							Et ester of acid, 48 9

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2				Miscellaneous
				Acid		Amide	Anilide	S-Benzyl thiuronium chloride	Amine	Benzamide	Benzene sulfonamide	Picrate	
				B P , °C	M P °C				B P °C				
195	**5-Iodo-2-naphthonitrile** (2-Cyano 5 iodonaphthalene)	148 5			264, al	196	203						M p of amine, 120 HCl salt of amine, 251 3 N-Acetyl deriv amine 135-6
196	**3-Cyano-3-phenylpropionic acid**	150	215 8^{10}		166-7								Di-Me ester of acid, 55, al , Imide of acid, 88-90, M p of amine, 209 HCl salt of amine, 203, N-Acetyl deriv of amine, 65
197	**2-Cyano-2-propylvaleramide** (Dipropylcyanoacetamide)	153			161	*dl* 214	*dl* 168 8 5, me al						
198	**2,6-Dibromobenzonitrile**	155, subl	308 9		157	208 5							Me ester of acid, 83 Hydrazide of acid, 204
199	**3-Chloro-4-hydroxybenzonitrile**	155			169-70, w , 164 5	180-2							Me ester of acid, 106 7, Et ester of acid, 77-8
200	**5-Chloro-2,4-dinitrobenzonitrile**	156			182 3	212	226						
201	**4-Benzamidobenzonitrile** (N-Benzoylanthranilonitrile)	156			181	218 9	279						Me ester of acid, 100 Et ester of acid 98
202	**5-Bromo-2-hydroxybenzonitrile**	158-9			165	232	222						O-Acetyl deriv of acid, 60
203	***d l*-2,3-Diphenylsuccinonitrile**	160			183 (+1 H_2O)		*mono* 173 5, al						
204	**Isophthalonitrile** (*m*-Dicyanobenzene)	161 5 2 0			345 7	*dl* 280							
205	**2-Hydroxy-4-nitrobenzonitrile** (2-Cyano-5-nitrophenol)	160 1, yel			235, 226, w	192 4							Benzoate, 122, yel , al , Et ester of acid, 84-5
206	***d l*-4-Cyano-3,4-diphenylbutyric acid** (*d l*-2,3-Diphenylglutaromononitrile)	162 3, bz			208-10 (cor), aq ac a	*mono* 200-5 d , al	*mono* 201-2, 50% al						Et ester, 99-100, al , Imide of acid, 225-9, aq al
207	***d*-3-Carboxy-2,2,3-trimethylcyclopentylacetonitrile**	164				233, $PhNO_2$							$[\alpha]_D$ +64 41, Me ester, 77, Et ester, 58
208	**5-Chloro-2-hydroxybenzonitrile** (4-Chloro-2-cyanophenol)	165-7			172, 167 5	226							Me ester of acid, 84
209	**2,3-Diphenylcinnamonitrile** (Cyanotriphenylethylene)	166 7, 162-3			213	223							
210	**1,7-Dicyanonaphthalene**	167, al			294-6								
211	**4,4'-Dicyanodiphenylmethane**	169			334, 290								Di-Me ester of acid, 81 2
212	**2,2'-Diphenic acid mononitrile** (2-Carboxy-2'-cyanobiphenyl)	170 2, bz			233 5	*mono* 193, *dl* 212	*mono* 181-3						Di-Me ester of acid, 74, Me ester, 110, Et ester, 91-2
213	**5-Nitro-2-naphthonitrile** (2-Cyano-5-nitronaphthalene)	172-3			295, yel	261-3, br -yel							Me ester of acid, 112, yel

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2				Miscellaneous
				Acid		Amide	Anilide	S-Benzylthiuronium chloride	Amine	Benzamide	Benzenesulfonamide	Picrate	
				B P °C	M P °C				B P °C				
214	**9-Cyanoanthracene** (9-Anthracenecarbonitrile)	175, 170-2			207, pa yel								Me ester of acid, 111, M p of amine, 90
215	**2,3-Dicyanopyridine**	175 6			228 9	*2-mono* 168 5d, *di* 165							
216	**1,3-Dicyanonaphthalene**	179, ac a			267 8								
217	**3-Cyanocoumarin**	182			187 d	236	250						Me ester of acid, 116 7 Et ester of acid, 64
218	**2-Cyanocinnamic acid**	183, al			195 6d	*di* 189-90							NH_3 → 2-Cyanocinnamamide, 123 Me ester of nitrile 89 Di-Me ester of acid, 44 5
219	**2-Cyanobenzoic acid**	187, 192			200 6	*di* 219	*di* 253	*di* 151, 157		*di* 184		170	NH_3 → 2-Cyanobenzamide, 173 Me ester 51 Et ester, 70 65
220	**1,2-Dicyanonaphthalene**	190, bz			175	*di* 265							
221	**2-Hydroxy-5-nitrobenzonitrile** (2-Cyano-4-nitrophenol)	194-6, yel , w			229-30, 227	225, al							*p*-Nitrobenzoyl ester of acid, 115
222	**Tetracyanoethylene**	198 200, subl	223										n_D^{25} 1 560 D^2 1 348 N,N Dimethylaniline → N,N-dimethyl 4-tricyanovinylaniline 173 5, ac a Anthracene → adduct, 268 70, acet
223	**5-Nitro-1-naphthonitrile** (1-Cyano-5-nitronaphthalene)	205			241 2, 239	235 6							Me ester of acid, 109-10, Et ester of acid, 93
224	**1,4-Dicyanonaphthalene**	208, ac a			309, 288								Di-Me ester of acid, 67 Di-Et ester of acid, 64
225	**1,6-Dicyanonaphthalene**	208-10			310								Di-Me ester of acid, 99
226	**1,5-Dicyanonaphthalene**	211, 266-7			310, ac a								Di-Me ester of acid, 114 5 Di-Et ester of acid, 123-4
227	**3-Cyanobenzoic acid**	217			345	280							NH_3 → 3-Cyanobenzamide, >300 Me ester, 65, Et ester, 56
228	**4-Cyanobenzoic acid**	219			*ca* 300, subl	*di* >250	*di* 334-7					232 d	NH_3 → 4-Cyanobenzamide, 223, Me ester, 62, Et ester, 54
229	**Terephthalonitrile** (*p*-Dicyanobenzene)	222			*ca* 300, subl	*di* >250	*di* 334-7					232d	N,N'-Diacetyl deriv of diamine, 225
230	**1,8-Dicyanonaphthalene**	232			260	*di* 250-82d							Di-Me ester of acid, 102 3, Di-Et ester of acid, 58 60
231	**4,4'-Dicyanobiphenyl**	233 4											Di-Me ester of acid, 214 224, Di-Et ester of acid, 112, Heating acid with lime → biphenyl, 71
232	***l*-2,3-Diphenylsuccinonitrile**	239 40			176-7, 190, w								Imide of acid, 196 8, ac a

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXI. ORGANIC DERIVATIVES OF NITRILES

b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	Derivatives of the corresponding acid RCN → RCOOH					Derivatives of the corresponding amine RCN → RCH_2NH_2				Miscellaneous
				Acid		Amide	Anilide	S Benzyl thiuronium chloride	Amine	Benz amide	Benzene sulfon amide	Picrate	
				B P °C	M P °C				B P °C				
233	**1-Cyano-9,10-anthraquinone**	247, yel, ac a			293 4, pa yel, ac a	280, pa yel, al	288–9, pa yel, $PhNO_2$						Me ester of acid, 189, yel, Et ester of acid, 169, yel
234	**2,3-Dicyanonaphthalene**	251, al			239–41								Imide of diacid, 275
235	**2,7-Dicyanonaphthalene**	267 8, ac a			>320	*dt* 297–8							Di-Me ester of acid 135–6
236	**2,6-Dicyanonaphthalene**	293, al			>300 d	*dt* >320							Di-Me ester of acid, 191

*Derivative data given in order m p, crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLES XXII AND XXIII

The main derivatives of the sulfonic acids are obtained by converting them to the corresponding sulfonyl chlorides Hence sulfonic acids and sulfonyl chlorides are often identified through the same derivatives

Sulfonyl chloride

$$RSO_3Na + PCl_5 \rightarrow \underset{\text{Sulfonyl chloride}}{RSO_2Cl} + POCl_3 + NaCl$$

From the sulfonic acid or its sodium or potassium salt with phosphorus pentachloride without solvent

For directions and examples see Cheronis, p 638, Linstead, p 89, Shriner, pp 268, 270, Vogel, p 553, Wild, p 161

Sulfonamide *

$$RSO_3Na \rightarrow \underset{\text{Sulfonyl chloride}}{RSO_2Cl} \xrightarrow{NH_3} \underset{\text{Sulfon amide}}{RSO_2NH_2}$$

From the sulfonyl chloride (prepared from the acid or its salt) and concentrated aqueous ammonia solution

For directions and examples see Linstead, p 49, Shriner, pp 268, 270 Vogel, p 553, Wild, p 161

From the sulfonyl chloride, aqueous ammonia and ammonium carbonate

See Cheronis, p 639

Sulfonanilide *

$$RSO_3Na \rightarrow \underset{\text{Sulfonyl chloride}}{RSO_2Cl} \xrightarrow[NaOH]{C_6H_5NH_2} \underset{\text{Sulfonanilide}}{RSO_2NHC_6H_5} + NaCl$$

From the sulfonyl chloride (prepared from the acid), aniline, and sodium hydroxide

For directions and examples see Linstead, p 89, Wild, p 161

From the sulfonyl chloride and aniline

See Vogel, p 553

Sulfon-p-toluidide *

$$RSO_3Na \rightarrow \underset{\text{Sulfonyl chloride}}{RSO_2Cl} \xrightarrow[NaOH]{p\text{-}CH_3C_6H_4NH_2} \underset{\text{Sulfon } p\text{-toluidide}}{RSO_2NHC_6H_4CH_3\text{-}p} + NaCl$$

From the sulfonyl chloride, *p*-toluidine and aqueous sodium hydroxide

For directions and examples see Vogel, p 553

Sulfon-1-naphthylamide *

$$RSO_3Na \rightarrow \underset{\text{Sulfonyl chloride}}{RSO_2Cl} \xrightarrow{1\text{-}C_{10}H_7NH_2} \underset{\text{Sulfon-1-naphthylamide}}{RSO_2NHC_{10}H_7\text{-}1} + NaCl$$

From the sulfonyl chloride (prepared from the acid) and 1-naphthylamine in benzene

For directions and examples see Cheronis, p 639

S-Benzylthiuronium salt *

$$RSO_3Na + \underset{\text{S-Benzylthiuronium chloride}}{[C_6H_5CH_2SC(NH_2)_2]^+Cl^-} \rightarrow \underset{\text{S-Benzylthiuronium sulfonate}}{[C_6H_5CH_2SC(NH_2)_2]^+RSO_3^-} + NaCl$$

From the sodium, potassium or ammonium salt of the sulfonic acid and S-benzylthiuronium chloride in water

For directions and examples see Cheronis, pp 635, 636, Linstead, pp 15, 89 Shriner, p 269, Wild, pp 149, 159, E Chambers and G. W Watt, *J Org Chem*, **6**, 376 (1941), E Campaigne and C M Suter, *J Amer Chem Soc*, **64**, 3040 (1942), S Veibel, *J Amer Chem Soc*, **67**, 1867 (1945)

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

From sodium or potassium sulfonate and S-benzylthiuronium chloride in alcohol
See J J Donleavy, *J Amer Chem Soc*, **58**, 1004 (1936)

Anilinium salt *

$$RSO_3Na + C_6H_5NH_2 + HCl \rightarrow \underset{\text{Anilinium sulfonate}}{[C_6H_5NH_3]^+RSO_3^-} + NaCl$$

From the sodium or potassium salt of the acid, aniline and hydrochloric acid in water
For directions and examples see Cheronis, p 637, O C Dermer and V H Dermer, *J Org Chem*, **7**, 581 (1942)

p-Toluidinium salt *

$$RSO_3Na + p\text{-}CH_3C_6H_4NH_2 + HCl \rightarrow \underset{p\text{ Toluidinium sulfonate}}{[p\text{-}CH_3C_6H_4NH_3]^+RSO_3^-} + NaCl$$

From the sulfonic acid and *p*-toluidine
For directions and examples see Shriner, p 269
From the sodium, potassium or ammonium salt with *p*-toluidine or *p*-toluidine hydrochloride in water
See Shriner, p 269, Vogel, p 555, O C Dermer and V H Dermer, *J Org Chem*, **7**, 581 (1942), A D Barton and L Young, *J Amer Chem Soc*, **65**, 294 (1943)
From the sodium, potassium, ferric or barium salt (after boiling with sulfuric acid) with *p*-toluidine and hydrochloric acid
See Cheronis, p 637, Fieser, *J Amer Chem Soc*, **51**, 2460 (1929)

o-Toluidinium salt *

$$RSO_3Na + o\text{-}CH_3C_6H_4NH_2 + HCl \rightarrow \underset{o\text{-Toluidinium sulfonate}}{[o\text{-}CH_3C_6H_4NH_3]^+RSO_3^-} + NaCl$$

From the sodium or the potassium salt of the sulfonic acid with *o*-toluidine and hydrochloric acid in water
For directions and examples see Cheronis, p 637, O C Dermer and V H Dermer, *J Org Chem*, **7**, 581 (1942)

Phenylhydrazinium salt *

$$RSO_3H + C_6H_5NHNH_2 \rightarrow \underset{\substack{\text{Phenylhydrazinium}\\ \text{sulfonate}}}{[C_6H_5NHNH_3]^+RSO_3^-}$$

From the sulfonic acid with phenylhydrazine in water-alcohol
For directions and examples see Wild, p 159, P H Latimer and R W Bost, *J Amer Chem Soc*, **59**, 2500 (1937)

Phenols by KOH fusion

$$ArSO_3Na + NaOH \rightarrow \underset{\text{Phenol}}{ArOH} + Na_2SO_3$$

By fusion of the sodium arylsulfonate and sodium hydroxide in a nickel crucible
For directions and examples see Vogel, p 552
By fusion of the sodium arylsulfonate, potassium hydroxide and zinc dust
See Linstead, p 89

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE XXII. ORGANIC DERIVATIVES OF SULFONIC ACIDS

a) Listed in order of increasing m.p. of the corresponding sulfonamide*

No	Name	Melting point °C	S-Benzyl thiuronium salt	*p*-Toluidinium salt	Anilinium salt	*o* Toluidinium salt	Sulfonyl chloride	Sulfonamide	Sulfonanilide	Sulfon-1-naphthylamide	Miscellaneous
1	**Propane-1-sulfonic acid**			67-8			b p 180	52, eth		84	Phenylhydrazine salt, 204 5
2	**Ethane sulfonic acid**		115				b p 171	60, eth		66	Phenylhydrazine salt, 182 8
3	**Propane-2-sulfonic acid**	−37					b p 79[18]	60, eth - pet eth		134	B p 159[1 4], D_4^{25} = 1 1877, n_D^{20} = 1 4332, *m*-T uidide, 109
4	**Heptane-1-sulfonic acid**						16	75			Phenylhydrazine salt, 100 0 5
5	**2,4,5-Trimethoxybenzene sulfonic acid**						130	76	170		
6	**Methane sulfonic acid**	20					b p 60[21]	90	100	125-6	Phenylhydrazine salt, 193 5-4d
7	**Hexadecane-1-sulfonic acid** (Cetyl sulfonic acid)	54					54	97			
8	**10-Bromocamphor-3-sulfonic acid**						97	100 2			
9	**Benzyl sulfonic acid**			113, al	102	83	92 3, eth , bz	105, w , al	102, al	166 (146), yel , al	Diethylamide, 29, Ethylamide, 65-6, Hydrazide, 131-2, Methylamide, 109-10, Phenylhydrazine salt, 173
10	**3-Toluene sulfonic acid** (3-Methylbenzene sulfonic acid)	oil		106		108	12	108, al	96, al		
11	**3-Hydroxynaphthalene-2-sulfonic acid**				241 2		112	110			
12	**Pyridine-3-sulfonic acid**	357					Hydrochloride, 141-4 d	110 1	145		Diethylamide, 49-50, Hydrazide, 94, me al
13	**2,6-Dimethylbenzene sulfonic acid**	98					39	113 (96)			
14	**2-(N-Methylamino)benzene sulfonic acid**	182 d						114 5 5 5			N-4-Toluene sulfonyl, 193
15	**Indane-4-sulfonic acid**						53 3 5	118-9, w			
16	**2-Phenylethane-1-sulfonic acid**	91					33	122	77		
17	**4-Formylbenzene sulfonic acid** (Benzaldehyde-4-sulfonic acid)							122-4			Amide oxime, 185, Dimethylamide, 134-7, Di-O-acetate, 86-7 5, Chloride diacetate, 111-3
18	**2-Methylnaphthalene-1-sulfonic acid**						83-5	124			
19	**4-Fluorobenzene sulfonic acid**						36 (30)	125 (123), w			
20	**4-Chloro-3-methylbenzene sulfonic acid**						65	128	92		Sulfonyl bromide, 67 5
21	**3-Chloro-4-methoxybenzene sulfonic acid**						82	131			
22	**3-Ethoxybenzene sulfonic acid**						38	131			
23	**D-Camphor-10-sulfonic acid**	193					67	132	121		
24	**2-Fluoronaphthalene-6-sulfonic acid**	105					97, chl	133	129		
25	**DL-Camphor-8-sulfonic acid**	56 8					106	133-5, w			
26	**3-Methyl-4-nitrobenzene sulfonic acid**						50	133 5			. .
27	**3-Chloro-4-methylbenzene sulfonic acid**						38	134	96		.
28	**3,5-Dimethylbenzene sulfonic acid**			121-2, al			94 (90), bz	135, al	119, al		.

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXII. ORGANIC DERIVATIVES OF SULFONIC ACIDS

a) Listed in order of increasing m.p. of the corresponding sulfonamide* (Continued)

No	Name	Melting point °C	S-Benzyl thiuronium salt	*p* Toluidinium salt	Anilinium salt	*o* Toluidinium salt	Sulfonyl chloride	Sulfonamide	Sulfonanilide	Sulfon-1-naphthylamide	Miscellaneous
29	**Indane-5-sulfonic acid**	92					46–7, eth	135 5 6, al	129, al		
30	**D-Camphor-8-sulfonic acid**						138, $([\alpha]_D^{14}$ +128 7 in chl)	137, $([\alpha]_D^{13}$ +93 6 in al)			
31	**4-Toluene sulfonic acid** (4-Methylbenzene sulfonic acid)	104 5 (92)	181-2	198	238	190	71, eth	*anh* 138 5 9, *dihyd* 105	103, eth -al	157, al	Phenylhydrazide, 155, al , *o*-Toluidide, 110, aq ac a , Triethylammonium salt, 65
32	**2,4-Dimethylbenzene sulfonic acid**	62 (*hyd*)	146				34	139 (137)	110		
33	**4-Vinylbenzene sulfonic acid** (4-Styrene sulfonic acid)			182 3				139 40			Dimethylamide, 62 3
34	**3,4-Dichlorobenzene sulfonic acid**						22 4 (19)	140 (135)			
35	**2-Bromonaphthalene-1-sulfonic acid**						97	140			
36	**2,4,6-Trimethylbenzene sulfonic acid**	77					56	142	109		
37	**3-Aminobenzene sulfonic acid** (Metanilic acid)		148					142			
38	**D-Camphor-2-sulfonic acid**			196 7			88	143	124		Me ester 77, $([\alpha]_D$ +98 6 in chl)
39	**4-Methylnaphthalene-2-sulfonic acid**						124–5, eth	143 4, al			
40	**3,4-Dimethylbenzene sulfonic acid**	64	208				52	144			
41	**4-Chlorobenzene sulfonic acid**	93	175	208 10	222 3	163 4	53	144	104	190	
42	**4-Methyl-3-nitrobenzene sulfonic acid**	92 hyg		130	109	128	36	144 5		153	
43	**3-Bromocamphor-8-sulfonic acid**	195 6 (*anh*)					136 7	145			
44	**5-Chloro-2-methylbenzene sulfonic acid**						24 (21)	145, aq al			
45	**4-Bromo-3-methylbenzene sulfonic acid**						50	146			
46	**4-Methoxy-3-nitrobenzene sulfonic acid**						66	146 3			
47	**3-Chlorobenzene sulfonic acid**			199 200	206 7			148			
48	**2,5-Dimethylbenzene sulfonic acid**		184				24 6	148			
49	**Naphthalene-1-sulfonic acid**	90	137	181	183	237	68 (66)	150	112 (152)		
50	**4-Ethoxybenzene sulfonic acid**						39	150			
51	**4,6-Dichloro-2,5-dimethylbenzene sulfonic acid**						81	150	175		
52	**3-Bromo-4-methylbenzene sulfonic acid**						60	151			
53	**Benzene sulfonic acid**	66	148	205	240	176	14 5	153 (156)	112 (110)	170 1	N-Xanthylsulfonamide, 200
54	**2-Aminobenzene sulfonic acid** (Orthanilic acid)		132					153			N-Benzoyl deriv of amide, 198, Hydrochloride, 201
55	**2-Iodonaphthalene-1-sulfonic acid**						110	154			
56	**2,6-Dichloro-4-methylbenzene sulfonic acid**						56	154–5			
57	**2-Chloro-5-methylbenzene sulfonic acid**						56	156	229 30 5		
58	**2-Toluene sulfonic acid** (2-Methylbenzene sulfonic acid)	57	170	203 4	218		10	156 3	136, aq al		Sulfonyl bromide, b p 138^{10}, N-Xanthylsulfonamide, 182 3 5

*Derivative data given in order m p crystal color, solvent from which crystallized

TABLE XXII. ORGANIC DERIVATIVES OF SULFONIC ACIDS

a) Listed in order of increasing m.p. of the corresponding sulfonamide* (Continued)

No	Name	Melting point, °C	S Benzyl thiuronium salt	*p*-Toluidinium salt	Anilinium salt	*o*-Toluidinium salt	Sulfonyl chloride	Sulfonamide	Sulfonanilide	Sulfon-1-naphthylamide	Miscellaneous
59	**3-Bromocamphor-10-sulfonic acid**	47 5					65	156 5			
60	**2,4-Dinitrobenzene sulfonic acid**	106 8 (*hyd*)					102	157 (154)			Hydrazide, 110
61	**2-Methyl-4-nitrobenzene sulfonic acid**	130 (*anh*)				177	106	157			
62	**Benzophenone-3,3′-disulfonic acid**						*di* 137 8	*di* 157	*di* 177 8		Methylamide, 106 7, Dimethylamide, 118 9
63	**3-Nitrobenzyl sulfonic acid**	74					100, bz	159, w			
64	**4,6-Dimethyl-2-hydroxy-1,3-benzene disulfonic acid**						*di* 89 91	*di* 160 1			
65	**2-Nitrodiphenylamine-4-sulfonic acid**	220 d					157	162			
66	**2-Ethoxybenzene sulfonic acid**						65 6	163	158		Phenylhydrazide, 132 3
67	**3-Methyl-2-nitrobenzene sulfonic acid**						58 5	163 5			
68	**3-Amino-6-methylbenzene sulfonic acid**							164	146 7		Chloride of N-acetyl deriv, 124 Chloride of N-chloroacetyl deriv, 87, Amide of N-acetyl deriv, 242
69	**4-Chloro-2-nitrobenzene sulfonic acid**						75	164	138		Anhydride, 114 5, Phenylhydrazide, 151, Ph ester, 82
70	**4-Aminobenzene sulfonic acid** (Sulfanilic acid)		185	109		132		165	200	196	N-Acetyl, 214, Me ester, 92
71	**3,6-Dichloro-2,5-dimethylbenzene sulfonic acid**						71	165	171		
72	**6-Aminonaphthalene-1-sulfonic acid**		172 4					165			Benzoylguanidine salt, 210 11
73	**4-Bromobenzene sulfonic acid**	102 3 (88 9)	170	215 6	237 8	182 3	76, eth	166 (161)	119	183 4	
74	**5-Bromo-2-methylbenzene sulfonic acid**						33 5	167			
75	**2,3-Dimethylbenzene sulfonic acid**						47	167			
76	**5-Chloro-2-methyl-3-nitrobenzene sulfonic acid**						60	167			
77	**3-Nitrobenzene sulfonic acid**	48	146	222	222	193	64	167	126	166 7	
79	**4,6-Dichloro-2-methylbenzene sulfonic acid**						43	168			
80	**4-Chloronaphthalene-2-sulfonic acid**						106	168			Et ester, 76 9
81	**4-Bromo-2-methylbenzene sulfonic acid**						50	168			
82	**Propane-1,3-disulfonic acid**	92, d without melting					*di* 45	*di* 169, w	*di* 129		B p 157[14], Di-*m*-toluidide, 222, Dihydrazide, 105
83	**Propane-1,1-disulfonic acid**							*di* 169 70	151 2, al		Di-(N-ethyl)anilide, 128 9, al
84	**3-Carboxybenzene sulfonic acid** (3-Sulfobenzoic acid)	98 (*hyd*)	163		224 6		*di* 20	*di* 170			
85	**4-Methyl-2-nitrobenzene sulfonic acid**	141 (*anh*)					98 9	170			*o*-Anisidide, 135
86	**2,4-Dimethyl-3-nitrobenzene sulfonic acid**	144 (*anh*)					96	172			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXII. ORGANIC DERIVATIVES OF SULFONIC ACIDS

a) Listed in order of increasing m.p. of the corresponding sulfonamide* (Continued)

No	Name	Melting point, °C	S-Benzyl thiuronium salt	*p* Toluidinium salt	Anilinium salt	*o*-Toluidinium salt	Sulfonyl chloride	Sulfonamide	Sulfonanilide	Sulfon-1-naphthylamide	Miscellaneous
87	**2,5-Dimethyl-3-nitrobenzene sulfonic acid**	128		135–6		126 5–7 5	60 1	172 3	143 4		
88	**4-Nitrodiphenylamine-2-sulfonic acid**						102–4	173	164		
90	**3,4-Dibromobenzene sulfonic acid**	66 5 7 5 (*anh*)					34	175			
91	**4-Chloro-3-nitrobenzene sulfonic acid**						40 1	175–6, yel, al			
92	**3-Amino-4-methylbenzene sulfonic acid**							176			N-Acetyl of chloride, 144, N-Benzoyl of Chloride, 196, N-Benzoyl, 203
93	**7-Chloronaphthalene-2-sulfonic acid**	118 (*anh*), 68 (*tetrahyd*)					86 5	176			Me ester, 89, Et ester, 65
94	**4-Bromo-3-nitrobenzene sulfonic acid**						55 7	176 7			
95	**4-Hydroxybenzene sulfonic acid**		169	202	170	192		176–7	141		
96	**5-Methylnaphthalene-1-sulfonic acid**	115						176–8			
97	**4-Methylnaphthalene-1-sulfonic acid**						81	177	158		
98	**4-Nitrobenzene sulfonic acid**	95 (109 11), hyg		179 80			80, lgr	180, 50% al	136 (171), al		
99	**3-Chloro-2-methylbenzene sulfonic acid**	60 72, 72 (*anh*)					72, pet eth	180, w			
100	**2,5-Dichlorobenzene sulfonic acid**	93 7 (> 100)	170	247–8	262 3	250–1	38	181 (186)	160	160	
101	**2,4,5-Trimethylbenzene sulfonic acid**	112					61 2	181			
102	**8-Aminonaphthalene-2-sulfonic acid**							181	146 7		N-Acetyl deriv of amide, 213, Benzoylguanidine salt, 214–6
103	**5-Chloro-4-methyl-2-nitrobenzene sulfonic acid**	128					99	181			
104	**2,4-Dichlorobenzene sulfonic acid**	86		204–6		170–2	55	182			
105	**4-Iodobenzene sulfonic acid**						85	183	143		
106	**Quinoline-8-sulfonic acid**	312					124	183 4			Picrate of Na salt, 226 7, Me ester, 96, Et ester, 73
107	**6-Chloronaphthalene-2-sulfonic acid**						110 5	183–4			Me ester, 89, Et ester, 79, Sulfonyl bromide, 124
108	**5-Nitronaphthalene-2-sulfonic acid**	118–9, yel			260		125	184, yel			
109	**4-Chloro-2-methylbenzene sulfonic acid**						54	185			
110	**4-Chloro-2,5-dimethylbenzene sulfonic acid**	100					50	185	155		

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXII. ORGANIC DERIVATIVES OF SULFONIC ACIDS

a) Listed in order of increasing m.p. of the corresponding sulfonamide* (Continued)

No	Name	Melting point, °C	S-Benzyl thiuronium salt	*p* Toluidinium salt	Anilinium salt	*o* Toluidinium salt	Sulfonyl chloride	Sulfonamide	Sulfonanilide	Sulfon-1-naphthylamide	Miscellaneous
111	**2-Carboxy-5-methylbenzene sulfonic acid**	190 (158), (*anh*)					*di* 59	185			Nitrile of the sulfonyl chloride, 67, lgr, NH_4 salt of 2-amide, 186 (monohyd)
112	**8-Chloronaphthalene-2-sulfonic acid**						94	185-6			Et ester, 92
113	**2-Chloro-5-nitrobenzene sulfonic acid**	168-9 d (*hyd*)					89-90, w	185 6, w			
114	**2-Bromobenzene sulfonic acid**						51, eth	186, w			
115	**2,3-Dichloro-6-methylbenzene sulfonic acid**						49	186			
116	**2-Methyl-5-nitrobenzene sulfonic acid**	133 5 (*di-hyd*)		256 7		256-8	46 7	186	148		
117	**2-Chloro-4-methylbenzene sulfonic acid**						46 (52)	186			
118	**3,5-Dichloro-2-methylbenzene sulfonic acid**						54	186			
119	**6-Chloro-3-nitrobenzene sulfonic acid**	168 9					90, eth	186, w			
120	**2,4-Dimethyl-5-nitrobenzene sulfonic acid**	132 (122), dil HNO_3					98	187 (179)			Sulfonyl fluoride, 109-10
121	**2-Methyl-5-nitrobenzene sulfonic acid**	131					46 7 (44), eth -pet eth	187	148		
122	**4-Chloronaphthalene-1-sulfonic acid**	130 3 d			145-6	151	95	187	145-6	162	Me ester, 83, Et ester, 104
123	**8-Iodonaphthalene-1-sulfonic acid**						115	187	140		
124	**2,4-Diaminobenzene-1,5-disulfonic acid**						275	187	236		
125	**2,6-Dichloro-3-methylbenzene sulfonic acid**						19 5	188			
126	**4-Nitronaphthalene-1-sulfonic acid**						99	188			
127	**2-Chlorobenzene sulfonic acid**						28 5, eth	188			
128	**5-Methylnaphthalene-2-sulfonic acid**						120-2	188 9	248-50		
129	**Phenanthrene-3-sulfonic acid**	175 6 (*anh*), 120-1 (*mono-hyd*), 88-9 (*di-hyd*)		222			110-1 (108)	190			Me ester, 119-20, al, Et ester, 107 8
130	**2,4-Dibromobenzene sulfonic acid**	110 (*anh*)					79, eth	190			
131	**8-Nitronaphthalene-1-sulfonic acid**	115 (*tri-hyd*)					165 d	190 5-1 5	178-8 5		
132	**4-Methylbenzene-2,4-disulfonic acid**	oil		277 d	*di* 189	170-1	54 (56), eth	*di* 190 5-1	189		
133	**3,5-Dichloro-4-methylbenzene sulfonic acid**						69	191			
134	**2,5-Dimethyl-6-nitrobenzene sulfonic acid**	145 (*anh*)		158 5-9, al		143-5, 50% al	110, eth -pet -eth	192, 50% al	182, bl, al		

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE XXII. ORGANIC DERIVATIVES OF SULFONIC ACIDS

a) Listed in order of increasing m.p. of the corresponding sulfonamide* (Continued)

No	Name	Melting point, °C	S-Benzyl thiuronium salt	*p*-Toluidinium salt	Anilinium salt	*o* Toluidinium salt	Sulfonyl chloride	Sulfonamide	Sulfonanilide	Sulfon-1 naphthylamide	Miscellaneous
135	**Quinoline-6-sulfonic acid**	>260					91	192			
136	**3,4-Dicarboxybenzene sulfonic acid** (4-sulfophthalic acid)	138–40 (*monohyd*)					167–70 d, eth	192–200 d, w			
137	**2-Nitrobenzene sulfonic acid**	70 (85)					69	193	115		
138	**Phenanthrene-9-sulfonic acid**	174 (*anh*) 134 (*hyd*)		235			127	193 4, al			Me ester, 106, me al, Et ester, 108, al
139	**2-Carboxybenzene sulfonic acid** (2-Sulfobenzoic acid)	68 9 (*hyd*), 134 (*anh*)	206	197 (200)	165	127–8	79, pet eth, 40, eth	*C* 193–4 (*anh*), *S* 153 4, sl htng	194 5		
140	**4-Bromonaphthalene-1-sulfonic acid**						87	195			
141	**2,5-Dibromobenzene sulfonic acid**	128 (*anh*)					71, pet eth -eth	195, al			
142	**7-Methylnaphthalene-1-sulfonic acid**						96	195–6	162 4		
143	**5-Fluoronaphthalene-1-sulfonic acid**	105 6					122–3	196–7			Me ester, 118, eth
144	**Acenaphthene-3-sulfonic acid**				284 6		113–4	196–9			Me ester, 122–3, Et ester, 137–9, lgr
145	**2,5-Dimethyl-4-nitrobenzene sulfonic acid**	140		143 5 4 5		143 5 4 5	75	197–8	131		
146	**8-Chloronaphthalene-1-sulfonic acid**						101 (96 8)	197 6			Me ester, 70, Et ester, 67–8
147	**4-Chloro-3-methyl-5-nitrobenzene sulfonic acid**						52	201			
148	**5-Amino-2-hydroxybenzene sulfonic acid** (4-Aminophenol-2-sulfonic acid)	100 (*anh*)						202	159		Pyridine salt of O,N-diacetyl deriv, 143–4
149	**4-Nitrobenzyl sulfonic acid**	71					90	204	220		
150	**Anthracene-1-sulfonic acid**						90	205			
151	**6-Methylnaphthalene-2-sulfonic acid**						97 8	205 6			
152	**4-Iodonaphthalene-1-sulfonic acid**						124 (121)	206 (204)	136		
153	**4-Fluoronaphthalene-1-sulfonic acid**	100					86, chl	206	144		Et ester, 93
154	**4-Aminonaphthalene-1-sulfonic acid** (Naphthionic acid)		195					206			N-Acetyl deriv of amide, 241 N-Acetyl deriv of anilide, 231
155	**4-Amino-2-nitrobenzene sulfonic acid**						59–60	206 7			
156	**Retene-6-sulfonic acid**	121–3					146–7 5	206 7 5			Me ester, 117 9, Et ester, 114 5
157	**2,6-Dimethyl-4-hydroxybenzene-1,3-disulfonic acid**						119	208	207		
158	**4-(N-methylamino)benzene sulfonic acid**	244 5 d						210–1			N-4-Toluenesulfonyl, benzidine salt, 255
159	**6-Chloronaphthalene-1-sulfonic acid**						70	214			Et ester, 114–5
160	**1-Nitronaphthalene-2-sulfonic acid**	105, grn			(202)		120–1, pink, bz - pet eth	214, 50% al	202		
161	**2,5-Dichlorobenzene-1,3-disulfonic acid**						114	215–7			

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE XXII. ORGANIC DERIVATIVES OF SULFONIC ACIDS

a) Listed in order of increasing m.p. of the corresponding sulfonamide* (Continued)

No	Name	Melting point, °C	S-Benzyl thiuronium salt	*p*-Toluidinium salt	Anilinium salt	*o*-Toluidinium salt	Sulfonyl chloride	Sulfonamide	Sulfonanilide	Sulfon 1 naphthylamide	Miscellaneous
162	**5-Methylbenzene-1,3-disulfonic acid**						94, eth	216, w	153, al		
163	**Naphthalene-2-sulfonic acid**	91, hyg	190 1	221	269	213	76 (79)	217 (213)	132		
164	**4-Acetamidobenzene-1-sulfonic acid**							218		215	
165	**5-Aminonaphthalene-2-sulfonic acid**		191					218 9 d	127-8		N-Acetyl, 238-9
166	**8-Nitronaphthalene-2-sulfonic acid**	135-6 (*hyd*)					169	223, 228	172-3		
167	**5-Chlorobenzene-1,3-disulfonic acid**						106	224			
168	**2-Methylbenzene-1,4-disulfonic acid**						98, bz - pet eth	*di* 224	*di* 178		
169	**4-Carboxy-3-nitrobenzene sulfonic acid**	111 ($+2\frac{1}{2}$-H_2O)					*di* 160	*di* 226, *mono-S* 192			
170	**5-Chloronaphthalene-1-sulfonic acid**						95	226	138		Me ester, 89, Et ester, 46 Sulfonyl bromide, 110
171	**3,4-Di-iodobenzene sulfonic acid**	122 5, after drying at 100					82, bz - pet eth	227, aq al			Me ester, 93, al, Et ester, 82 5, al
172	**2,4,6-Tribromobenzene sulfonic acid**	64					64	228	220-2		
173	**4'-Nitrobiphenyl-4-sulfonic acid**						178	228			
174	**3,4-Dichloro-2-methylbenzene sulfonic acid**						52	228			
175	**Benzene-1,3-disulfonic acid**		214				63	229	148 50	245	Alkali fusion → resorcinol, 110
176	**Biphenyl-4-sulfonic acid**						115	230	125		
177	**2,4-Di-iodobenzene sulfonic acid**	162 (*anh*)					77 8	230			Me ester, 78, al, Et ester, 57, al
178	**1-Ethoxybenzene-2,5-disulfonic acid**						*di* 106-8	*di* 233			
179	**Methane disulfonic acid** (Methionic acid)						8, b p 133^{10}	*di* 233	*di* 192-3		B p $220\text{-}70^{10\text{-}15}$ d
180	**3,5-Dinitrobenzene sulfonic acid**						99, chl - lgr	235, w, al			
181	**4-Aminobenzene-1,3-disulfonic acid** (Aniline-2,4-disulfonic acid)	120 d						*di* 235			
182	**5-Iodonaphthalene-1-sulfonic acid**						114	236 (239)			
183	**5-Nitronaphthalene-1-sulfonic acid**				265		113	236	123		Me ester, 117 8, chl
184	**4-Carboxybenzene sulfonic acid** (4-Sulfobenzoic acid)	94 (*hyd*), 260 (*anh*)	213					*di* 57	*di* 236	*di* 252	
185	**2,3-Dichloro-4-methylbenzene sulfonic acid**						41	237			
186	**6-Hydroxynaphthalene-2-sulfonic acid**	167 (*anh*), 129 (*hyd*)	217 (207)	248	264	208		237	161		
188	**4-Methylbenzene-1,2-disulfonic acid**						109-11, bz -pet eth	237 9	190, al		

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXII. ORGANIC DERIVATIVES OF SULFONIC ACIDS

a) Listed in order of increasing m.p. of the corresponding sulfonamide* (Continued)

No	Name	Melting point °C	S-Benzyl thiuronium salt	*o* Toluidinium salt	Anilinium salt	*p*-Toluidinium salt	Sulfonyl chloride	Sulfonamide	Sulfonanilide	Sulfon-1 naphthylamide	Miscellaneous
189	**4,5-Dimethylbenzene-1,3-disulfonic acid**						79, yel , al	239	200, al		
190	**4-Hydroxybenzene-1,3-disulfonic acid** (Phenol-2,4-disulfonic acid)	>100 d					*di* 89	*di* 239	*di* 205		
191	**4-Methoxybenzene-1,3-disulfonic acid**						86	240	209		
192	**4-Acetamidonaphthalene-1-sulfonic acid** (Acetylnaphthionic acid)			232 3	231 2			241	231		
193	**Naphthalene-2,7-disulfonic acid**		212	299	251-2	238	158 (162), bz	242			
194	**5-Nitrobenzene-1,3-disulfonic acid**						*di* 97 8	*di* 242			
195	**2,4,6-Trimethylbenzene-1,3-disulfonic acid** (Mesitylene disulfonic acid)						*di* 125	*di* 244	*di* 150-1		
196	**2,3,4,6-Tetrabromobenzene sulfonic acid**						96 5	*ca* 245 d			
197	**4,6-Dimethylbenzene-1,3-disulfonic acid**						130, pet eth	249, w	196, 50% al		
198	**1-Chloronaphthalene-2-sulfonic acid**	130 3 d (*anh*)					84-5	250	171 2		Et ester, 104
199	**Azobenzene-4,4′-disulfonic acid**	169 d (*anh*)					*di* 222 (170)	*di* 250 d			
200	**Phenanthrene-2-sulfonic acid**	150		291			156, ac a	253-4, al	157 8		Me ester, 101-2 (96-8), Et ester, 89, yel br , al
201	**Benzene-1,2-disulfonic acid**		206				143	254	241		Imide, 186
202	**2-Amino-5-methylbenzene-1,4-disulfonic acid**	d at 290					*di* 156, chl	*di* 257, w	*di* 196-7, aq al		
203	**5-Aminonaphthalene-1-sulfonic acid** (Laurent's acid)		179					259-60	171		N-Acetyl deriv of aniline salt, 344
204	**2-Methylbenzene-1,3-disulfonic acid**						88, bz	>260	162, al		
205	**Anthracene-2-sulfonic acid**						122, yel , tol	261	201		Me ester, 157, yel , Et ester, 160, Phenylhydrazide, 210
206	**Anthraquinone-2-sulfonic acid**		211	308	309		197, pa yel , bz	261, yel , ac a	193, yel -br		Me ester, 123, Et ester, 125
207	**7-Nitronaphthalene-1-sulfonic acid**						169 70	261 2			
208	**Azoxybenzene-3,3 -disulfonic acid**	126					138	273			
209	**Naphthalene-1,4-disulfonic acid**						160 (166)	273, w , al	179		
210	**4,6-Dichlorobenzene-1,3-disulfonic acid**						123	276			
211	**Benzidine-2,2′-disulfonic acid**						Hydrochloride, 205	278			
212	**9,10-Dichloroanthracene-2-sulfonic acid**						221	279	248		
213	**4-Nitronaphthalene-2,7-disulfonic acid**						*di* 140 1	*di* 286-7			
214	**Benzene-1,4-disulfonic acid**						131 (139)	288	249		
215	**Azobenzene-3,4′-disulfonic acid**						*di* 123 5	*di* 288			
216	**Naphthalene-1,3-disulfonic acid**						*di* 137 5	*di* 292 3			
217	**2,5-Dimethylbenzene-1,3-disulfonic acid**						81, lgr	295, al	174, al		
218	**Naphthalene-1,6-disulfonic acid**	125 (*anh*)	81	314-5	298-9	323 4	129, bz	297-8			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXII. ORGANIC DERIVATIVES OF SULFONIC ACIDS

a) Listed in order of increasing m.p. of the corresponding sulfonamide* (Continued)

No	Name	Melting point °C	S-Benzyl thiuronium salt	*p* Toluidinium salt	Anilinium salt	*o* Toluidinium salt	Sulfonyl chloride	Sulfonamide	Sulfonanilide	Sulfon 1 naphthylamide	Miscellaneous
219	**Naphthalene-1,7-disulfonic acid**						*di* 123	*di* 298 300			
220	**Biphenyl-4,4 -disulfonic acid**	72	171	330			203	300			
221	**Naphthalene-2,6-disulfonic acid**		256				225, bz	305			
222	**Azobenzene-3,3 -disulfonic acid**						166	305			
223	**Naphthalene-1,5-disulfonic acid**	240 5 (*anh*)	257 (251)				*di* 183	*di* 310 (>340)	*di* 249		Di-Me ester, 205, chl
224	**Benzene-1,3,5-trisulfonic acid**	>100					*tri* 187	*tri* 310 5	*tri* 237		Tri-Et ester, 147, bz
225	**Anthracene-1,5-disulfonic acid**						*di* 249, pa yel	*di* >330, yel	*di* 293		
226	**Anthracene-1,8-disulfonic acid**						225 yel, bz	333	224		
227	**Anthraquinone-1,8-disulfonic acid**	293 4					222 3, yel $PhNO_2$	>340	237 8, yel, $PhNO_2$		
228	**Anthraquinone-1,5-disulfonic acid**	310-1 (*hyd*), yel					265-70, yel, $PhNO_2$	>350	269 70, red-yel, $PhNO_2$		

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXII. ORGANIC DERIVATIVES OF SULFONIC ACIDS

b) M.p. of the amide deriv. not available; listed in order of increasing m.p. of the corresponding anilide deriv.*

No	Name	Melting point, °C	S-Benzyl thiuronium salt	*p*-Toluidinium salt	Anilinium salt	*o*-Toluidinium salt	Sulfonyl chloride	Sulfonamide	Sulfon anilide	Sulfon-1-naphthylamide	Miscellaneous
1	**Ethane-1,2-disulfonic acid**	104	201 2	270 d	270, w		*di* 95		69		*m*-Toluidide, 230, Di-Et ester, 77, eth
2	**Vinylsulfonic acid** (Ethylenesulfonic acid)		145 6, w				b p 118 20^{250}		71, b p 174[1]		B p 135[2], n_D^{25} 1 4505
3	**Phenol-O-sulfonic acid**	145 (hyd)		124-5	165				126 5-7 5		
4	**8-Aminonaphthalene-1-sulfonic acid** (Peri acid)		300						139 40		Anilinium salt of N-acetyl deriv , 273
5	**3,5-Dimethyl-2-hydroxybenzene sulfonic acid**	121 5 d							142 3		Chloride of O-acetyl deriv , 62, pet eth , Methylanilide, 111 2
6	**Benzophenone-2-sulfonic acid**						96-7		143 5		
7	**7-Hydroxynaphthalene-1,3,6-trisulfonic acid**						196		152-5		
8	**1-Hydroxynaphthalene-2-sulfonic acid**	>250	169						O-acetyl deriv , 157-8		O-acetyl deriv of *p*-toluidide, 135-6
9	**2-Hydroxynaphthalene-1,6-disulfonic acid**						*di* 111		*di* 191		
10	**Anthraquinone-2,7-disulfonic acid**						*di* 186, chl eth		*di* 192		
12	**7-Hydroxynaphthalene-1,3-disulfonic acid** (G-Acid)		228	294		271	161-2		195		
13	**7-Hydroxynaphthalene-1-sulfonic acid** (Bayer Acid)		218	232	240	242			195		
14	**4-Hydroxynaphthalene-1-sulfonic acid** (NW-Acid)	170, r h	103	196	186 7	203-4			199-200		2-Naphthylamide, 204
15	**5-Hydroxynaphthalene-1-sulfonic acid**	110-2 d							201		Chloride of O-acetyl deriv , 129
16	**2-Hydroxynaphthalene-3,6-disulfonic acid** (R-Acid)		233	250	254	257			202		
17	**Anthraquinone-1-sulfonic acid**	218	191		284		216 8, yel , $PhNO_2$		214, gold-yel		$NH_3 \rightarrow$ 1-Aminoanthraquinone, 252 (243)
18	**Anthraquinone-1,6-disulfonic acid**	215 7, gold, ac a					197 8, yel , $PhNO_2$		227 8, yel , cl -bz		
19	**2-Hydroxynaphthalene-1,5-disulfonic acid**						*di* 177		*di* 231		
20	**2-Hydroxynaphthalene-1,7-disulfonic acid**			219			169		233		
21	**Anthraquinone-1,7-disulfonic acid**	120 (*hyd*)					231-2, br-yel , $PhNO_2$		237 8, yel , cl -bz		
22	**Anthraquinone-2,6-disulfonic acid**						*di* 250, yel , cl -bz		*di* 321		

*Derivative data given in order m p , crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLES XXII AND XXIII

The main derivatives of the sulfonic acids are obtained by converting them to the corresponding sulfonyl chlorides Hence sulfonic acids and sulfonyl chlorides are often identified through the same derivatives

Sulfonyl chloride

$$RSO_3Na + PCl_5 \rightarrow \underset{\text{Sulfonyl chloride}}{RSO_2Cl} + POCl_3 + NaCl$$

From the sulfonic acid or its sodium or potassium salt with phosphorus pentachloride without solvent

For directions and examples see Cheronis, p 638, Linstead, p 89, Shriner, pp 268, 270, Vogel, p 553, Wild, p 161

Sulfonamide *

$$RSO_3Na \rightarrow \underset{\text{Sulfonyl chloride}}{RSO_2Cl} \xrightarrow{NH_3} \underset{\text{Sulfon amide}}{RSO_2NH_2}$$

From the sulfonyl chloride (prepared from the acid or its salt) and concentrated aqueous ammonia solution

For directions and examples see Linstead, p 49, Shriner, pp 268, 270 Vogel, p 553, Wild, p 161

From the sulfonyl chloride, aqueous ammonia and ammonium carbonate

See Cheronis, p 639

Sulfonanilide *

$$RSO_3Na \rightarrow \underset{\text{Sulfonyl chloride}}{RSO_2Cl} \xrightarrow[NaOH]{C_6H_5NH_2} \underset{\text{Sulfonanilide}}{RSO_2NHC_6H_5} + NaCl$$

From the sulfonyl chloride (prepared from the acid), aniline, and sodium hydroxide

For directions and examples see Linstead, p 89, Wild, p 161

From the sulfonyl chloride and aniline

See Vogel, p 553

Sulfon-p-toluidide *

$$RSO_3Na \rightarrow \underset{\text{Sulfonyl chloride}}{RSO_2Cl} \xrightarrow[NaOH]{p\text{-}CH_3C_6H_4NH_2} \underset{\text{Sulfon } p\text{-toluidide}}{RSO_2NHC_6H_4CH_3\text{-}p} + NaCl$$

From the sulfonyl chloride, *p*-toluidine and aqueous sodium hydroxide

For directions and examples see Vogel, p 553

Sulfon-1-naphthylamide *

$$RSO_3Na \rightarrow \underset{\text{Sulfonyl chloride}}{RSO_2Cl} \xrightarrow{1\text{-}C_{10}H_7NH_2} \underset{\text{Sulfon-1-naphthylamide}}{RSO_2NHC_{10}H_7\text{-}1} + NaCl$$

From the sulfonyl chloride (prepared from the acid) and 1-naphthylamine in benzene

For directions and examples see Cheronis, p 639

S-Benzylthiuronium salt *

$$RSO_3Na + \underset{\text{S-Benzylthiuronium chloride}}{[C_6H_5CH_2SC(NH_2)_2]^+Cl^-} \rightarrow \underset{\text{S-Benzylthiuronium sulfonate}}{[C_6H_5CH_2SC(NH_2)_2]^+RSO_3^-} + NaCl$$

From the sodium, potassium or ammonium salt of the sulfonic acid and S-benzylthiuronium chloride in water

For directions and examples see Cheronis, pp 635, 636, Linstead, pp 15, 89 Shriner, p 269, Wild, pp 149, 159, E Chambers and G. W Watt, *J Org Chem*, **6**, 376 (1941), E Campaigne and C M Suter, *J Amer Chem Soc*, **64**, 3040 (1942), S Veibel, *J Amer Chem Soc*, **67**, 1867 (1945)

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

From sodium or potassium sulfonate and S-benzylthiuronium chloride in alcohol
See J J Donleavy, *J Amer Chem Soc*, **58**, 1004 (1936)

Anilinium salt *

$$RSO_3Na + C_6H_5NH_2 + HCl \rightarrow \underset{\text{Anilinium sulfonate}}{[C_6H_5NH_3]^+RSO_3^-} + NaCl$$

From the sodium or potassium salt of the acid, aniline and hydrochloric acid in water
For directions and examples see Cheronis, p 637, O C Dermer and V H Dermer, *J Org Chem*, **7**, 581 (1942)

p-Toluidinium salt *

$$RSO_3Na + p\text{-}CH_3C_6H_4NH_2 + HCl \rightarrow \underset{p\text{ Toluidinium sulfonate}}{[p\text{-}CH_3C_6H_4NH_3]^+RSO_3^-} + NaCl$$

From the sulfonic acid and *p*-toluidine
For directions and examples see Shriner, p 269
From the sodium, potassium or ammonium salt with *p*-toluidine or *p*-toluidine hydrochloride in water
See Shriner, p 269, Vogel, p 555, O C Dermer and V H Dermer, *J Org Chem*, **7**, 581 (1942), A D Barton and L Young, *J Amer Chem Soc*, **65**, 294 (1943)
From the sodium, potassium, ferric or barium salt (after boiling with sulfuric acid) with *p*-toluidine and hydrochloric acid
See Cheronis, p 637, Fieser, *J Amer Chem Soc*, **51**, 2460 (1929)

o-Toluidinium salt *

$$RSO_3Na + o\text{-}CH_3C_6H_4NH_2 + HCl \rightarrow \underset{o\text{-Toluidinium sulfonate}}{[o\text{-}CH_3C_6H_4NH_3]^+RSO_3^-} + NaCl$$

From the sodium or the potassium salt of the sulfonic acid with *o*-toluidine and hydrochloric acid in water
For directions and examples see Cheronis, p 637, O C Dermer and V H Dermer, *J Org Chem*, **7**, 581 (1942)

Phenylhydrazinium salt *

$$RSO_3H + C_6H_5NHNH_2 \rightarrow \underset{\substack{\text{Phenylhydrazinium}\\ \text{sulfonate}}}{[C_6H_5NHNH_3]^+RSO_3^-}$$

From the sulfonic acid with phenylhydrazine in water-alcohol
For directions and examples see Wild, p 159, P H Latimer and R W Bost, *J Amer Chem Soc*, **59**, 2500 (1937)

Phenols by KOH fusion

$$ArSO_3Na + NaOH \rightarrow \underset{\text{Phenol}}{ArOH} + Na_2SO_3$$

By fusion of the sodium arylsulfonate and sodium hydroxide in a nickel crucible
For directions and examples see Vogel, p 552
By fusion of the sodium arylsulfonate, potassium hydroxide and zinc dust
See Linstead, p 89

*Derivatives recommended for first trial
WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE XXIII. ORGANIC DERIVATIVES OF SULFONYL CHLORIDES
(Listed in order of increasing m.p.)*

No	Name	Melting point °C	Sulfonic acid	Amide	Anilide	1 Naphthyl amide	Salts of the corresponding acid				Miscellaneous
							S Benzylthiuronium	*p*-Toluidine	Aniline	*o* Toluidine	
1	**Methanedisulfonyl chloride**	8	b p 220 $70^{15\ 20}$d	233	192-3						B p 133[10]
2	**2-Ethylbenzenesulfonyl chloride**	11 7		100							
3	**3-Methylbenzenesulfonyl chloride** (Toluene-3-sulfonyl chloride)	12		108, al	96						
4	**4-Ethylbenzenesulfonyl chloride**	12		110							N-Xanthylsulfonamide 196
5	**Benzenesulfonyl chloride**	14 5	43 4 (monohyd) 66 (anh)	156, 153		170 1	148	205	240	176	N-Xanthylsulfonamide, 200
6	**Heptane-1-sulfonyl chloride**	16		75							
7	**2,6-Dichloro-3-methylbenzenesulfonyl chloride**	19 5		188							
8	**3-Carboxybenzenesulfonyl chloride**	20	98 (hyd), 148 (anh)	*di* 170			163	224 6			The m p is that of the 1,3-dichloride
9	**3,4-Dichlorobenzenesulfonyl chloride**	22 4 19		140 135							
10	**5-Chloro-2-methylbenzenesulfonyl chloride**	24		145, aq al							
11	**2,5-Dimethylbenzenesulfonyl chloride**	24 6	48 (anh) 86 (hyd)	148			184				N-Xanthylsulfonamide, 176
12	**2-Chlorobenzenesulfonyl chloride**	28 5		188							
13	**2-Phenylethane-1-sulfonyl chloride**	33	91	122	77						
14	**5-Bromo-2-methylbenzenesulfonyl chloride**	33 5		166 7							
15	**2,4-Dimethylbenzenesulfonyl chloride**	34	62 (hyd)	110							
16	**3,4-Dibromobenzenesulfonyl chloride**	34	66 5 7 5 (anh)	175							
17	**2,4,6-Trichlorobenzenesulfonyl chloride**	35 40		210 2d							
18	**4-Methyl-3-nitrobenzenesulfonyl chloride**	36	92, hyg	144 5	109	153		130-1		28	
19	**4-Fluorobenzenesulfonyl chloride**	36, 30		125							
20	**3-Ethoxybenzenesulfonyl chloride**	38		131							
21	**3-Chloro-4-methylbenzenesulfonyl chloride**	38		134	96						
22	**2,5-Dichlorobenzenesulfonyl chloride**	38	93-7	181	160	160	170	247-8	262 3	250 1	
23	**2,6-Dimethylbenzenesulfonyl chloride**	39	98	113 96							
24	**4-Ethoxybenzenesulfonyl chloride**	39		150							
25	**4-Chloro-3-nitrobenzenesulfonyl chloride**	40 1 60-2		175 6 yel al							
26	**2,3-Dichloro-4-methylbenzenesulfonyl chloride**	41		237							
27	**4,6-Dichloro-2-methylbenzenesulfonyl chloride**	43		168							
28	**3,3-Dimethylbutane-1-sulfonyl chloride**	43 4		96 7							
29	**Propane-1,3-disulfonyl chloride**	45	92d	169, w	*di* 125						Di-*m*-toluidide 222
30	**2-Chloro-4-methylbenzenesulfonyl chloride**	46, 52		186							
31	**Indane-5-sulfonyl chloride**	46-7, eth	92	135 5-6, al	129, al						
32	**2-Methyl-5-nitrobenzenesulfonyl chloride**	46-7	133 5 (+2H_2O)	186	148			256-7		256-8	B p 183 5[10]
33	**2,3-Dimethylbenzenesulfonyl chloride**	47		167							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIII. ORGANIC DERIVATIVES OF SULFONYL CHLORIDES
(Listed in order of increasimg m.p.)* (Continued)

No	Name	Melting point °C	Sulfonic acid	Amide	Anilide	1-Naphthyl amide	Salts of the corresponding acid				Miscellaneous
							S Benzylthiuronium	*p*-Toluidine	Aniline	*o*-Toluidine	
34	**4-Bromo-3-methylbenzenesulfonyl chloride**	50		146							
35	**3-Methyl-4-nitrobenzenesulfonyl chloride**	50		133 5							
36	**4-Bromo-2-methylbenzenesulfonyl chloride**	50		168							
37	**4-Chloro-2,5-dimethylbenzenesulfonyl chloride**	50	100	185	155						
38	**2-Bromobenzenesulfonyl chloride**	51, eth		186 w							
39	**3,4-Dichloro-2-methylbenzenesulfonyl chloride**	51 2		228							
40	**3,4-Dimethylbenzenesulfonyl chloride**	52	64 55	144			208				
41	**4-Chloro-3-methyl-5-nitrobenzenesulfonyl chloride**	52		201							
42	**4-Chlorobenzenesulfonyl chloride**	53	69 93	144	104	190	175	208-10	222 3	163 4	
43	**Indane-4-sulfonyl chloride**	53 3 5		118 9, w							B p 140 1
44	**4-Methylbenzene-1,3-disulfonyl chloride** (Toluene-2,4-disulfonyl chloride)	54 46		*di* 186 7 191	189						
45	**4-Chloro-2-methylbenzenesulfonyl chloride**	54		185							
46	**3,5-Dichloro-2-methylbenzenesulfonyl chloride**	54		186							
47	**Hexadecane-1-sulfonyl chloride**	54	54	97							
48	**2,4-Dichlorobenzenesulfonyl chloride**	55	86	182				204 6		170-2	
49	**4-Bromo-3-nitrobenzenesulfonyl chloride**	55 7		176 7							
50	**2,4,6-Trimethylbenzenesulfonyl chloride**	56	78	142	109						
51	**2-Chloro-5-methylbenzenesulfonyl chloride**	56		156	229 30 5						
52	**2,6-Dichloro-4-methylbenzenesulfonyl chloride**	56		154 5							
53	**4-Carboxybenzenesulfonyl chloride**	57	94 (hyd), 260 (anh)	*di* 236	*di* 252						The m p is that of the 1,4-dichloride
54	**Tetralin-6-sulfonyl chloride**	58		135	155 6						
55	**3-Methyl-2-nitrobenzenesulfonyl chloride**	58 5		163 5							
56	**5-Carboxy-2-methylbenzenesulfonyl chloride** (4-Toluic acid-2-sulfonyl chloride)	59	190, 158 (anh)	185							The m p is that of the 1,5-dichloride
57	**4-Amino-3-nitrobenzenesulfonyl chloride** (2-Nitroaniline-4-sulfonyl chloride)	59-60		206-7							
58	**5-Chloro-2-methyl-3-nitrobenzenesulfonyl chloride**	60		167							
59	**3-Bromo-4-methylbenzenesulfonyl chloride**	60		151							
60	**2,5-Dimethyl-3-nitrobenzenesulfonyl chloride**	61	128, 200	173	143 4			136			
61	**2,4,5-Trimethylbenzenesulfonyl chloride**	61	112	181							
62	**Benzene-1,3-disulfonyl chloride**	63		229	148 50	245	214				N-Xanthylsulfonamide, 170 Alk fusion → resorcinol, 110
63	**4-Chloro-3-methylbenzenesulfonyl chloride**	63		128	92						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIII. ORGANIC DERIVATIVES OF SULFONYL CHLORIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Sulfonic acid	Amide	Anilide	1 Naphthyl amide	Salts of the corresponding acid				Miscellaneous
							S-Benzylthiuronium	*p*-Toluidine	Aniline	*o* Toluidine	
64	**7-Methylnaphthalene-2-sulfonyl chloride**	63 4		163-4							
65	**2,4,6-Tribromobenzenesulfonyl chloride**	64	64	228	220-2d						
66	**3-Nitrobenzenesulfonyl chloride**	64	48	167	126	166 5	146	222	126 5-7 5	193	
67	**2,3,4-Trichlorobenzenesulfonyl chloride**	64-5		227-30							
68	**3-Bromocamphor-10-sulfonyl chloride**	65	47 5	156							
70	**2-Ethoxybenzenesulfonyl chloride**	65 6		163	158						
71	**4-Methoxy-3-nitrobenzenesulfonyl chloride**	66		146 3							
72	**D-Camphor-10-sulfonyl chloride**	67	193	132	121 88						
73	**2-Methylbenzenesulfonyl chloride** (Toluene-2-sulfonyl chloride)	68	57	156 3	136		170	203-4	218		N-Xanthylsulfonamide, 182 3 5
74	**Naphthalene-1-sulfonyl chloride**	68, 66	90	150	112 152		137	181	183	237	
75	**4-Methylbenzenesulfonyl chloride** (Toluene-4-sulfonyl chloride)	69	104 5	138 5 9 (anh), 105 (+2H_2O)	103	157	181-2	198	238	190	
76	**2-Nitrobenzenesulfonyl chloride**	69	70 85	193	115						
77	**3,5-Dichloro-4-methylbenzenesulfonyl chloride**	69		191							
78	**2,4-Dimethoxybenzenesulfonyl chloride**	70		167							
79	**6-Chloronaphthalene-1-sulfonyl chloride**	70		214							
80	**3,4-Dimethyl-5-nitrobenzenesulfonyl chloride**	70		180							
81	**2,5-Dibromobenzenesulfonyl chloride**	71	128 (anh)	195							
82	**3,6-Dichloro-2,5-dimethylbenzenesulfonyl chloride**	71		165	171						
83	**3-Chloro-2-methylbenzenesulfonyl chloride**	72, pet eth	60-72	180, w							
84	**4-Methoxynaphthalene-2-sulfonyl chloride**	75		157	145						
85	**2-Chloronaphthalene-1-sulfonyl chloride**	75		153							
86	**4-Chloro-2-nitrobenzenesulfonyl chloride**	75	82	164, 237	138						Phenylhydrazide 151, Ph ester, 82
87	**2,5-Dimethyl-4-nitrobenzenesulfonyl chloride**	75	140	197-8	131			143 5 4 5		143 5 4 5	
88	**4-Bromobenzenesulfonyl chloride**	76, eth	88 90	166, 161	119	183 5	170	215 6	237-8	182-3	
89	**Naphthalene-2-sulfonyl chloride**	76, 79	91, hyg , 122	217, 213	132		190 1	221	269	213	
90	**6-Bromonaphthalene-1-sulfonyl chloride**	77		217							
91	**2,4-Di-iodobenzenesulfonyl chloride**	77-8	167 (anh)	230							Me ester, 78, al , Et ester, 57, al
92	**2-Carboxybenzenesulfonyl chloride**	79, pet eth	68 9 (hyd), 134 (anh)		194-5		206	196 200	165	127-8	The m p is that of the 1,2-dichloride
93	**2,4-Dibromobenzenesulfonyl chloride**	79, eth	110 (anh)	190							
94	**4,5-Dimethylbenzene-1,3-disulfonyl chloride**	79, yel		239	200, al						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIII. ORGANIC DERIVATIVES OF SULFONYL CHLORIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Sulfonic acid	Amide	Anilide	1-Naphthyl amide	Salts of the corresponding acid				Miscellaneous
							S Benzylthiuronium	*p*-Toluidine	Aniline	*o*-Toluidine	
95	**4-Nitrobenzenesulfonyl chloride**	80 lgr	109 11 95 hyg	180, 50% al	171 136 d			179 80			
96	**6-Methoxynaphthalene-1-sulfonyl chloride**	80 5		149 5	177 5						
97	**2,5-Dimethylbenzene-1,3-disulfonyl chloride**	81, lgr		295 al	174 al						
98	**4,6-Dichloro-2,5-dimethylbenzenesulfonyl chloride**	81		150	175						
99	**4-Methylnaphthalene-1-sulfonyl chloride**	81, eth		174 177 al	158						
100	**3,4-Di-iodobenzenesulfonyl chloride**	82, bz pet eth	122 5	227, aq al							
101	**3-Chloro-4-methoxybenzenesulfonyl chloride**	82		131							
102	**7-Methoxynaphthalene-2-sulfonyl chloride**	83		220	121						
103	**2-Methylnaphthalene-1-sulfonyl chloride**	83 5		124							
104	**1-Chloronaphthalene-2-sulfonyl chloride**	84 5	130 3d (anh)	250	171 2						
105	**4-Iodobenzenesulfonyl chloride**	85		183	143						
106	**4-Ethoxynaphthalene-2-sulfonyl chloride**	85		183	143 5						
107	**4,5-Dichloro-3-methylbenzenesulfonyl chloride**	85 8		183 5							
108	**4-Methoxybenzene-1,3-disulfonyl chloride**	86		240	209						
109	**4-Fluoronaphthalene-1-sulfonyl chloride**	86	100 (hyd)	206	144						Et ester, 93
110	**7-Chloronaphthalene-2-sulfonyl chloride**	87	68 (tetrahyd) 118 (anh)	76							Me ester, 89, Et ester, 65
111	**4-Bromonaphthalene-1-sulfonyl chloride**	87		195							
112	**D-Camphor-3-sulfonyl chloride**	88	77	143	124			196 7			Me ester, 77
113	**2-Methylbenzene-1,3-disulfonyl chloride**	88		260	162						
114	**8-Methylnaphthalene-2-sulfonyl chloride**	88		116							
115	**4-Hydroxybenzene-1,3-disulfonyl chloride** (Phenol-2,4 disulfonyl chloride)	89	>100d	239							
116	**3,5-Dimethyl-2-hydroxybenzene-1,3-disulfonyl chloride**	89 91		160 1							
117	**Anthracene-1-sulfonyl chloride**	90		205							
118	**2-Chloro-5-nitrobenzenesulfonyl chloride**	90, w	168 9d (hyd)	185 6							
119	**Quinoline-6-sulfonyl chloride**	91	>260	192							
120	**Benzylsulfonyl chloride**	92 3, eth , lgr		105, w , al	102	166 146		113, al	102	83	Hydrazide, 131 2, Phenylhydrazide, 173
121	**6-Iodonaphthalene-1-sulfonyl chloride**	92 5		213							
122	**6-Methoxynaphthalene-2-sulfonyl chloride**	93		189	120						
123	**5-Chloro-2-nitrobenzenesulfonyl chloride**	93		159							
124	**1-Bromonaphthalene-2-sulfonyl chloride**	93		271							

*Derivative data given in order m p , crystal color solvent from which crystallized

TABLE XXIII. ORGANIC DERIVATIVES OF SULFONYL CHLORIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Sulfonic acid	Amide	Anilide	1-Naphthyl amide	Salts of the corresponding acid				Miscellaneous
							S-Benzyl thiuronium	*p*-Toluidine	Aniline	*o* Toluidine	
125	**5-Methylbenzene-1,3-disulfonyl chloride**	94, eth		216, w	153, al						
126	**3,5-Dimethylbenzenesulfonyl chloride**	94, 90, bz		135, al	129, al			121 2, al			
127	**8-Chloronaphthalene-2-sulfonyl chloride**	94		185							
128	**1-Iodonaphthalene-2-sulfonyl chloride**	94		247							
129	**4-Chloronaphthalene-1-sulfonyl chloride**	94 5	130 3d	187		162				151	*o* Toluidide 145 6 Me ester 83 Et ester, 104
130	**Ethane-1,2-disulfonyl chloride**	95		69			201 2	270d	270, w		Di-Et ester 77 eth *m*-Toluidide 230
131	**5-Bromonaphthalene-1-sulfonyl chloride**	95		232 3							
132	**5-Chloronaphthalene-1-sulfonyl chloride**	95		226	138						Sulfonyl bromide, 110, Me ester, 89, Et ester, 46
133	**7-Methylnaphthalene-1-sulfonyl chloride**	96		195 6	162 4						
134	**2,4-Dimethyl-3-nitrobenzene-sulfonyl chloride**	96	144 (anh)	172							
135	**5-Bromonaphthalene-2-sulfonyl chloride**	96		220							
136	**2-Benzoylbenzenesulfonyl chloride** (Benzophenone 2-sulfonyl chloride)	96 7			143 5						
137	**2,3,4,6-Tetrabromobenzenesulfonyl chloride**	96 5		245d							
138	**10-Bromocamphor-3-sulfonyl chloride**	97		100 2							
139	**6-Fluoronaphthalene-2-sulfonyl chloride**	97 chl	105 (hyd)	133	129		190 1	221	269	213	
140	**2-Bromonaphthalene-1-sulfonyl chloride**	97		140							
141	**6-Methylnaphthalene-2-sulfonyl chloride**	97 8		205 6							
142	**5-Nitrobenzene-1,3-disulfonyl chloride**	97 8		242							
143	**2,4-Dimethyl-5-nitrobenzene-sulfonyl chloride**	98	132 122 dil HNO_3	187 179							Sulfonyl fluoride, 109 10
144	**2-Methylbenzene-1,4-disulfonyl chloride**	98		224	*di* 178						
145	**4-Methyl-3-nitrobenzenesulfonyl chloride**	98 9		170							*o* Anisidide, 135
146	**4-Methoxynaphthalene-1-sulfonyl chloride**	98 5		226	147 5						
147	**5-Chloro-4-methyl-2-nitro-benzenesulfonyl chloride**	99	128	181							
148	**3,5-Dinitrobenzenesulfonyl chloride**	99, chl , lgr		235							
149	**4-Nitronaphthalene-1-sulfonyl chloride**	99		188							
150	**7-Iodonaphthalene-2-sulfonyl chloride**	100		210							
151	**7-Bromonaphthalene-2-sulfonyl chloride**	100		218							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIII. ORGANIC DERIVATIVES OF SULFONYL CHLORIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Sulfonic acid	Amide	Anilide	1-Naphthyl amide	Salts of the corresponding acid				Miscellaneous
							S Benzylthiuronium	*p* Toluidine	Aniline	*o*-Toluidine	
152	**3-Nitrobenzylsulfonyl chloride**	100, bz	74 (hyd)	159 d , w							Me amide 106 7 Dimethylamide 118 9
153	**8-Chloronaphthalene-1-sulfonyl chloride**	101		197							
154	**2,4-Dinitrobenzenesulfonyl chloride**	102	106 8 (hyd) 130 (anh)	157 154							Hydrazide, 110
155	**4-Nitrodiphenylamine-2-sulfonyl chloride**	102 4		173	164						
156	**4-Ethoxynaphthalene-1-sulfonyl chloride**	103		170	180						
157	**7-Ethoxynaphthalene-2-sulfonyl chloride**	103		142	153						
158	**3,7-Diethylnaphthalene-1-sulfonyl chloride**	105 7		207							
159	**5,6-Dichloronaphthalene-1-sulfonyl chloride**	106		223							
160	**4-Chloronaphthalene-2-sulfonyl chloride**	106		168							Et ester 76 9
161	**2-Methyl-4-nitrobenzene-sulfonyl chloride**	106		157							
162	**DL-Camphor-8-sulfonyl chloride**	106	56 8	133 5, w							
163	**5-Chlorobenzene-1,3-disulfonyl chloride**	106		224							
164	**3-Ethoxybenzene-1,4-disulfonyl chloride**	106 8		*di* 233							
165	**6-Ethoxynaphthalene-2-sulfonyl chloride**	107 5		183	153						
166	**4-Methylbenzene-1,2-disulfonyl chloride**	109 11		237 9	190						
167	**2,5-Dimethyl-6-nitrobenzene-sulfonyl chloride**	110	145 (anh)	192	182			158 5 9		143 5 50% al	
168	**2-Iodonaphthalene-1-sulfonyl chloride**	110		154							
169	**Phenanthrene-3-sulfonyl chloride**	110-1	175 6 (anh) 120 1 (+1 H_2O) 88d (+2H_2O)	190			222				Me ester 119 20, al Et ester 107 8
170	**6-Chloronaphthalene-2-sulfonyl chloride**	110 5		184							
171	**2-Hydroxynaphthalene-1,6-disulfonyl chloride**	111			*di* 191						
172	**Acenaphthene-5-sulfonyl chloride**	111		223	178						
173	**3-Hydroxynaphthalene-2-sulfonyl chloride**	112		110					241 2		
174	**5-Nitronaphthalene-1-sulfonyl chloride**	113		236	123						
175	**Acenaphthene-3-sulfonyl chloride**	113 4	87 9	199	284 6						Me ester, 122 3, Et ester, 137 9, lgr
176	**2,5-Dichlorobenzene-1,3-disulfonyl chloride**	114		215 7							
177	**5-Chloronaphthalene-2-sulfonyl chloride**	115		216							
178	**Biphenyl-4-sulfonyl chloride** (4-Phenylbenzenesulfonyl chloride	115		230	125						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIII. ORGANIC DERIVATIVES OF SULFONYL CHLORIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Amide	Anilide	1-Naphthyl amide	Salts of the corresponding acid				Miscellaneous
							S-Benzylthiuronium	*p*-Toluidine	Aniline	*o*-Toluidine	
179	**2-Ethoxynaphthalene-1-sulfonyl chloride**	116		158	187						
180	**4,5-Dichloronaphthalene-1-sulfonyl chloride**	117		229							
181	**2,6-Dimethyl-4-hydroxybenzene-1,3-disulfonyl chloride**	117 8		206–8	205 7						
182	**6-Ethoxynaphthalene-1-sulfonyl chloride**	118		154	194 5						
183	**4,6-Dichloronaphthalene-1-sulfonyl chloride**	119		226							
184	**5-Methoxynaphthalene-1-sulfonyl chloride**	119 5		194 5	157						
185	**5-Methylnaphthalene-2-sulfonyl chloride**	120 2		188 9	248–50, 133–4						
186	**8-Bromonaphthalene-2-sulfonyl chloride**	121		187							
187	**5-Ethoxynaphthalene-1-sulfonyl chloride**	121		182 5	130						
188	**2-Methoxynaphthalene-1-sulfonyl chloride**	121		159	196 5						
189	**1-Nitronaphthalene-2-sulfonyl chloride**	121, pink, bz -pet eth	105, lgr	214	202						
190	**6,8-Dichloronaphthalene-2-sulfonyl chloride**	121		228							
191	**2-Chloro-5-methyl-6-nitrobenzene sulfonyl chloride**	122		177							
192	**Anthracene-2-sulfonyl chloride**	122		261	201						Me ester, 157, Et ester, 160
193	**5-Fluoronaphthalene-1-sulfonyl chloride**	122–3	105 (hyd)	196 7							Me ester, 118, eth
194	**4,6-Dichlorobenzene-1,3-disulfonyl chloride**	123		276							
195	**Azobenzene-3,4′-disulfonyl chloride**	123 5		*di* 288							
196	**7,8-Dichloronaphthalene-2-sulfonyl chloride**	124		227							
197	**4-Iodonaphthalene-1-sulfonyl chloride**	124, 121		206, 204	136						
198	**6-Bromonaphthalene-2-sulfonyl chloride**	124		127							
199	**Quinoline-8-sulfonyl chloride**	124	312	183–4							Me ester, 96, Et ester, 73
200	**4-Methylnaphthalene-2-sulfonyl chloride**	124 5		143–4							
201	**1,5-Dichloronaphthalene-1-sulfonyl chloride**	125		282							
202	**2,4,6-Trimethylbenzene-1,3-disulfonyl chloride**	125		*di* 244	*di* 150 1						
203	**5-Nitronaphthalene-2-sulfonyl chloride**	125	118–9, yel	184							
204	**6-Nitronaphthalene-1-sulfonyl chloride**	127		223–4							
205	**Phenanthrene-9-sulfonyl chloride**	127	174 (anh)	193–4				235			Me ester, 106, me al , Et ester, 108 al
206	**Naphthalene-1,6-disulfonyl chloride**	129	125 (anh)	298			81, 235	314–5	298–9	323–4	
207	**7-Chloronaphthalene-1-sulfonyl chloride**	129		235							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIII. ORGANIC DERIVATIVES OF SULFONYL CHLORIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Amide	Anilide	1 Naphthyl amide	Salts of the corresponding acid				Miscellaneous
							S-Benzyl thiuronium	*p*-Toluidine	Aniline	*o*-Toluidine	
208	**4,6-Dichloronaphthalene-2-sulfonyl chloride**	130		218							
209	**2,4,5-Trimethoxybenzenesulfonyl chloride**	130		76	170						
210	**4,6-Dimethylbenzene-1,3-disulfonyl chloride**	130, pet eth		249, w	196, 50% al						
211	**5,6,7-Trichloronaphthalene-1-sulfonyl chloride**	131		249							
212	**Benzene-1,4-disulfonyl chloride**	131 139		288	249						
213	**5,8-Dichloronaphthalene-2-sulfonyl chloride**	134		244							
214	**3,7-Dichloronaphthalene-1-sulfonyl chloride**	136		269							
215	**3-Bromocamphor-8-sulfonyl chloride**	136 7									
216	**8-Chloro-7-methoxynaphthalene-1-sulfonyl chloride**	137		153	196						
217	**Benzophenone-3,3 -disulfonyl chloride**	137 8		*di* 157	*di* 177 8						N-Xanthylsulfonamide, 197
218	**Naphthalene-1,3-disulfonyl chloride**	137 5		*di* 292 3							
219	**7,8-Dichloronaphthalene-1-sulfonyl chloride**	138		221							
220	**Azoxybenzene-3,3'-disulfonyl chloride**	138	126	*di* 273							
221	**D-Camphor-8-sulfonyl chloride**	138		137							
222	**3-Methoxynaphthalene-2-sulfonyl chloride**	138		113	174						
223	**8-Cyanonaphthalene-1-sulfonyl chloride**	139		333 4							
224	**4-Nitronaphthalene-2-sulfonyl chloride**	139 5		225							
225	**6-Iodonaphthalene-2-sulfonyl chloride**	140		222							
226	**8-Iodonaphthalene-1-sulfonyl chloride**	140	115	187							
227	**4-Nitronaphthalene-2,7-disulfonyl chloride**	140 1		286–7							
228	**4-Hydroxybenzenesulfonyl chloride**	141		176–7			169	202	170	192	
229	**4,8-Dichloronaphthalene-2-sulfonyl chloride**	141		205							
230	**5-Iodonaphthalene-1-sulfonyl chloride**	141		239							
231	**Pyridine-3-sulfonyl chloride**	Hydrochloride, 141 4	357	110 1	145						Hydrazide, 94
232	**6,7-Dichloronaphthalene-1-sulfonyl chloride**	142		268							
233	**Benzene-1,2-disulfonyl chloride**	143		254	241						
234	**6-Ethoxy-1-nitronaphthalene-2-sulfonyl chloride**	146		218							
235	**Retene-6-sulfonyl chloride**	146 7 5, yel -br	121 3	206 7 5							
236	**7-Bromonaphthalene-1-sulfonyl chloride**	147		209							
237	**4-Acetamidobenzenesulfonyl chloride**	149		219	214	215					
238	**5,7-Dichloronaphthalene-1-sulfonyl chloride**	149		272							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIII. ORGANIC DERIVATIVES OF SULFONYL CHLORIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Sulfonic acid	Amide	Anilide	1 Naphthyl amide	Salts of the corresponding acid				Miscellaneous
							S-Benzylthiuronium	*p*-Toluidine	Aniline	*o*-Toluidine	
239	**4,5-Dibenzylnaphthalene-1-sulfonyl chloride**	151		168							
240	**4,7-Dichloronaphthalene-1-sulfonyl chloride**	151		217							
241	**7-Ethoxy-8-nitronaphthalene-1-sulfonyl chloride**	155		173 4							
242	**2-Amino-5-methylbenzene-1,3-disulfonyl chloride**	156, chl		*dt* 257, w	*dt* 196-7, aq al						
243	**Phenanthrene-2-sulfonyl chloride**	156	150	253-4	157-8			291			Me ester, 101 2, Et ester, 89, yel -br
244	**4,7-Dichloronaphthalene-2-sulfonyl chloride**	156		196							
245	**6,7,8-Trichloronaphthalene-2-sulfonyl chloride**	157		245							
246	**4,5-Dichloronaphthalene-2-sulfonyl chloride**	158		197							
247	**5,6,8-Trichloronaphthalene-2-sulfonyl chloride**	158		235							
248	**Naphthalene-2,7-disulfonyl chloride**	158, 162		242			212	299	251-2	238	
249	**Naphthalene-1,4-disulfonyl chloride**	160 166		273, w , or al	179						
250	**4-Carboxy-3-nitrobenzene-sulfonyl chloride**	*dt* 160	111 (+2½ H_2O)	192							The m p is that of the 1,4-dichloride, Diamide, 226
251	**7-Hydroxynaphthalene-1,3-disulfonyl chloride**	161 2			195		228	294		271	
252	**Fluorene-2-sulfonyl chloride**	164	155 (hyd)	213d							
253	**2,5-Dimethylbenzene-1,4-disulfonyl chloride**	164		310	223						
254	**8-Nitronaphthalene-1-sulfonyl chloride**	165 d	115 d (+3H_2O)	191	178 8 5						
255	**7-Iodonaphthalene-1-sulfonyl chloride**	165		240							
256	**Azobenzene-3,3'-disulfonyl chloride**	166		*dt* 305							
257	**3,6-Dichloronaphthalene-2-sulfonyl chloride**	166		218							
258	**5,6-Dichloronaphthalene-2-sulfonyl chloride**	167		192							
259	**Phthalic acid-4-sulfonyl chloride** (3,4-Dicarboxybenzenesulfonyl chloride)	167-70, d eth	138 40 (+1H_2O)	192-200 d , w							
260	**8-Nitronaphthalene-2-sulfonyl chloride**	169	135-6 (+1½ H_2O)	223	172-3						
261	**4-Amino-2-hydroxybenzene-sulfonyl chloride**	169		155							
262	**2-Hydroxynaphthalene-1,7-disulfonyl chloride**	169		233							
263	**7-Nitronaphthalene-1-sulfonyl chloride**	169-70		261-2							
264	**4,6,7,8-Tetrachloronaphthalene-2-sulfonyl chloride**	176		235							
265	**4'-Nitrobiphenyl-4-sulfonyl chloride**	178		228							
266	**Naphthalene-1,5-disulfonyl chloride**	183	245 (anh)	310, 340	249		257, 251 d	332			Di-Me ester, 205, chl
267	**Anthraquinone-2,7-disulfonyl chloride**	186, chl			*dt* 192						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIII. ORGANIC DERIVATIVES OF SULFONYL CHLORIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Sulfonic acid	Amide	Anilide	1 Naphthyl amide	Salts of the corresponding acid				Miscellaneous
							S Benzylthiuronium	*p*-Toluidine	Aniline	*o*-Toluidine	
268	**Benzene-1,3,5-trisulfonyl chloride**	187		*tri* 310 5	*tri* 237						Tri-Et ester, 147, bz
269	**7-Hydroxynaphthalene-1,3,6-trisulfonyl chloride**	196			152 5						
270	**Anthraquinone-2-sulfonyl chloride**	197		261	193		211	308	309		Me ester, 123, Et ester, 125
271	**Anthraquinone-1,6-disulfonyl chloride**	197 8, yel, $PhNO_2$	215 7, gold		227 8, yel						
272	**Biphenyl-4,4'-disulfonyl chloride**	203		300			171	330 d			
273	**Benzidine-2,2'-disulfonyl chloride**	Hydrochloride, 205		*di* 278							
274	**Anthraquinone-1-sulfonyl chloride**	216 8, yel, $PhNO_2$	218		214		191		284		NH_3 → 1-Aminoanthraquinone, 252, 243
275	**9,10-Dichloroanthracene-2-sulfonyl chloride**	221		279	248						
276	**Azobenzene-4,4'-disulfonyl chloride**	222	169d (anh)	250 d							Et ester, 104
277	**Anthraquinone-1,8-disulfonyl chloride**	222 3, yel, $PhNO_2$	293-4	>340	237-8, yel, $PhNO_2$						
278	**Anthracene-1,8-disulfonyl chloride**	225		333	224						
279	**Naphthalene-2,6-disulfonyl chloride**	225		305			256		360		
280	**2-Hydroxynaphthalene-1,5-disulfonyl chloride**	231			231						
281	**Anthracene-1,5-disulfonyl chloride**	240		*di* 330	*di* 293						
282	**Anthraquinone-2,6-disulfonyl chloride**	250, yel cl bz			*di* 321						
283	**Anthraquinone-1,3-disulfonyl chloride**	265 70, yel	310 1 (hyd)	>350	269 70, yel-red						
284	**2,4-Diaminobenzene-1,5-disulfonyl chloride**	275		187	236						
285	**Anthraquinone-1,7-disulfonyl chloride**	301 2, br-yel, $PhNO_2$	120 (hyd)		237-8, yel cl bz						

*Derivative data given in order m p , crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLE XXIV

Formation of sulfonic acid by hydrolysis *

$$RSO_2NH_2 + H_2O \xrightarrow{HCl} \underset{\text{Sulfonic acid}}{RSO_3H} + NH_4Cl$$

From hydrolysis of the sulfonamide by 25% hydrochloric acid.

For directions and examples see Cheronis, p 631, Shriner, pp. 104, 267, R. S. Schreiber and R L Shriner, *J Amer Chem. Soc*, **56**, 1618 (1934).

From hydrolysis of the sulfonamide in a mixture of concentrated sulfuric acid and 85% phosphoric acid

See Cheronis, p. 633.

Formation of the amine by hydrolysis

$$2\,ArSO_2NHR + 5\,HBr + 5\,C_6H_5OH \rightarrow ArSSAr + \underset{\text{Amine}}{2\,RNH_2} + 5\,p\text{-}BrC_6H_4OH + 4\,H_2O$$

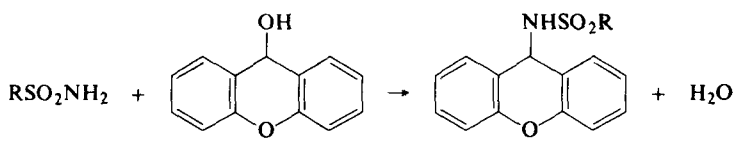
From hydrolysis of the sulfonamide in 48% hydrobromic acid and phenol.

For directions and examples see Shriner, pp 105, 267, H. R. Snyder and R E Heckert, *J Amer Chem Soc*, **74**, 2006 (1952); H R Snyder and H C Geller, *J Amer Chem Soc*, **74**, 4864 (1952).

NOTE For directions and explanations for the preparation of derivatives of the sulfonic acid formed by the hydrolysis of the sulfonamide see explanations and references to Table XXII, pp 369, 370.

For directions and explanations for the preparation of the amine formed by the hydrolysis of the sulfonamide see explanations and references to Table XVIII, pp. 291, 292, 293

N-Xanthylsulfonamide *



From the sulfonamide and xanthydrol in glacial acetic acid.

For directions and examples see. Cheronis, p. 634, Linstead, p. 95; Shriner, p. 267; R. F. Phillips and V. S. Frank, *J Org Chem*, **9**, 9 (1944).

N-Acetylsulfonamide.

$$RSO_2NH_2 + (CH_3CO)_2O \rightarrow RSO_2NHCOCH_3 + CH_3COOH$$

$$RSO_2NHR' + CH_3COCl \rightarrow \underset{\text{N-Acetyl-sulfonamide}}{RSO_2NR'COCH_3} + HCl$$

From the sulfonamide and acetic anhydride.

For directions and examples see. Cheronis, p. 634.

From the sulfonamide and acetyl chloride in acetic acid.

See. Linstead, p. 95; Vogel, p. 555.

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES
(Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1-Naphthylamide	S Benzylthiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
1	**2-Methylpropane-1-sulfonamide**	14–6		b p 80[13]		38	107					
2	**N,N-Diethylbenzylsulfonamide**	29		92	105, w , al	102	166 (146)		113, al	102	83	
3	**2-Methylpropane-1-sulfonanilide**	38		b p 80[13]	14–6		107					
4	**3-Methylbutane-1-sulfonanilide**	42		b p 98[13]	3		90 1					
5	**Butane-1-sulfonamide**	45	–15	b p 75[10]		10 5	60 5					Phenylhydrazinium salt, 114 5
6	**Propane-1-sulfonamide**	52, eth	7 5	b p 78[15]		10	84		67–8			Phenylhydrazinium salt, 204 5d
7	**Ethane sulfonamide**	58, eth	–17	b p 178		58	66	115				Phenylhydrazinium salt, 182 8
8	**Ethane sulfonanilide**	58	–17	b p 178	58		66	115				Phenylhydrazinium salt, 182 8
9	**N,N-Diethyltoluene-4-sulfonamide**	60	104–5	69	105 (dihyd), 138 5 9 (anh)	103	157	181–2	198	238	190	*m*-Toluidide, 109
10	**Propane-2-sulfonamide**	60, eth - pet eth	–37	b p 61[9]		84	134					
11	**N-Ethyltoluene-4-sulfonamide**	64	104–5	69	105 (dihyd), 138 5–9 (anh)	103	157	181 2	198	238	190	
12	**N-Ethylbenzyl sulfonamide**	65–6, eth , lgr		92	105, w , al	102	166 (146)		113, al	102	83	
13	**N-(1-Naphthyl)ethane sulfonamide**	66	–17	b p 178	58	58		115				
14	**Ethane-1,2-disulfonanilide**	69		*di* 95, eth				201 2	d at 270	270, w		Di Et ester, 77, eth , *m*-Toluidide, 230
15	**N-Methyltoluene-2-sulfonamide**	74–5	57	68		136		170	203 4	218		
16	**Heptane-1-sulfonamide**	75		16								
17	**2,4,5-Trimethoxybenzene sulfonamide**	76		130		170						
18	**2-Phenylethane-1-sulfonanilide**	77	91	33	122							
19	**N-Methyltoluene-4-sulfonamide**	78 9	104–5	69	105 (dihyd), 138 5–9 (anh)	103	157	181 2	198	238	190	
20	**Propane-2-sulfonanilide**	84		b p 61[9]	60		134					
21	**N-(1-Naphthyl)propane-1-sulfonamide**	84	7 5	b p 78[15]	52	10			67 8			
22	**N,N-Dimethyltoluene-4-sulfonamide**	86–7	104–5	69	105 (dihyd), 138 5 9 (anh)	103	157	181 2	198	238	190	
23	**Methane sulfonamide**	90	20	b p 60[21]		100 5	125 5					Phenylhydrazinium salt, 193 5–4d
24	**N-(1-Naphthyl)-3-methylbutane-1-sulfonamide**	90–1		b p 98[13]	3	42						
25	**4-Chloro-3-methylbenzene sulfonanilide**	92		63	128							
26	**Toluene-3-sulfonanilide**	96		12	108				106			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1-Naphthyl amide	S-Benzyl thiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
27	**3-Chloro-4-methylbenzene sulfonanilide**	96		38	134							
28	**3,3-Dimethylbutane sulfonamide**	96–7		43 4								
29	**Hexadecane-1-sulfonamide**	97	54	54								
30	**2-Ethylbenzene sulfonamide**	100		11 7								
31	**10-Bromocamphor-3-sulfonamide**	100–2		97								
32	**Methane sulfonanilide**	100 5	20	b p 60[21]	90		125 5					Phenylhydrazinium salt, 193 5–4d
33	**N,N-Dimethylbenzyl sulfonamide**	101		92–3, eth , lgr	105, w , al	102, al	166 (146)		113, al	102	83	Hydrazide, 131 2, Phenylhydrazide, 173
34	**Benzyl sulfonanilide** (Toluene-α-sulfonanilide)	102, al		92	105, w , al		166 (146)		113, al	102	83	Hydrazide, 131 2, Phenylhydrazide, 173
35	**Toluene-4-sulfonanilide**	103	92 (104 5)	69	137			181 2	198	238	190	N-Xanthylsulfonamide, 197
36	**4-Chlorobenzene sulfonanilide**	104	69 (93)	53	144		190	175	208 10	222 3	163 4	
37	**Benzyl sulfonamide** (Toluene-α-sulfonamide)	105, w , al		92–3, eth , lgr		102, al	166 (146)		113, al	102	83	Hydrazide, 131 2, Phenylhydrazide, 173
38	**N-(1-Naphthyl)-2-methylpropane sulfonamide**	107		b p 80[13]	14–6	38						
39	**Toluene-3-sulfonamide**	108, al		12		96			106		108	
40	**2,4-Dimethyl-6-nitrobenzene sulfonamide**	108	97									
41	**2,4,6-Trimethylbenzene sulfonanilide**	109	78	56	142							N-Xanthylsulfonamide, 203
42	**N-Methylbenzyl sulfonamide**	109–10		92–3, eth , bz	105, w , al	102, al	166 (146)		113, al	102	83	N-Xanthylsulfonamide, 188, Hydrazide, 131 2, Phenylhydrazide, 173
43	**2,4-Dimethylbenzene sulfonanilide**	110	62 (hyd)	34								
44	**4-Ethylbenzene sulfonamide**	110		12								N-Xanthylsulfonamide, 196
45	**3-Hydroxynaphthalene-2-sulfonamide**	110		112						241 2		
46	**Pyridine-3-sulfonamide**	110–1	357	Hydrochloride, 141–4 d		145						Hydrazide, 94
47	**Naphthalene-1-sulfonanilide**	112 (152)	90	68, 66	150			137	181	183	237	
48	**Benzene sulfonanilide**	112	66 (anh)	14 5	156		170 1	148	205	240	176	N-Xanthylsulfonamide, 200
49	**3-Methoxynaphthalene-2-sulfonamide**	113		138		174						
50	**2,6-Dimethylbenzene sulfonamide**	113 (96)	98	39								
51	**2-(N-Methylamino)benzene sulfonamide**	114 5 5 5	182 d									2-N-*p*-Toluenesulfonyl deriv of sulfonamide, 193

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1-Naphthyl amide	S Benzyl thiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
52	**2-Nitrobenzene sulfonanilide**	115	70 (85)	69	193							
53	**N-Benzyltoluene-4-sulfonamide**	115 6	92	69	137			181-2	198	238	190	N-Xanthylsulfonamide, 197
54	**8-Methylnaphthalene-2-sulfonamide**	116		88								
55	**Indane-4-sulfonamide**	118 9, w		53-3 5, b p 140-1[4]								
56	**4-Bromobenzene sulfonanilide**	119	88 90	76, eth	166, 161		183 5	170	215 6	237 8	182 3	
57	**3,5-Dimethylbenzene sulfonanilide**	119		94 90	135				121 2 d			
58	**6-Methoxynaphthalene-2-sulfonanilide**	120		93	189							
59	**D-Camphor-10-sulfonanilide**	121	193	67	132							
60	**7-Methoxynaphthalene-2-sulfonanilide**	121		83	220							
61	**2-Phenylethane-1-sulfonamide**	122	91	33		77						
62	**4-Formylbenzene sulfonamide**	122 4										Oxime, 158, O,O-Diacetate of sulfonamide, 86-7 5
63	**5-Nitronaphthalene-1-sulfonanilide**	123		113	236							Me ester, 117 8, chl
64	**2-Methylnaphthalene-1-sulfonamide**	124		83 5								
65	**D-Camphor-3-sulfonanilide**	124	77	88	143				196 7			Me ester, 77, $[\alpha]_D$ +98 6 in chl
66	**Biphenyl-4-sulfonanilide**	125		115	230							
67	**4-Fluorobenzene sulfonamide**	125		36 30								
68	**N-(1-Naphthyl)methane sulfonamide**	125 5	20	b p 60[21]	90	100 5						
69	**3-Nitrobenzene sulfonanilide**	126	48	64	167		166 5	146	222	222	193	
70	**Phenol-O-sulfonanilide**	126 5 7 5	145 (monohyd)						124 5	126 5 7 5		
71	**5-Aminonaphthalene-2-sulfonanilide**	127 8			219			191				5-N-Acetyl deriv of sulfonamide, 247
73	**4-Chloro-3-methylbenzene sulfonamide**	128		63		92						Sulfonyl bromide, 67 5
74	**6-Fluoronaphthalene-2-sulfonanilide**	129	105 (hyd)	97	133							
75	**5-Ethoxynaphthalene-1-sulfonanilide**	130		121	182 5							
76	**3-Chloro-4-methoxybenzene sulfonamide**	131		82								
77	**4-Aminonaphthalene-2-sulfonamide**	131 (hyd)										4-N-Acetyl deriv of sulfonamide, 220
78	**2,5-Dimethyl-4-nitrobenzene sulfonanilide**	131	140	75	197-8				143 5 4 5		143 5 4 5	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1 Naphthyl-amide	S Benzyl thiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
79	**3-Ethoxybenzene sulfonamide**	131		38								
80	**D-Camphor-10-sulfonamide**	132	193	67		121 (88)						
81	**Naphthalene-2-sulfonanilide**	132	91 (hyg)	76 79	217 -13							
82	**6-Fluoronaphthalene-2-sulfonamide**	133	105 (hyd)	97, chl		129		190 1	221	269	213	
83	**DL-Camphor-8-sulfonamide**	133 5 w	56 8	106								
84	**3-Methyl-4-nitrobenzene sulfonamide**	133 5		50								
85	**3-Chloro-4-methylbenzene sulfonamide**	134		38		96						
86	**N-(1-Naphthyl)propane-2-sulfonamide**	134	-37	b p 61[a]	60	84						*m*-Toluidide, 109
87	**3,5-Dimethylbenzene sulfonamide**	135, al		94, 90, bz		129, al			121 2 al			
88	**Tetraline-6-sulfonamide**	135		58		155 6						
89	**Indane-5-sulfonamide**	135 5 6, al	92	46-7, eth b p 148 9[a]		129, al						
90	**Toluene-2-sulfonanilide**	136	57	68	156			170	203 4	218		N-Xanthylsulfonamide, 183
91	**4-Iodonaphthalene-1-sulfonanilide**	136		124 121	206 204							
92	**D-Camphor-8-sulfonamide**	137		138								$[\alpha]_D^{15}$ +93 6, in al
93	**4-Chloro-2-nitrobenzene sulfonanilide**	138	82	75	237							
94	**2,4-Dimethylbenzene sulfonamide**	138	62 (hyd)	34		110		146				N-Xanthylsulfonamide, 188
95	**Toluene-4-sulfonamide**	138 5 9 0 (anh) 105 (dihyd)	104 5	69		103	157	181 2	198	238	190	N-Xanthylsulfonamide, 197
96	**8-Aminonaphthalene-1-sulfonanilide**	139 40						300				
97	**4-Vinylbenzene sulfonamide**	139 40							182 3			Dimethylamide, 62 3
98	**2-Bromonaphthalene-1-sulfonamide**	140		97								
99	**3,4-Dichlorobenzene sulfonamide**	140, 135		22 4, 19								
100	**2,4,6-Trimethylbenzene sulfonamide**	142	78	56		109						N-Xanthylsulfonamide, 203
101	**7-Ethoxynaphthalene-2-sulfonamide**	142		103		153						
102	**3-Aminobenzene sulfonamide**	142						148				
103	**3,5-Dimethyl-2-hydroxybenzene sulfonanilide**	142 3	121 5									2-O-Acetyl deriv of sulfonyl chloride, 62, pet eth
104	**D-Camphor-3-sulfonamide**	143	77	88		124			196 7			N-Methylanilide, 111 2, Me ester, 77, $[\alpha]_D$ +98 6 in chl
105	**5-Chloro-2-methylbenzene sulfonamide**	143	21, 24									

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1 Naphthylamide	S Benzylthiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
106	**4-Iodobenzene sulfonanilide**	143		85	183							
107	**2,5-Dimethyl-3-nitrobenzene sulfonanilide**	143 4	128 (200)	61	173				135-6		126 5-7 5	
108	**4-Methylnaphthalene-2-sulfonamide**	143 4		124 5								
109	**Benzophenone-2-sulfonanilide**	143 5		96 7								
110	**4-Ethoxynaphthalene-2-sulfonanilide**	143 5		85	183							
111	**3,4-Dimethylbenzene sulfonamide**	144	64 (55)	52				208				
112	**4-Fluoronaphthalene-1-sulfonanilide**	144	100 (hyd)	86	206							Et ester, 93
113	**4-Chlorobenzene sulfonamide**	144	69 (93)	53		104	190	175	208-10	222 3	163 4	
114	**4-Methyl-3-nitrobenzene sulfonamide**	144 5	92 (hyg)	36		109	153		130 1		28	
115	**3-Chloro-6-methylbenzene sulfonamide**	145, aq al		24								
116	**Pyridine-3-sulfonanilide**	145			110 1							
117	**3-Bromocamphor-8-sulfonamide**	145	195 6 (anh)	136 7								
118	**4-Chloronaphthalene-1-sulfonanilide**	145 6	130 3	94 5	187		162			145 6	151	Me ester, 83 Et ester, 104
119	**4-Bromo-3-methylbenzene sulfonamide**	146		50								
120	**4-Methoxy-3-nitrobenzene sulfonamide**	146 3		66								
121	**1-Aminonaphthalene-7-sulfonanilide**	147			181 (hyd)							Benzoylguanidine salt, 214 6
122	**4-Methoxynaphthalene-2-sulfonanilide**	147 5		98 5	226							
123	**3-Chlorobenzene sulfonamide**	148							199-200	206 7		
124	**2-Methyl-5-nitrobenzene sulfonanilide**	148	133 5	46-7	186				256 7		256 8	
125	**2,5-Dimethylbenzene sulfonamide**	148	48 (anhyd) 86 (hyd)	24 6				184				N-Xanthylsulfonamide, 176
126	**Benzene-1,3-disulfonanilide**	148 50		63	229		245	214				N-Xanthylsulfonamide, 170
127	**6-Methoxynaphthalene-1-sulfonamide**	149 5		80 5		177 5						
128	**Naphthalene-1-sulfonamide**	150	90	68, 66		112 (152)		137	181	183	237	
129	**4-Ethoxybenzene sulfonamide**	150		39								
130	**4,6-Dichloro-2,5-dimethylbenzene sulfonamide**	150		81		175						
131	**3-Bromo-4-methylbenzene sulfonamide**	151		60								
132	**2-Hydroxynaphthalene-3,6,8-trisulfonanilide**	152-5		*tri* 196								
133	**7-Ethoxynaphthalene-2-sulfonanilide**	153		103	142							
134	**2-Chloronaphthalene-1-sulfonamide**	153		75								

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1-Naphthyl amide	S Benzylthiuronium	*p* Toluidinium	Anilinium	*o* Toluidinium	
135	**8-Chloro-7-methoxynaphthalene-1-sulfonamide**	153		137		196						
136	**2-Aminobenzene sulfonamide**	153						132				2-N Benzoyl deriv of sulfonamide 198, Hydrochloride, 201
137	**5-Methylbenzene-1,3-disulfonanilide**	153, al		94, eth	216, w							
138	**6-Ethoxynaphthalene-2-sulfonanilide**	153		107 5	183							
139	**2-Iodonaphthalene-1-sulfonamide**	154		110								
140	**6-Ethoxynaphthalene-1-sulfonamide**	154		118		194 5						
141	**2,6-Dichloro-4-methylbenzene sulfonamide**	154–5		56								
142	**4-Chloro-2,5-dimethylbenzene sulfonanilide**	155	100	50	185							
143	**4-Amino-2-hydroxybenzene sulfonamide**	155		169								
144	**Tetraline-6-sulfonanilide**	155 6		58	135							
145	**Benzene sulfonamide**	156 (153)	43 4 (monohyd), 66 (anh)	14 5			170 1	148	205	240	176	N Xanthylsulfonamide, 200
146	**2-Chloro-5-methylbenzene sulfonamide**	156		56		229–30 5						
147	**D-3-Bromocamphor-10-sulfonamide**	156	47 5	65								
148	**Toluene-2-sulfonamide**	156 3	57	68		136		170	203 4	218		N Xanthylsulfonamide, 182–3,5
149	**4-Methoxynaphthalene-2-sulfonamide**	157		75 5	145							
150	**5-Methoxynaphthalene-1-sulfonanilide**	157		119 5	194 5							
151	**N-(1-Naphthyl)toluene-4-sulfonamide**	157	104–5	69	105 (dihyd), 138 5 9 (anh)	103		181 2	198	238	190	
152	**Benzophenone-3,3′-disulfonamide**	157		*di* 137–8		*di* 177 8						N-Xanthylsulfonamide, 197
153	**2,4-Dinitrobenzene sulfonamide**	157, 154	106 8 (hyd), 130 (anh)	102								Hydrazide 110
154	**2-Methyl-4-nitrobenzene sulfonamide**	157		106								
155	**2-Nitrodiphenylamine-4-sulfonanilide**	157	220d		162							
156	**Phenanthrene-2-sulfonanilide**	157 8	150	156	253–4				291			Me ester, 101 2, Et ester, 89, yel -br
157	**4-Methylnaphthalene-1-sulfonanilide**	158		81	174, 177							
158	**2-Ethoxynaphthalene-1-sulfonamide**	158		116		187						
159	**4-Methoxynaphthalene-1-sulfonanilide**	158		81	177							

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1 Naphthyl amide	S Benzyl thiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
160	**2-Ethoxybenzene sulfonanilide**	158		65 6	163							Phenylhydrazide, 132 3
161	**2-Methoxynaphthalene-1-sulfonamide**	159		121		196 5						
162	**3-Nitrobenzylsulfonamide** (3-Nitrotoluene-α-sulfonamide)	159d , w	74 (hyd)	100 bz								Me amide, 106 7 Dimethylamide, 118 9
163	**5-Amino-2-hydroxybenzene sulfonanilide**	159 (98)	100 (anh)		202 d							
164	**5-Chloro-2-nitrobenzene sulfonamide**	159		93								
165	**2,5-Dichlorobenzene sulfonanilide**	160	93 7	38	181			170				
166	**3,5-Dimethyl-2-hydroxybenzene-1,4-disulfonamide**	160 1		*di* 89 91								
167	**6-Hydroxynaphthalene-2-sulfonanilide**	161	129 (hyd) 167 (anhyd)		238			217 (207)	247	264	208	
168	**2-Methylbenzene-1,3-disulfonanilide**	162		88	260							
169	**N-(1-Naphthyl)-4-chloronaphthalene-1-sulfonamide**	162	130 3	94 5	187	145 6				145 6	151	Me ester, 83 Et ester, 104
170	**2-Nitrodiphenylamine-4-sulfonamide**	162	220 d			157						
171	**7-Methylnaphthalene-1-sulfonanilide**	162 4		96	197							
172	**2-Ethoxybenzene sulfonamide**	163		65 6		158						Phenylhydrazide, 132 3
173	**7-Methylnaphthalene-2-sulfonamide**	163 4		63 4								
174	**3-Methyl-2-nitrobenzene sulfonamide**	163 5		58 5								
175	**5-Amino-2-methylbenzene sulfonamide**	164				146 7						5-N-Acetyl deriv of sulfonamide, 242
176	**4-Chloro-2-nitrobenzene sulfonamide**	164		75		138						Phenylhydrazide, 151, Ph ester, 82
177	**4-Nitrodiphenylamine-2-sulfonanilide**	164		102 4	174							
178	**4-Aminobenzene sulfonamide**	165				200	196	185				
179	**3,6-Dichloro-2,5-dimethylbenzene sulfonamide**	165		71		171						
180	**6-Aminonaphthalene-1-sulfonamide**	165						172 4				Benzoylguanidine salt, 210 1
181	**N-(1-Naphthyl)benzyl sulfonamide**	166 (146)		92 3, eth , bz	105, w , al	102, al			113, al	102	83	Hydrazide, 131 2, Phenylhydrazide, 173
182	**4-Bromobenzene sulfonamide**	166, 161	88-90	76, eth		119	183 5	170	215-6	237-8	182-3	
183	**5-Bromo-2-methylbenzene sulfonamide**	166 7		33-5								
184	**N-(1-Naphthyl)-3-nitrobenzene sulfonamide**	166 5	48	64	167	126		146	222	126 5-7 5	193	
185	**3-Nitrobenzene sulfonamide**	167	48	64		126	166 5	146	222	126 5-7 5	193	

*Derivative data given in order m p crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1 Naphthylamide	S-Benzyl thiuronium	*p*-Toluidinium	Anilinium	*o* Toluidinium	
186	**2,4-Dimethoxybenzene sulfonamide**	167		70								
187	**5-Chloro-2-methyl-3-nitrobenzene sulfonamide**	167		60								
188	**4-Hydroxynaphthalene-1-sulfonamide**	167				199-200						
189	**2,3-Dimethylbenzene sulfonamide**	167		47								
190	**4,6-Dichloro-2-methylbenzene sulfonamide**	168		43								
191	**4-Chloronaphthalene-2-sulfonamide**	168		106								Et ester, 76 9
192	**4,5-Dibenzylnaphthalene-1-sulfonamide**	168		151								
193	**4-Bromo-2-methylbenzene sulfonamide**	168		50								
194	**Propane-1,3-disulfonamide**	169, w	92 d	*di* 45		*di* 125						Di-*m*-toluidide, 222, Dihydrazide, 105
195	**Propane-1,1-disulfonamide**	169 70				151-2, al						
196	**2,4,5-Trimethoxybenzene sulfonanilide**	170		130	76							
197	**4-Acetamidonaphthalene-1-sulfonanilide**	170			241							
198	**4-Ethoxynaphthalene-1-sulfonamide**	170		103		180						
199	**3-Carboxybenzene sulfonamide**	*di* 170	98 (hyd), 148 (anh)	*di* 20				163	224-6			
200	**4-Methyl-2-nitrobenzene sulfonamide**	170		98 9								*o*-Anisidide, 135
201	**N-(1-Naphthyl)benzene sulfonamide**	170-1	43-4 (monohyd), 66 (anh)	14 5	156	112		148	205	240	176	Me ester, b p 150^{15}, N-Xanthylsulfonamide, 200
202	**3,6-Dichloro-2,5-dimethylbenzene sulfonanilide**	171		71	165							
203	**5-Aminonaphthalene-1-sulfonanilide**	171			260			179				
204	**4-Nitrobenzene sulfonanilide**	171 (136)	109 11 (95)	80, lgr	180				179-80			
205	**2,4-Dimethyl-3-nitrobenzene sulfonamide**	172	144 (anh)	96								
206	**8-Nitronaphthalene-2-sulfonanilide**	172-3	135 6 (hyd)	169	223							
207	**2,5-Dimethyl-3-nitrobenzene sulfonamide**	173	128 (200)	61		143 4			136			
208	**4-Nitrodiphenylamine-2-sulfonamide**	173		102 4		164						
209	**7-Ethoxy-8-nitronaphthalene-1-sulfonamide**	173 4		155								
210	**2,5-Dimethylbenzene-1,3-disulfonanilide**	174, al		81, lgr	295, al							
211	**3-Methoxynaphthalene-2-sulfonanilide**	174		138	113							
212	**3,4-Dibromobenzene sulfonamide**	175	66 5-7 5 (anhyd)	34								

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1-Naphthylamide	S-Benzylthiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
213	**4,6-Dichloro-2,5-dimethylbenzene sulfonanilide**	175		81	150							
214	**4-Chloro-3-nitrobenzene sulfonamide**	175 6, yel, al		40 1 (60 2)								
215	**7-Chloronaphthalene-2-sulfonamide**	176	68 (tetrahyd) 118 (anhyd)	87								Me ester, 89, Et ester, 65
216	**3-Amino-4-methylbenzene sulfonamide**	176										3-N-Benzoyl deriv of sulfonamide, 203, 3-N-Acetyl deriv of sulfonyl chloride, 144, 3-N-Benzoyl deriv of sulfonyl chloride, 196
217	**4-Bromo-3-nitrobenzene sulfonamide**	176-7		55 7								
218	**4-Hydroxybenzene sulfonamide**	176 7		141				169	202	170	192	
219	**5-Methylnaphthalene-1-sulfonamide**	176 8	115									
220	**4-Methylnaphthalene-1-sulfonamide**	177 d 174		81, lgr		158						
221	**2-Chloro-5-methyl-6-nitrobenzene sulfonamide**	177		122								
222	**Benzophenone-3,3 -disulfonanilide**	177 8		*di* 137 8	*di* 157							
223	**6-Methoxynaphthalene-1-sulfonanilide**	177 5		80 5	149 5							
224	**Acenaphthene-5-sulfonanilide**	178		111	223							
225	**2-Methylbenzene-1,4-disulfonanilide**	*di* 178		98	224							
226	**8-Nitronaphthalene-1-sulfonanilide**	178 8 5	115 (trihyd)	165 d	190 5 1 5							
227	**Naphthalene-1,4-disulfonanilide**	179		160 (166)	273, w , al							
228	**4-Nitrobenzene sulfonamide**	180, 50% al	109 11 (95) (hyg)	80, lgr		171 (136) d			179 80			
229	**4-Ethoxynaphthalene-1-sulfonanilide**	180		103	170							
230	**3,4-Dimethyl-5-nitrobenzene sulfonamide**	180		70								
231	**3-Chloro-2-methylbenzene sulfonamide**	180 w	60-72	72, pet eth								
232	**2-Aminonaphthalene-8-sulfonamide**	181 (hyd)				147						1-N-Acetyl deriv of sulfonamide, 213, Benzoylguanidine salt, 214-6
233	**2,5-Dichlorobenzene sulfonamide**	181	93 7 (>1 00)	38		160	160	170	247-8	262-3	250-1	
234	**2,4,5-Trimethylbenzene sulfonamide**	181	112	61								

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1-Naphthylamide	S-Benzylthiuronium	*p*-Toluidinium	Anilinium	*o* Toluidinium	
235	**5-Chloro-4-methyl-2-nitrobenzene sulfonamide**	181	128	99								
236	**2,4-Dichlorobenzene sulfonamide**	182	86	55					204 6		170 2	
237	**2,5-Dimethyl-6-nitrobenzene sulfonanilide**	182	145 (anh)	110	192				158 5 9, al		143 5, 50°, al	
238	**5-Ethoxynaphthalene-1-sulfonamide**	182 5		121		130						
239	**6-Ethoxynaphthalene-2-sulfonamide**	183		107 5		153						
240	**4-Iodobenzene sulfonamide**	183		85		143						
241	**4-Ethoxynaphthalene-2-sulfonamide**	183		85		143 5						
242	**Quinoline-8-sulfonamide**	183-4	312	124								Me ester, 96, Et ester, 73, Picrate of Na salt, 226-7
243	**4,5-Dichloro-3-methylbenzene sulfonamide**	183-5		85 8								
244	**N-(1-Naphthyl)-4-bromobenzene sulfonamide**	183 5	88 90	76, eth	166 161	119		170	215 6	237-8	182 3	
245	**6-Chloronaphthalene-2-sulfonamide**	184		110 5								
246	**5-Nitronaphthalene-2-sulfonamide**	184	118 9, yel	125						260 d		
247	**8-Chloronaphthalene-2-sulfonamide**	185		94								
248	**4-Chloro-2-methylbenzene sulfonamide**	185		54								
249	**4-Chloro-2,5-dimethylbenzene sulfonamide**	185	100	50		155						
250	**2-Carboxy-5-methylbenzene sulfonamide** (4-Toluic acid-2-sulfonamide)	185	190 (158) (anh)	*di* 59								
251	**2-Chloro-5-nitrobenzene sulfonamide**	185-6	168-9 d (hyd)	90, w								
252	**2-Bromobenzene sulfonamide**	186, w		51, eth								
253	**3,5-Dichloro-2-methylbenzene sulfonamide**	186		54								
254	**2-Methyl-5-nitrobenzene sulfonamide**	186	133 5 (dihyd)	46-7, b p 183-5[10]		148			256-7		256-8	
255	**2-Chloro-4-methylbenzene sulfonamide**	186		46, 52								
256	**4-Methylbenzene-1,3-disulfonamide** (Toluene-2,4-disulfonamide)	186-7 (191)		54, 46		189			277 d	*di* 189	*di* 170-1	Di-*m*-toluidide, 138
257	**2-Ethoxynaphthalene-1-sulfonanilide**	187		116	158							
258	**4-Chloronaphthalene-1-sulfonamide**	187	130 3 d	94-5		145-6	162			145-6	151	Me ester, 83, Et ester, 104
259	**8-Iodonaphthalene-1-sulfonamide**	187	115	140								

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1 Naphthyl amide	S-Benzyl thiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
260	**2,4-Dimethyl-5-nitrobenzene sulfonamide**	187 (179)	132 (122) dil HNO_3	98								Sulfonyl chloride, 109 10
261	**2,4-Diaminobenzene-1,5-disulfonamide**	187		275		236						
262	**8-Bromonaphthalene-2-sulfonamide**	187		121								
263	**2-Chlorobenzene sulfonamide**	188		28 5								
264	**4-Nitronaphthalene-1-sulfonamide**	188		99								
265	**2,6-Dichloro-3-methylbenzene sulfonamide**	188		19 5								
266	**5-Methylnaphthalene-2-sulfonamide**	188 9		120 2		248 50 (133 4)						
267	**4-Methylbenzene-1,3-disulfonanilide**	189		54, 46	186-7							
268	**6-Methoxynaphthalene-2-sulfonamide**	189		93		120						
269	**Sulfanilylguanidine** (Sulfaguanidine)	189 90 (anh), 143 (hyd)										4-N-Acetyl deriv of sulfonamide, 262 6 (248 51) Hydrochloride, 205 6
270	**N-(1-Naphthyl)-4-chlorobenzene sulfonamide**	190	69 (93)	53	144	104		175	208-10	222 3	163 4	
271	**2,4-Dibromobenzene sulfonamide**	190	110 (anh)	79, eth								
272	**4-Methylbenzene-1,2-disulfonanilide** (Toluene-3,4-disulfonanilide)	190		109 11	237 9							
273	**Phenanthrene-3-sulfonamide**	190	175-6 (anh), 120-1 (monohyd) 88 d (dihyd)	110 1				222				Me ester, 119 20, al Et ester, 107-8
274	**4-Aminonaphthalene-1-sulfonanilide**	190										4-N-Acetyl deriv of sulfonamide, 247
275	**8-Nitronaphthalene-1-sulfonamide**	191	115 d (trihyd)	165 d		178-8 5						
276	**2-Hydroxynaphthalene-1,6-disulfonanilide**	191		*di* 111								
277	**3,5-Dichloro-4-methylbenzene sulfonamide**	191		69								
278	**Sulfapyridine**	191-2										4-N-Acetyl deriv of sulfonamide, 226 7, acet
279	**Anthraquinone-2,7-disulfonanilide**	192		*di* 186 chl								
280	**4-Carboxy-3-nitrobenzene sulfonamide** (2-Nitrobenzoic acid-4-sulfonamide)	192	111 (+2½ H_2O)	*di* 160								Diamide, 226
281	**Quinoline-6-sulfonamide**	192	>260	91								
282	**5,6-Dichloronaphthalene-2-sulfonamide**	192		167								

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1-Naphthyl amide	S Benzyl thiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
283	**Anthraquinone-2,7-disulfonamide**	192		186								
284	**2,5-Dimethyl-6-nitrobenzene sulfonamide**	192	145 (anh)	110		182			158 5 9		143 5, 50% al	
285	**2-Amino-5-methylbenzene-1,3-disulfonanilide**	192		156	257							
286	**Methane disulfonanilide**	192 3	220 7[15] d	8 b p 133[10]	*di* 233							
287	**3,4-Dicarboxybenzene sulfonamide** (Phthalic acid-4 sulfonamide)	192 200 d w	138 40 (monohyd)	167 70 d eth								
288	**2-Nitrobenzene sulfonamide**	193	70 (85)	69		115						
289	**Anthraquinone-2-sulfonanilide**	193		197	261			211	308	309		Me ester, 123 Et ester, 125
290	**Phenanthrene-9-sulfonamide**	193 4	174 (anh)	127					235			Me ester, 106, me al Et ester, 108, al
291	**2-Carboxybenzene sulfonanilide**	194 5	68 9 (hyd) 134 (anh)	79, pet eth				206	196 (200)	165	127 8	
292	**5-Methoxynaphthalene-1-sulfonamide**	194 5		119 5		157						
293	**6-Ethoxynaphthalene-1-sulfonanilide**	194 5		118	154							
294	**7-Hydroxynaphthalene-1,3-disulfonanilide**	195		161 2				228	294		271	
295	**4-Bromonaphthalene-1-sulfonamide**	195		87								
296	**7-Hydroxynaphthalene-1-sulfonanilide**	195						218	232	240	242	
297	**2,5-Dibromobenzene sulfonamide**	195	128 (anh)	71								
298	**7-Methylnaphthalene-1-sulfonamide**	195 6		96		162 4						
299	**4,6-Dimethylbenzene-1,3-disulfonanilide**	196, 50% al		130, pet eth	249, w							
300	**4,7-Dichloronaphthalene-2-sulfonamide**	196		156								
301	**N-(1-Naphthyl)-4-aminobenzene sulfonamide**	196			165	200		185				
302	**8-Chloro-7-methoxynaphthalene-1-sulfonanilide**	196		137	153							
303	**5-Fluoronaphthalene-1-sulfonamide**	196 7	105 (hyd)	122 3								Me ester, 118, eth
304	**2-Methoxynaphthalene-1-sulfonanilide**	196 5		121	159							
305	**8-Chloronaphthalene-1-sulfonamide**	197		101								
306	**4,5-Dichloronaphthalene-2-sulfonamide**	197		158								
307	**2,5-Dimethyl-4-nitrobenzene sulfonamide**	197 8	140	75		131			143 5 4 5		143 5 4 5	

*Derivative data given in order m p crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1-Naphthylamide	S-Benzylthiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
308	**Sulfamethazine** (Sulfadimethylpyrimidine)	198 9 (+½ H_2O), pa yel										4-N-Acetyl deriv of sulfonamide, 249 50
309	**Acenaphthene-3-sulfonamide**	199	87 9	113 4		284 6						Me ester, 122 3, Et ester, 137 9, lgr
310	**4-Hydroxynaphthalene-1-sulfonanilide**	199 200	170		167			103	196	186-7	203 4	2-Naphthyl sulfonamide, 204
311	**4-Aminobenzene sulfonanilide**	200			165		196	185	109		132	4-N-Acetyl deriv of sulfonanilide, 214, Me ester, 92
312	**4,5-Dimethylbenzene-1,3-disulfonanilide**	200, al		79, yel	239							
313	**4-Chloro-3-methyl-5-nitrobenzene sulfonamide**	201		52								
314	**Anthracene-2-sulfonanilide**	201		122	261							Phenylhydrazide, 210, Me ester, 157, Et ester, 160
315	**5-Hydroxynaphthalene-1-sulfonanilide**	201	110 2 d									O-Acetyl deriv of sulfonyl chloride, 129
316	**2-Hydroxynaphthalene-3,6-disulfonanilide**	202						233	250	254	257	
317	**5-Amino-2-hydroxybenzene sulfonamide**	202 d	100 (anh)			159 (98)						
318	**1-Nitronaphthalene-2-sulfonanilide**	202	105, grn	121, bz - pet eth	214							
319	**Sulfathiazole**	202 5										4-N-Acetyl deriv of sulfonamide, 256 7
320	**4-Nitrobenzyl sulfonamide** (4-Nitrotoluene-α-sulfonamide)	204	71	90	220 d							
321	**Anthracene-1-sulfonamide**	205		90								
322	**4,8-Dichloronaphthalene-2-sulfonamide**	205		141								
323	**3-Amino-4-hydroxybenzene sulfonamide**	205 (170)	155-6 d									
324	**4-Hydroxybenzene-1,3-disulfonanilide** (Phenol-2,4-disulfonanilide)	205	> 100 d	89	239							
325	**6-Methylnaphthalene-2-sulfonamide**	205-6		97 8								
326	**2,6-Dimethyl-4-hydroxybenzene-1,3-disulfonanilide**	205-7		117-8	206-8							
327	**4-Iodonaphthalene-1-sulfonamide**	206, 204		124, 121		136						
328	**4-Fluoronaphthalene-1-sulfonamide**	206	100 (hyd)	86		144						Et ester, 93
330	**4-Amino-3-nitrobenzene sulfonamide**	206 7		59-60								

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1-Naphthylamide	S Benzylthiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
331	**Retene-6-sulfonamide**	206 7 5	121 3	146 7 5, yel -br								Me ester, 117 9, Et ester, 114-5
332	**2,6-Dimethyl-4-hydroxybenzene-1,3-disulfonamide**	206 8		117-8		205 7						
333	**3,7-Diethylnaphthalene-1-sulfonamide**	207		105 7								
334	**6-Bromonaphthalene-2-sulfonamide**	207		124								
335	**7-Bromonaphthalene-1-sulfonamide**	209		147								
336	**4-Methoxybenzene-1,3-disulfonanilide**	209		86	240							
337	**7-Iodonaphthalene-2-sulfonamide**	210		100								
338	**4-(N-Methylamino)benzene sulfonamide**	210 11	244 5 d									*p*-Toluenesulfonate, benzidine salt, 255
339	**2,4,6-Trichlorobenzene sulfonamide**	210-2 d		35 40								
340	**4-Aminonaphthalene-1-sulfonamide**	212				190						
341	**6-Iodonaphthalene-1-sulfonamide**	213		92 5								
342	**Fluorene-2-sulfonamide**	213 d	155 (hyd)	164								
343	**Anthraquinone-1-sulfonanilide**	214	218	216-8, yel , $PhNO_2$				191		284		$NH_3 \rightarrow$ 1-Aminoanthraquinone, 252 (243)
344	**1-Nitronaphthalene-2-sulfonamide**	214	105, grn	121, pink, bz -pet eth		202						
345	**4-Acetamidobenzene sulfonanilide**	214		149	219		215					
346	**6-Chloronaphthalene-1-sulfonamide**	214		70								Et ester, 114-5
347	**N-(1-Naphthyl)-4-acetamidobenzene sulfonamide**	215		149	219	214						
348	**2,5-Dichlorobenzene-1,3-disulfonamide**	215 7		114								
349	**5-Methylbenzene-1,3-disulfonamide**	216, w		94, eth		153, al						
350	**5-Chloronaphthalene-2-sulfonamide**	216		115								
351	**Naphthalene-2-sulfonamide**	217, 213	91 (hyg), (122)	76, 79		132		190 1	221	269	213	
352	**4,7-Dichloronaphthalene-1-sulfonamide**	217		151								
353	**6-Bromonaphthalene-1-sulfonamide**	217		77								
354	**4,6-Dichloronaphthalene-2-sulfonamide**	218		136								
355	**7-Bromonaphthalene-2-sulfonamide**	218		100								
356	**3,6-Dichloronaphthalene-2-sulfonamide**	218		166								

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1 Naphthyl amide	S-Benzyl thiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
357	**6-Ethoxy-1-nitronaphthalene-2-sulfonamide**	218		146								
358	**5-Aminonaphthalene-2-sulfonamide**	218 9 d				127 8						1-N-Acetyl deriv of sulfonamide, 238 9
359	**4-Acetamidobenzene sulfonamide**	219		149		214	215					
360	**5-Bromonaphthalene-2-sulfonamide**	220		96								
361	**4-Nitrobenzyl sulfonanilide** (4-Nitrotoluene-α-sulfonanilide)	220 d	71	90	204							
362	**7-Methoxynaphthalene-2-sulfonamide**	220		83		121						
363	**2,4,6-Tribromobenzene sulfonanilide**	220 2 d	64	64	228							
364	**7,8-Dichloronaphthalene-1-sulfonamide**	221		138								
365	**8-Hydroxynaphthalene-1-sulfonamide**	222 d	107 (hyg)									
366	**6-Iodonaphthalene-2-sulfonamide**	222		140								
367	**2,5-Dimethylbenzene-1,4-disulfonanilide**	223		164	310							
368	**5,6-Dichloronaphthalene-1-sulfonamide**	223		106								
369	**Acenaphthene-5-sulfonamide**	223		111		178						
370	**6-Nitronaphthalene-1-sulfonamide**	223-4		127								
371	**2-Methylbenzene-1,4-disulfonamide**	224		98		*di* 178						
372	**5-Chlorobenzene-1,3-disulfonamide**	224		106								
373	**Anthracene-1,8-disulfonanilide**	224		225	333							
374	**4-Nitronaphthalene-2-sulfonamide**	225		139 5								
375	**4,6-Dichloronaphthalene-1-sulfonamide**	226		119								
376	**4-Carboxamido-3-nitrobenzene sulfonamide** (2-Nitrobenzamide-4-sulfonamide)	226	111 (+2 5 H_2O)	*di* 160	192							
377	**5-Chloronaphthalene-1-sulfonamide**	226		95		138						Sulfonyl bromide, 110, Me ester, 89, Et ester, 46
378	**4-Methoxynaphthalene-1-sulfonamide**	226		98 5		147 5						
379	**3,4-Di-iodobenzene sulfonamide**	227, aq al	122 5	82, bz - pet eth								
380	**7,8-Dichloronaphthalene-2-sulfonamide**	227		124								
381	**Anthraquinone-1,6-disulfonanilide**	227 8, yel	215 7, gold	197-8, yel , $PhNO_2$								
382	**2,3,4-Trichlorobenzene sulfonamide**	227-30		64 5								

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1 Naphthyl amide	S-Benzyl thiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
383	**3,4-Dichloro-2-methylbenzene sulfonamide**	228		51 2								
384	**4'-Nitrobiphenyl-4-sulfonamide**	228		178								
385	**2,4,6-Tribromobenzene sulfonamide**	228	64	64		220 2 d						
386	**8-Nitronaphthalene-2-sulfonamide**	228 223	135 6 (+1 5 H_2O)	169		172 3						
387	**6,8-Dichloronaphthalene-2-sulfonamide**	228		121								
388	**Benzene-1,3-disulfonamide**	229		63		148–50	245	214				N-Xanthylsulfonamide, 170, Alk fusion → resorcinol, 110
389	**4,5-Dichloronaphthalene-1-sulfonamide**	229		117								
390	**Biphenyl-4-sulfonamide**	230		115		125						
391	**2,4-Di-iodobenzene sulfonanilide**	230	167 (anh)	77 8								Me ester, 78, al, Et ester, 52, al
392	**2-Hydroxynaphthalene-1,5-disulfonanilide**	231		*di* 231								
393	**5-Bromonaphthalene-1-sulfonamide**	232–3		95								
394	**2-Hydroxynaphthalene-1,7-disulfonanilide**	233		169								
395	**Methane disulfonamide**	233	b p 220 70^{15-20} d	*di* 8, b p 133^{10}		*di* 192–3						
396	**2-Ethoxybenzene-1,4-disulfonamide**	233		*di* 106 8								
397	**3,5-Dinitrobenzene sulfonamide**	235		99, chl , lgr								
398	**4-Aminobenzene-1,3-disulfonamide** (Aniline-2,4-disulfonamide)	235, w	120 d									
399	**7-Chloronaphthalene-1-sulfonamide**	235		129								
400	**5,6,8-Trichloronaphthalene-2-sulfonamide**	235		158								
401	**4,6,7,8-Tetrachloronaphthalene-2-sulfonamide**	235		176								
402	**5-Nitronaphthalene-1-sulfonamide**	236		113		123						
403	**4-Carboxamidobenzene sulfonamide**	236	94 (hyd) 260 (anh)	*di* 57		*di* 252						
404	**2,4-Diaminobenzene-1,5-disulfonanilide**	236		275	187							
405	**2,3-Dichloro-4-methylbenzene sulfonamide**	237		41								
406	**Benzene-1,3,5-trisulfonanilide**	*tri* 237	>100	*tri* 187	*tri* 310 5							Tri-Et ester, 147, bz
408	**Anthraquinone-1,7-disulfonanilide**	237–8, yel , cl bz	120 (hyd)	321–2, br -yel , $PhNO_2$								
409	**Anthraquinone-1,8-disulfonanilide**	237–8, yel , $PhNO_2$	293–4	222 3	>340							
410	**4-Methylbenzene-1,2-disulfonamide**	237 9		109–11		190						

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1-Naphthyl amide	S-Benzyl thiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
411	**6-Hydroxynaphthalene-2-sulfonamide**	238	129 (hyd) 167 (anh)			161		217 (207)	248	264	208	
412	**4-Hydroxybenzene-1,3-disulfonamide** (Phenol-2,4-disulfonamide)	239	>100 d	89		205						
413	**5-Iodonaphthalene-1-sulfonamide**	239		141								
414	**4,5-Dimethylbenzene-1,3-disulfonamide**	239		79, yel		200, al						
415	**7-Iodonaphthalene-1-sulfonamide**	240		165								
416	**4-Methoxybenzene-1,3-disulfonamide**	240		86		209						
417	**4-Acetamidonaphthalene-1-sulfonamide**	241				170						
418	**Benzene-1,2-disulfonanilide**	241		143	254			206				
419	**5-Nitrobenzene-1,3-disulfonamide**	242		*di* 97 8								
420	**Naphthalene-2,7-disulfonamide**	242		158 162				212	299	251-2	238	
421	**2,4,6-Trimethylbenzene-1,3-disulfonamide**	244		*di* 125		*di* 150 1						
422	**5,8-Dichloronaphthalene-2-sulfonamide**	244		134								
423	**2,3,4,6-Tetrabromobenzene sulfonamide**	245 d		96 5								
424	**6,7,8-Trichloronaphthalene-2-sulfonamide**	245		157								
425	**N,N'-Di(1-naphthyl)benzene-1,3-disulfonamide**	245		63	229	148 50		214				Alk fusion → resorcinol, 110, N-Xanthylsulfonamide, 170
426	**Anthraquinone-1,5-disulfonamide**	246 (350)	310 d	265-70		270 d						
427	**1-Iodonaphthalene-2-sulfonamide**	247		94								
428	**9,10-Dichloroanthracene-2-sulfonanilide**	248		221	279							
430	**5-Methylnaphthalene-2-sulfonanilide**	248-50		120-2	188 9							
431	**4,6-Dimethylbenzene-1,3-disulfonamide**	249, w		130, pet eth		196, 50% al						
432	**Benzene-1,4-disulfonanilide**	249		131 (139)	288							
433	**5,6,7-Trichloronaphthalene-1-sulfonamide**	249		131								
434	**Naphthalene-1,5-disulfonanilide**	249	245 (anh)	*di* 183	310 (340)			257 251d	332			Di-Me ester, 205, chl
435	**1-Chloronaphthalene-2-sulfonamide**	250	130 3d (anh)	84 5		171 2						
436	**Azobenzene-4,4'-disulfonamide**	250 d	169d (anh)	*di* 222								Et ester, 104
437	**4-Carboxanilidobenzene sulfonanilide**	252	94 (hyd), 260 (anh)	*di* 57	*di* 236							

* Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1-Naphthyl amide	S-Benzyl thiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
438	**Phenanthrene-2-sulfonamide**	253 4	150	156		157 8			291			Me ester, 101-2, Et ester, 89, yel -br
439	**Benzene-1,2-disulfonamide**	254		143		241		206				
440	**2-Amino-5-methylbenzene-1,3-disulfonamide**	257		156		192						
441	**2-Amino-5-methylbenzene-1,4-disulfonamide**	257, w	290	*di* 156, chl		*di* 196-7, aq al						
442	**5-Aminonaphthalene-1-sulfonamide**	260				171		179				5-N-Acetyl deriv of sulfonamide, 231-2
443	**2-Methylbenzene-1,3-disulfonamide**	260		88		162						
444	**Anthracene-2-sulfonamide**	261		122		201						Me ester, 157, Et ester, 160
445	**Anthraquinone-2-sulfonamide**	261		197		193		211	308	309		Me ester, 123, Et ester, 125
446	**7-Nitronaphthalene-1-sulfonamide**	261-2		169 70								
447	**6,7-Dichloronaphthalene-1-sulfonamide**	268		142								
448	**3,7-Dichloronaphthalene-1-sulfonamide**	269		136								
449	**Anthraquinone-2,6-disulfonanilide**	269-70	310 11 (hyd)	265 70, yel	>350							
450	**Anthraquinone-1,5-disulfonanilide**	270 d	310 d	265-70	246 (350)							
451	**1-Bromonaphthalene-2-sulfonamide**	271		93								
452	**5,7-Dichloronaphthalene-1-sulfonamide**	272		149								
453	**Naphthalene-1,4-disulfonamide**	273, w , al		160 (166)		179						
454	**Azoxybenzene-3,3′-disulfonamide**	273	126	*di* 138								
455	**4,6-Dichlorobenzene-1,3-disulfonamide**	276		123								
456	**Benzidine-2,2′-disulfonamide**	278		Hydrochloride, 205								
457	**9,10-Dichloroanthracene-2-sulfonamide**	279		221		248						
458	**1,5-Dichloronaphthalene-2-sulfonamide**	282		125								
459	**4-Nitronaphthalene-2,7-disulfonamide**	286-7		140 1								
460	**Azobenzene-3,4′-disulfonamide**	288		123 5								
461	**Benzene-1,4-disulfonamide**	288		131 (139)		249						
462	**Naphthalene-1,3-disulfonamide**	292 3		*di* 137 5								
463	**Anthracene-1,5-disulfonanilide**	293		*di* 240	*di* >330							
464	**2,5-Dimethylbenzene-1,3-disulfonamide**	295, al		81, lgr		174, al						

*Derivative data given in order m p , crystal color, solvent from which crystallized

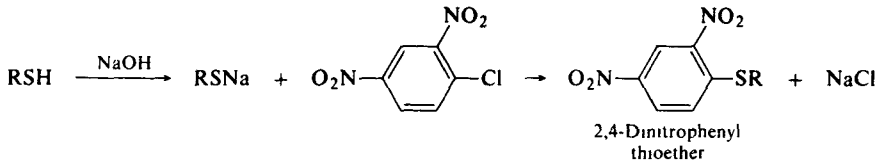
TABLE XXIV. ORGANIC DERIVATIVES OF SULFONAMIDES AND SULFONANILIDES
(Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point, °C	Sulfonic acid	Derivatives of the corresponding acid				Salts of the corresponding acid				Miscellaneous derivatives of the acid
				Chloride	Amide	Anilide	1-Naphthylamide	S-Benzylthiuronium	*p*-Toluidinium	Anilinium	*o*-Toluidinium	
465	**Naphthalene-1,6-disulfonamide**	298	125 (anh)	129				81 (235)	314–5	298–9	323–4	
466	**Naphthalene-1,7-disulfonamide**	298 300	123									
467	**Biphenyl-4,4'-disulfonamide**	300	72	203				171	330 d			
468	**Naphthalene-2,6-disulfonamide**	305		225				256		360		
469	**Azobenzene-3,3'-disulfonamide**	305		*di* 166								
470	**2,5-Dimethylbenzene-1,4-disulfonamide**	310		164		223						
471	**Naphthalene-1,5-disulfonamide**	310 (340)	245 (anh)	183		249		257, 251 d	332			Di-Me ester, 205, chl
472	**Benzene-1,3,5-trisulfonamide**	310 5	>100	*tri* 187		*tri* 237						Tri-Et ester, 147, bz
473	**Anthraquinone-2,6-disulfonanilide**	321		*di* 250, yel , cl bz								
474	**Anthracene-1,5-disulfonamide**	330		*di* 240		*di* 293						
475	**Anthracene-1,8-disulfonamide**	333		225		224						
476	**8-Cyanonaphthalene-1-sulfonamide**	333-4		139								
477	**Anthraquinone-1,8-disulfonamide**	>340	293 4	222 3, yel , $PhNO_2$		237–8, yel , $PhNO_2$						
478	**Anthraquinone-1,3-disulfonamide**	>350	310 11 (hyd)	265 70, yel		269–70, red-yel						

*Derivative data given in order m p , crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLE XXV

*2,4-Dinitrophenyl thioether (2,4-Dinitrophenyl sulfide).**



2,4-Dinitrophenyl thioether

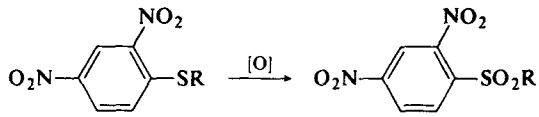
From the sodium thiolate (prepared from the thiol and sodium hydroxide) and 2,4-dinitrochlorobenzene in methanol.

For directions and examples see: Cheronis, p. 642.

From the sodium thiolate and 2,4-dinitrochlorobenzene in aqueous or absolute alcohol.

See: Linstead, p. 86; Shriner, p. 255; Vogel, p. 500; Wild, p. 91; R. W. Bost, J. O. Turner and R. D. Norton, *J. Amer. Chem. Soc.*, **54**, 1985 (1932); R. W. Bost, J. O. Turner and M. W. Conn, *J. Amer. Chem. Soc.*, **55**, 4956 (1933).

*2,4-Dinitrophenyl sulfone.**



2,4-Dinitrophenyl sulfone

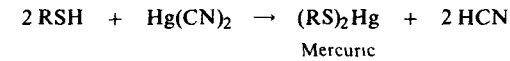
From the thioether (prepared from the thiol and 2,4-dinitrochlorobenzene) and potassium permanganate in aqueous or glacial acetic acid.

For directions and examples see: Cheronis, p. 641; Linstead, p. 87; Vogel, p. 501; Wild, pp. 91–2.

From the thioether with hydrogen peroxide, ammonium molybdate and perchloric acid in water.

See: Cheronis, p. 642.

Hg salt.

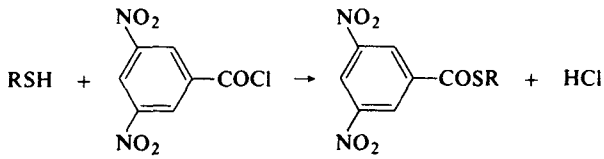


Mercuric thiolate

From the thiol and aqueous mercuric cyanide in ethanol.

For directions and examples see: Linstead, p. 86; Wild, pp. 90–91; E. Wertheim, *J. Amer. Chem. Soc.*, **51**, 3661 (1929).

*3,5-Dinitrothiobenzoate.**

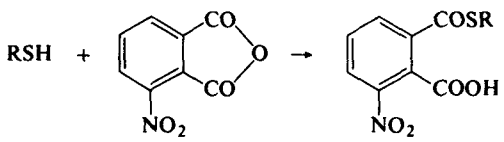


3,5-Dinitrothiobenzoate

From the thiol, 3,5-dinitrobenzoyl chloride and pyridine.

For directions and examples see: Cheronis, p. 643; Shriner, p. 255; Vogel, p. 501; Wild, p. 92; E. Wertheim, *J. Amer. Chem. Soc.*, **51**, 3661 (1929).

*3-Nitrothiophthalate.**



3-Nitrothiophthalate

From 3-Nitrophthalic anhydride and the thiol.

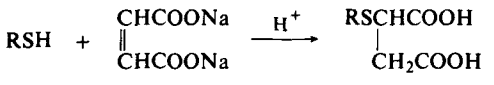
For directions and examples see: Wild, p. 93; E. Wertheim, *J. Amer. Chem. Soc.*, **51**, 3661 (1929).

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

EXPLANATIONS AND REFERENCES TO TABLE XXV (Continued)

S-Alkylmercaptosuccinic acid (Alkylthiosuccinic acid) *

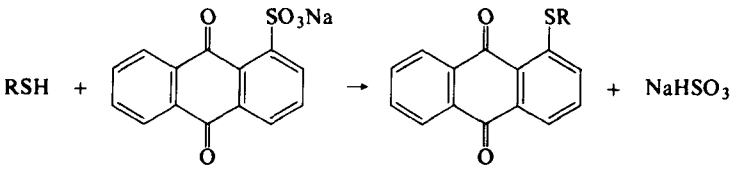


S-Alkylmercap tosuccinic acid

From the thiol and disodium maleate in ethanol

For directions and examples see J G Hendrickson and L F Hatch, *J Org Chem*, **25**, 1747 (1960)

1-Anthraquinonyl thioether



1 Anthraquinonyl thioether

From the thioether with sodium anthraquinone-1-sulfonate and sodium hydroxide in water

For directions and examples see E E Reid, C M MacKall and G E Miller, *J Amer Chem Soc*, **43**, 2104 (1921) W S Hoffman and E E Reid, *J Amer Chem Soc*, **45**, 1831 (1923) L M Ellis and E E Reid, *J Amer Chem Soc*, **54**, 1674 (1932)

Acetate

$$RSH + CH_3COCl \rightarrow CH_3COSR + HCl$$

$$RSH + (CH_3CO)_2O \rightarrow CH_3COSR + CH_3COOH$$

$$RSH + CH_2{=}C{=}O \rightarrow CH_3COSR$$

Acetate

From the thiol with acetyl chloride, or from the thiol with acetic anhydride and aqueous sodium hydroxide, or from the thiol with ketene

For directions and examples see A Schoberl and A Wagner in *Methoden der Organischen Chemie (Houben-Weyl)*, Vol 9 (Ed E Muller), Georg Thieme Verlag, Stuttgart, 1955, pp 753–756

Methyl thioether

$$RSNa + CH_3I \rightarrow RSCH_3 + NaI$$

Methyl thioether

From the sodium thiolate with alkyl halide

For directions and examples see E E Reid, *The Chemistry of Bivalent Sulfur*, Vol 2, Chemical Publishing Co, New York, 1960, p 25

Disulfide

$$2\,RSH \xrightarrow{[O]} RSSR + H_2O$$

Disulfide

From the thiol (or thiophenol) with ferric chloride in aqueous acetic acid

For directions and examples see Linstead, p 87, Wild, p 95, T Zincke and W Frohneberg, *Chem Ber*, **43**, 840 (1910)

From the thiol with chlorine, bromine or iodine in hydrocarbon solvent

See E E Reid, *The Chemistry of Bivalent Sulfur*, Vol 1, Chemical Publishing Co, New York, 1958, p 124

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE XXV. ORGANIC DERIVATIVES OF THIOLS (MERCAPTANS)

a) Liquids (Listed in order of increasing atmospheric b.p.)*

No	Name	Boiling point °C	Melting point, °C	n_D^{20}	D_4^{20}	2,4-Dinitrophenyl thioether	2,4-Dinitrophenyl sulfone	3,5-Dinitrothiobenzoate	3-Nitrothiophthalate	1-Anthraquinonyl thio ether	Mercury salt	S-Alkylmercaptosuccinic acid	Disulfide	Miscellaneous
1	**Methanethiol** (Methyl mercaptan)	5.96	−123		0.8599[25]	127.8	189.5			221	176	133	−84.72, b.p. 116.8	
2	**Ethanethiol** (Ethyl mercaptan)	36	−144.4	1.4318	0.83147[25]	114–5	160	62	149	184	85	119.5	−101.4, b.p. 153.5	Acetyl, b.p. 114
3	**2-Propanethiol** (*sec*-Propyl mercaptan)	56	−130.7	1.4256	0.8142	93.5–5.0	140.5	84	145	134	63		−69 b.p. 176	
4	**2-Methyl-2-propanethiol** (*tert*-Butyl mercaptan)	64.2	1.26	1.4230	0.7999	109–11						164	b.p. 200.1	Benzoyl, b.p. 110[28]
5	**1-Propanethiol** (*n*-Propyl mercaptan)	67.5	−113.8	1.4348	0.8047	85–6.5	127.5	52	137	151	72	118.9	−85.59 b.p. 195–6	
6	**2-Butanethiol** (*sec*-Butyl mercaptan)	84.5	−165.0	1.4367	0.8294	65.6–6.0	120				189	135	b.p. 95.7[14]	Benzoyl, b.p. 150[20]
7	**2-Methyl-1-propanethiol** (Isobutyl mercaptan)	88.72		1.4386	0.8357	74.5–5.0	105.5	63.4	136	144	95	120.9–1.4	b.p. 220	
8	**2-Propene-1-thiol** (Allyl mercaptan)	90.67.9		1.4680	0.93044	72	105	52					b.p. 174d	
9	**1-Butanethiol** (*n*-Butyl mercaptan)	98.100	−119 to −115	1.44402	0.8337	66	92	49	144	112.5	86	103.7–4 144.5	b.p. 226	Benzoyl, b.p. 160[23]
10	**2-Pentanethiol** (*sec*-Amyl mercaptan)	112.9	−169	1.4386[25]	0.82815[25]								b.p. 122.3[10]	
11	**2-Methoxyethanethiol**	113		1.4488[23]		90								Acetyl, b.p. 110[110]
12	**D,L-3-Methylbutanethiol** (Isoamyl mercaptan)	117 118 20		1.44118	0.83475							115.6–6.0	b.p. 250	
13	**1-Phenylethane-1-thiol**	119 20		1.557	1.022		161						58	Acetyl, b.p. 123–5[13]
14	**D-2-Methyl-1-butanethiol**	119 21			0.8403[25]	78.9					60	122.3–6	b.p. 122.3	$[\alpha]_D^{23}$ +3.21
15	**2-Chloropropanethiol**	125		1.4844	1.1062	76.7							b.p. 113–20[20]	Acetyl, b.p. 70–1[9]
16	**2-Chloroethanethiol**	125–6		1.5289	1.203	95.7							b.p. 170.80	Acetyl, b.p. 51[4]
17	**2-Ethoxyethanethiol**	125.6		1.5795	0.9462	66							b.p. 150–2[15]	
18	**1-Pentanethiol** (*n*-Amyl mercaptan)	126.64	−75.83	1.44366	0.8390	79.5 80.5	83	40	132	114	75	107.8	b.p. 140–5[17]	$PdCl_2$ deriv., 41
19	**2-Hexanethiol** (*sec*-Hexyl mercaptan)	142 138.9	−147.0	1.4426[25]	0.83050[25]									
20	**1,2-Ethanedithiol** (Ethylene dithioglycol)	147, 46 7[16]	−41.0	1.5550	1.1185[25]	248								Di-Me eth., b.p. 183
21	**1-Hexanethiol** (*n*-Hexyl mercaptan)	151.2	−81.03	1.4490	0.8526	73.5–5.0	97			129	58	96.0–5		
22	**2-Hydroxyethanethiol**	158, 54[12]		1.4443	1.1143	100.2					123		28	Diacetyl, b.p. 98–9, Dibenzoyl, 39, S-Phenylurethane, 59–60, bz

*Derivative data given in order m.p., crystal color, solvent from which crystallized

TABLE XXV. ORGANIC DERIVATIVES OF THIOLS (MERCAPTANS)

a) Liquids (Listed in order of increasing m.p.)* (Continued)

No	Name	Boiling point °C	Melting point, °C	n_D^{20}	D_4^{20}	2,4-Dinitrophenyl thio ether	2,4-Dinitrophenyl sulfone	3 5 Dinitrothiobenzoate	3 Nitro thio phthalate	1-Anthraquinonyl thioether	Mercury salt	S-Alkyl mercapto succinic acid	Disulfide	Miscellaneous
23	**Cyclohexanethiol** (Cyclohexyl mercaptan)	158–60		1 4933	0 9782	148	172				78	150 5–1 5	b p 288	
24	*cis*-**3-Methyl-1-cyclohexanethiol**	165		$1\ 4647^{25}$	$0\ 916^{25}$									$[\alpha]_{546}$ −2 24
25	**Thiophenol** (Mercaptobenzene)	169 5, 172 5	−14 9	1 5888	1 0780	121	161	149	131				66 5 61	4-Nitrothiobenzoyl, 115 7–8, Phenylurethane, 128
26	*trans*-**3-Methyl-1-cyclohexanethiol**	171		$1\ 4663^{25}$	$0\ 914^{25}$									$[\alpha]_{546}$ +5 50
27	**2-Thiophenethiol**	171 1, 166		1 6021	$1\ 168^{19\ 5}$	119	143						56	Acetyl, b p 230 2
28	**1,3-Propanedithiol**	172 9	−79 0	$1\ 5371^{25}$	$1\ 0775^{25}$	194							b p 198^{20}	Dibenzoyl, 56 3
29	**1-Heptanethiol** (*n*-Heptyl mercaptan)	176 7	−43 4	$1\ 4498^{25}$	$0\ 83891^{25}$	81–2	101	53	96	132	77	105 8–6 2	b p 164^{6}	
30	**2-Octanethiol** (*sec*-Octyl mercaptan)	186 4	−79 0	$1\ 4481^{25}$	$0\ 83293^{25}$								b p $161–71^{6}$	
31	**2-Thiocresol** (2-Toluenethiol)	194 3	15			101, 98 9 5	155				170 3			S-4-Nitrobenzoyl, 90–1
32	**Phenylmethanethiol** (Benzyl mercaptan)	194–5			1 058	130, 128 5–9 5	182 5	120	137			189–90, 192	74, 70	Ph eth, 42
33	**3-Thiocresol** (3-Toluenethiol)	195 4				100–1 5, 91	145							S-4-Nitrobenzoyl, 95–6, Ag deriv, 126–7
34	**1,4-Butanedithiol**	195 6	−53 9	$1\ 5265^{25}$	$1\ 0395^{25}$									Dibenzoyl, 49 5
35	**2-Phenylethanethiol**	199		$1\ 5643^{19}$	$1\ 0318^{18}$	93–4 5	133						b p $168–80^{15}$	Acetyl, b p 134 5^{14}
36	**1-Octanethiol** (*n*-Octyl mercaptan)	199 1	−49 2	$1\ 4519^{25}$	$0\ 83956^{25}$	78, 76–7 5	98			95	71	96 1–6	b p $178–83^{5}$	
37	**2-Chlorothiophenol**	205			$1\ 2752^{19\ 5}$	138							90	
38	**2,5-Dimethylthiophenol** (*p*-Xylene-2-thiol)	211–2												S-Ph eth, b p 172 5[11], S-4-Tolyl eth, b p 188[11]
39	**2,4-Dimethylthiophenol** (*m*-Xylene-4-thiol)	214												S-Ph eth, b p 171[11], S-Benzyl eth, 35

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE XXV. ORGANIC DERIVATIVES OF THIOLS (MERCAPTANS)

a) Liquids (Listed in order of increasing m.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	2,4-Dinitrophenyl thio ether	2,4-Dinitrophenyl sulfone	3 5 Dinitro thiobenzoate	3 Nitrothiophthalate	1-Anthraquinonyl thio ether	Mercury salt	S-Alkyl mercaptosuccinic acid	Disulfide	Miscellaneous
40	**2-Hydroxythiophenol** (Thiocatechol)	216 7^{751}, 88 90^{8}	5-6		1 2373^{0}									O-Me eth , b p 218-9, Di-Me eth , b p 237
41	**Bis(2-mercaptoethyl) ether**	217	−80	1 5339	1 1648^{25}									4-Nitrobenzoyl, 106 5
42	**1,5-Pentanedithiol**	217 3, 110^{16}	−72 5											Dibenzoyl, 45
43	**1-Nonanethiol** (*n*-Nonyl mercaptan)	220 2	−20 1	1 45197	0 83714	86, 84 5	92			117 5		105-6	b p 211-2^{6}	
44	**2-Isopropyl-5-methylbenzenethiol** (Thiothymol)	230-1										78, al		
45	**5-Isopropyl-2-methylbenzenethiol** (Thiocarvacrol)	235-6			0 9975$^{17.5}$						109			S-Me eth , b p 244
46	**1,6-Hexanedithiol**	237 1	−21 0	1 5077^{25}	0 9886^{25}									Dibenzoyl, 57
47	**1-Naphthalenethiol** (α-Mercapto naphthalene)	285, 114 8^{10}		1 6802	1 1607									Benzyl eth , 78-80, 4-Nitrobenzoyl, 121-30, Acetyl, b p , 200-3^{25}

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXV. ORGANIC DERIVATIVES OF THIOLS (MERCAPTANS)
b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point, °C	Boiling point °C	2,4-Dinitrophenyl thioether	2,4 Dinitrophenyl sulfone	Acetate	Benzoate	S-Alkylmercaptosuccinic acid	Disulfide	Methyl thioether	Miscellaneous
1	**3-Hydroxythiophenol** (Thioresorcinol)	17	168[15]				*di* 78		95	15 b p 224 sl d	Di-Me eth, b p 224-5
2	**Hexadecanethiol** (Cetyl mercaptan)	19	123-8[0.5]	91, 96	105			105 6 5	55 5		
3	**1,10-Decanedithiol**	20 17 8	297 1				*di* 57 55				D_4^{45} 0 9432 n_D^{45} 1 4940
4	**Benzoylmethanethiol** (2-Mercaptoacetophenone)	23 4	116 22[4]						81		D_4^{20} 1 1753, Oxime, 70, Phenylhydrazone, 90 1
5	**2-Aminothiophenol**	26	234, 125-7[6]	152		*di* 135			93	b p 234 sl d	
6	**3-Phenylenedithiol** (Dithioresorcinol)	27 1	245 123[14]								Trinitrobenzene add comp, 76 7
7	**4-Dimethylaminothiophenol**	28 5	259 60	176					118		
8	**2-Phenylenedithiol** (Dithiocatechol)	29	238 9			*di* 88 5	*di* 74 5 94-5				
9	**4-Hydroxybenzenethiol** (Thiohydroquinone)	30	144 6[20]			*S*- 85 6, bz-lgr, *di* 66	75, *di* 161			84 5	S-Et eth, 39-41
10	***threo*-Dithiothreitol** (*threo*-2,3-Dihydroxy-1,4 dithiobutane)	42 3	123-5[2]			*tetra* 73, me al					Oxid → *trans*-4,5-dihydroxy-*o*-dithiane, 132, Diisopropylidene deriv 78, me al
11	**4-Thiocresol** (4-Toluenethiol)	43-4	195	102 5 4	189 5	*di* 66	*di* 161				S-4-Tolyl deriv, 57 S-4-Nitrobenzoyl 114 5 S-Chloroacetyl, 40
12	**4-Chloro-1-naphthalenethiol**	43 4, al							122		
13	**4-Aminothiophenol**	46	140 5[16]			N-*mono* 154 163, yel			82	b p 272 3	
14	**1,4-(Dimethylthio)-benzene** (*p*-Xylylene dimercaptan)	46-7	156[12]				*di* 135				
15	**5-Amino-2-methylthiophenol**	47, bz-pet eth				*di* 125, yel, bz-pet eth				147 lgr	Tri-Me eth, b p 159
16	**4-Chlorothiophenol**	54	123					163 4	73		
17	**2-Hydroxy-1-naphthalenethiol**	55, pet eth				O- 120, CCl_4, *di* 57					
18	**1,3,5-Benzenetrithiol**	57 60				*tri* 73-4, al				*tri* 66 8, al	
19	**2-Nitrothiophenol**	58 61		131 3					199	64 5	
20	**1-Amino-2-propanethiol**	63 5							Dihydrochloride, 214		Hydrochloride, 87-8, al Picrate, 143-4 d
21	**4-Bromothiophenol**	75	231	142	190	51 2, me al			94 5	38, al	Benzenesulfonate, 75
22	**3-Nitrothiophenol**	77							84		
23	**4-Nitrothiophenol**	77		160			123 7, 50% ac a		184	72	
24	**4-Nitro-1-naphthalenethiol**	77 9		193					189		
25	**2-Naphthalenethiol** (2-Mercaptonaphthalene)	81	286	145	228	53 5			139		4-Nitrobenzoyl, 183-4, 2-Tolyl eth, b p 229 5[11]

*Derivative data given in order m p, crystal color, solvent from which crystallized

TABLE XXV. ORGANIC DERIVATIVES OF THIOLS (MERCAPTANS)
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point °C	2,4-Dinitro phenyl thio-ether	2,4-Dinitro-phenyl sulfone	Acetate	Benzoate	S-Alkyl mercapto succinic acid	Disulfide	Methyl thio-ether	Miscellaneous
26	**DL-*erythro*-Dithiothreitol** (*erythro*-2,3-Dihydroxy-1,4-dithiobutane)	82 3, lt pet eth				*tetra* 126, bz					Oxid → *cis*-4,5-dihydroxy-*o*-dithiane, 132 Di-isopropylidene deriv, 145, pet eth
27	**4-Iodothiophenol**	85 6, al		140 5					124	45 38	CrO_3/AcOH → sulfone, 83
28	**4-Amino-1-naphthalenethiol**	91 3				N-*mono* 173			168		
29	**2-(3-Aminopropionamido)ethanethiol** (Aletheine)	93 6, subl $140^{10\ s}$				*di* 139 40, et ac					Hydrochloride, 214 7, 95% al, Oxalate, 121 2, al
30	**Bis(4-mercaptophenyl)ether**	98				*di* 68					
31	**4-Phenylenedithiol** (1,4-Dimercaptobenzene)	98, aq al				*di* 126, pet eth				*di* 85, me al	Di-Et eth, 81 5, al
32	**2-Aminoethanethiol**	98 100	130	94 5		*di* 30			Dihydrochloride, 216		Hydrochloride, 70 2, al, Picrate, 126 S-Acetyl hydrochloride, 137
33	**Triphenylmethanethiol**	107		190		139-41	185		*ca* 155		
34	**4-Bromo-2-nitrothiophenol**	110		142							
35	**4-Biphenylthiol**	111 2, al		146	170				150	107 8, al	
36	**3-Amino-1-propanethiol**	112 3							Dihydrochloride, 219		Hydrochloride, 69, dil al
37	**1,8-Naphthalenedithiol**	113 4, al								*di* 84	
38	**4-Hydroxy-1-naphthalenethiol**	114				*di* 77					
39	**Bis(4-thiophenyl)sulfide**	114				*di* 65			190		
40	**2,4,6-Trinitrothiophenol**	114		217							
41	**1,5-Naphthalenedithiol**	118 21, yel				*di* 187-9	*di* 232			*di* 250	
42	**4-Chloro-2-nitrothiophenol**	120 2		141							
43	**2,4-Dinitrothiophenol**	131 2		193 7	240 1	107	113		280		
44	**6-Hydroxy-2-naphthalenethiol**	137, al				*di* 110, 107, al			221		
45	**2-Benzothiazolthiol**	177 9, aq me al								52, aq al	Et eth, 26 al
46	**2,7-Naphthalenedithiol**	181, 174, al				*di* 110	*di* 152-3				
47	**1-Anthraquinonethiol**	187, yel, ac a							>350,	218, yel, al	Et eth, 183, yel, al, Benzyl eth, 241, yel, ac a
48	**2-Anthraquinonethiol**	206, yel, ac a							257	162, yel, ac a	Et eth, 138, yel, al, Benzyl eth, 138, yel, al
49	**2-Benzimidazolthiol**	298, 296 7, dil al									Benzyl eth, 186 7, 1-N-Me eth, 190-2

*Derivative data given in order m p, crystal color, solvent from which crystallized

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EXPLANATIONS AND REFERENCES TO TABLE XXVI

Sulfone *

$$RSR' \xrightarrow{[O]} \underset{\text{Sulfone}}{RSO_2R'}$$

From the thioether in glacial acetic acid with dilute aqueous potassium permanganate

For directions and examples see Cheronis, p 641, Linstead, p 87, G W Fenton and C K Ingold, *J Chem Soc*, 2338 (1929), H Rheinboldt and E Giesbrecht, *J Amer Chem Soc*, **68,** 973 (1946)

From the thioether with aqueous hydrogen peroxide in acetone or in acetic acid

See O Hinsberg, *J prakt Chem*, **90,** 350 (1914), H Rheinboldt and E Giesbrecht, *J Amer Chem Soc*, **68,** 973 (1946), C G Overberger, S P Lighthelm and E A Swire, *J Amer Chem Soc*, **72,** 2856 (1950)

From the thioether with hydrogen peroxide and ammonium molybdate in aqueous perchloric acid

See Cheronis, p 641

From the thioether with potassium bichromate and sulfuric acid in water

See G Raiziss, L W Clemence, M Severac and J C Moetsch, *J Amer Chem Soc*, **61,** 2763 (1939)

From the thioether with chromic anhydride in glacial acetic acid

See C G Overberger, S P Lightelm and E A Swire, *J Amer Chem Soc*, **72,** 2856 (1950)

For extensive lists of references for the oxidation of thioethers to the corresponding sulfones *see* A Schoberl and A Wagner in *Methoden der Organischen Chemie (Houben-Weyl)*, Vol 9, (Ed E Miller), Georg Thieme Verlag, Stuttgart, 1955, pp 227–231, E E Reid, *Organic Chemistry of Bivalent Sulfur*, Vol 2, Chemical Publishing Co, New York, 1960, pp 64–65

Sulfoxide

$$RSR' \xrightarrow{[O]} \underset{\text{Sulfoxide}}{RSOR'}$$

From the thioether with hydrogen peroxide in acetic acid, in acetone or in alcohol-acetic acid mixture

For directions and examples see O Hinsberg, *Chem Ber*, **43,** 289 (1910), R L Shriner, H C Struck and W V Jorison, *J Amer Chem Soc*, **52,** 2060 (1930), P Karrer, N J Antia and R Schwyzer, *Helv chim Acta*, **34,** 1392 (1951)

From the thioether with perphthalic acid in ether

See H Bohme, *Chem Ber*, **70,** 378 (1937)

From the thioether with chromic anhydride in aqueous acetic acid

See R Knoll, *J prakt Chem*, **113,** 40 (1926)

For additional references for the oxidation of thioethers to the corresponding sulfoxides *see* A Schoberl and A Wagner in *Modern Methoden der Organischen Chemie (Houben-Weyl)*, Georg Thieme Verlag, Stuttgart, 1955, pp 211–215

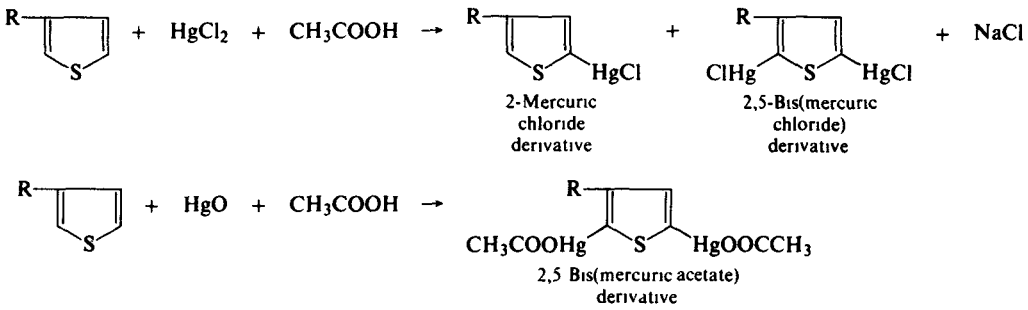
Mercuric halide addition compound

$$R_2S + HgX_2 \rightarrow \underset{\substack{\text{Mercuric halide}\\ \text{addition compound}}}{R_2S \cdot HgX_2}$$

From the thioether with mercuric chloride, bromide or iodide in ethanol, acetone or aqueous solution

For directions and examples see W F Faragher, J C Morrell and S Comay, *J Amer Chem Soc*, **51,** 2774 (1929), E E Reid, *Organic Chemistry of Bivalent Sulfur*, Vol 2, Chemical Publishing Co, New York, 1960.

Mercuric halide or mercuric acetate derivative



*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

EXPLANATIONS AND REFERENCES TO TABLE XXVI (Continued)

These derivatives are for substituted thiophenes only.

From the substituted thiophene with the mercuric salt (with or without sodium acetate) in ethanol or in acetic acid.

For directions and examples see: H. D. Hartough, *Thiophene and its Derivatives*, (*The Chemistry of Heterocyclic Compounds*, Vol. 3), Interscience, London, 1952, pp. 444–453.

For various additional compounds of thioethers with metal salts *see*: E. E. Reid, *Organic Chemistry of Bivalent Sulfur*, Vol. 2, Chemical Publishing Co., New York, 1960, pp. 52–60.

*Derivatives recommended for first trial.

WARNING: This is not an instruction manual. References should be consulted for the preparation of derivatives.

TABLE XXVI. ORGANIC DERIVATIVES OF THIOETHERS (SULFIDES)

a) Liquids 1) Noncyclic (Listed in order of increasing b.p.)*

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Sulfone	Sulfoxide	Disulfide	Miscellaneous
1	**Dimethyl sulfide** (Methyl sulfide)	37 3	−98 27	1 4356	0 8458[21]	109 b p 238	18 45 b p 189	109 7	Tri-$HgCl_2$ add comp , 158 150 1, rapid htng HgI_2 add comp , 75, $SnBr_4$ add comp , 85-7, $PtCl_2$ add comp 159 $PtBr_2$ add comp 159 $PdCl_2$ add comp , 130 $PdBr_2$ add comp , 125 $AgNO_3$ add comp , 126
2	**Ethyl methyl sulfide**	66 9	−104 8	1 4353	0 8483	36, eth		130	$HgCl_2$ add comp , 128 HgI_2 add comp 59 $PdCl_2$ add comp 67
3	**Methyl vinyl sulfide**	67 3		1 4845	0 9026				
4	**Divinyl sulfide** (Vinyl sulfide)	84			0 9174				
5	**Allyl methyl sulfide**	91 3		1 4712	0 8767				
6	**Diethyl sulfide** (Ethyl sulfide)	92	−102 05	1 44233	0 8368	73 4 b p 248	4 6, 15 b p 88 9[15]	152 6 154	Disulfoxide 123 4[11] Mono-$HgCl_2$ add comp , 90 Di-$HgCl_2$ add comp , 119 5 HgI_2 add comp 110 $AgNO_3$ add comp , 122 $SnCl_4$ add comp , 102 $SnBr_4$ add comp 84, $PtCl_2$ add comp , 106 $PtBr_2$ add comp , 118 PtI_2 add comp 136, $PdCl_2$ add comp , 83 $PdBr_2$ add comp , 100
7	**Ethyl vinyl sulfide**	92		1 4756	0 8756				
8	**Isopropyl methyl sulfide**	93 5, 85	−101 48	1 4392	0 8291				
9	**Methyl *n*-propyl sulfide**	95 5	−112 98	1 4442	0 8438				
10	***tert*-Butyl methyl sulfide**	99		1 4402	0 8257				
11	**Chloromethyl methyl sulfide**	107 1		1 4967					
12	**Ethyl isopropyl sulfide**	107 3	−122 19	1 4407	0 8246				
13	**Isobutyl methyl sulfide**	112 5		1 4433	0 8335				
14	**Methyl 2-methylallyl sulfide**	113 0 2		1 4712					
15	**Allyl ethyl sulfide**	115 6			0 8676				
16	**Ethyl *n*-propyl sulfide**	118 5, 110 2	−117 04	1 4461	0 84448	25, b p 142[23]		173 7	
17	**Di-isopropyl sulfide** (Isopropyl sulfide)	120 7	−78 08	1 4381	0 8135	36	68 5	176	$PtCl_2$ add comp , 163 $PtBr_2$ add comp , 174, PtI_2 add comp , 176, PtI_4 add comp , 139
18	***n*-Butyl methyl sulfide**	122 5		1 4477	0 8427				$HgCl_2$ add comp , 116 5
19	**Chloromethyl ethyl sulfide**	128				33		b p 78 80[16]	
20	**Isopropyl propyl sulfide**	132		1 4440	0 8269				
21	***sec*-Butyl ethyl sulfide**	133 6		1 4477	0 8353				
22	**Ethyl isobutyl sulfide**	134 2		1 4452	0 8306				$HgCl_2$ add comp , 108
23	**Diallyl sulfide** (Allyl sulfide)	139[758], 35[5-7]	−83	1 4877[27]	0 88765[27]	b p 109[3]	b p 107-9[7 8]	b p 78 80[16]	
24	**Methyl 2-methylbutyl sulfide**	139-40			0 8410[19]				
25	**2-Chloroethyl methyl sulfide**	140, 44[20]		1 4908	1 1155				
26	**Di-*n*-propyl sulfide** (*n*-Propyl sulfide)	141 2	−101 9	1 4481	0 8358	30	14 5 5 0, b p 82[15]	194	Mono-$HgCl_2$ add comp , 88 9 Di-$HgCl_2$ add comp 122 127 5 Chloroamine-T → sulfilimide, 110 1 5
27	***n*-Butyl ethyl sulfide**	144 2	−95 13	1 4491	0 8376	50		193	
28	**Methyl pentyl sulfide** (Amyl methyl sulfide)	144 5-5 5		1 448	0 843				$HgCl_2$ add comp , 127
29	**Di-*tert*-butyl sulfide** (*tert*-Butyl sulfide)	150		1 4505				201, b p 88[21]	
30	**Diacetyl sulfide** (Thioacetic anhydride)	155 8d , 63[20]		1 4810[21]	1 124				Reduction → acetaldehyde, b p 20 2, 2,4-dinitrophenylhydrazone, 168
31	**Dichloromethyl sulfide** (Chloromethyl sulfide)	156 5	−54, −37	1 5313	1 4065	70 5-2 0			
32	**2-Chloroethyl ethyl sulfide**	157, 63-5[47]		1 06644	1 4878				

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXVI. ORGANIC DERIVATIVES OF THIOETHERS (SULFIDES)
a) Liquids 1) Noncyclic (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Sulfone	Sulfoxide	Disulfide	Miscellaneous
33	**2-Aminoisopropyl methyl sulfide**	158				b p 140[4]			
34	**Ethyl 3-methylbutyl sulfide**	160		1 4495	0 8349	13 5			$HgCl_2$ add comp , 87
35	**4-Chlorophenyl methyl sulfide**	170		1 6023[25]	1 1224[25]	57 8			
36	**3-Aminopropyl methyl sulfide**	170				44, b p 165 8[6]	197		Hydrochloride, 136, Picrate, 127, Oxalate, 207d
37	**Di-isobutyl sulfide** (Isobutyl sulfide)	172 3		1 4463	0 8262	17, b p 265	68 5	215	Mono-$HgCl_2$ add comp , 116, Di-$HgCl_2$ add comp , 131, $PtCl_2$ add comp , (i) 83 (ii) 139, $PtBr_2$ add comp , 143 4 PtI_2 add comp , 187 $PtCl_4$ add comp , 162, $AuCl_3$ add comp , 87 $PdCl_2$ add comp , 95, $PdBr_2$ add comp , 140, PdI_2 add comp , 145
38	**Di-2-methylallyl sulfide** (2-Methylallyl sulfide)	173							
39	**Chloromethyl dichloromethyl sulfide**	177 2[753]		1 5395	1 5258				
40	**Dicrotyl sulfide** (Crotyl sulfide)	186 5, 88 9[20]		1 495[25]	0 9032[0]				
41	**Di-*n*-butyl sulfide** (*n*-Butyl sulfide)	188 0 182, 109 15[15]	−79 7	1 45405	0 8386	44, resolidifies at 32 5	33	231	Di-$HgCl_2$ add comp 113 110 5 $PtBr_2$ add comp 65 PtI_2 add comp 67 $PdCl_2$ add comp , 32 $Pd(NO_3)_2$ add comp , 166, $AgNO_3$ add comp 98
42	**4-Aminobutyl methyl sulfide**	188 90				42 b p 165[3]			Hydrochloride, 153 4, acet Picrate, 116 8
43	**Di-dichloromethyl sulfide** (Di-chloromethyl sulfide)	189 62 4[10]		1 5464	1 6273				
44	**Methyl phenyl sulfide**	194-6 78-9[13]		1 5870	1 0533[25]	88, w			
45	**2-Chloroethyl chloromethyl sulfide**	194 5 77[10]		1 5311	1 338				
46	**Benzyl methyl sulfide**	195 8		1 5550[25]		127, w			
47	**Ethyl phenyl sulfide**	205, 200-2		1 5701[15]	1 024[15]	42, b p 160[12]			$PdCl_2$ add comp , 140
48	**Isopropyl phenyl sulfide**	208		1 5468	0 9855				$PdCl_2$ add comp , 162
49	**Methyl 4-tolyl sulfide**	211 2, 104-5[20]		1 57537[16]	1 0302[16]	89, bz - pet eth	50-4		
50	**Di-(3-methylbutyl)sulfide** (Isoamyl sulfide)	215 3		1 4471	0 8285	31, b p 295		250	$PdCl_2$ add comp , 95 $PdBr_2$ add comp , 133 PdI_2 add comp , 143, $SnCl_4$ add comp , 64, $SnBr_4$ add comp , 45 6
51	**Allyl phenyl sulfide**	215-8, 104-6[25]		1 5760	1 0275				
52	**Di-2-chloroethyl sulfide** (2-Chloroethyl sulfide, Mustard gas, Yperite)	217	14 4	1 53125	1 2741	56, b p 183[20]	109-11		
53	**Phenyl propyl sulfide**	219-20		1 5571	0 9995	44			$PdCl_2$ add comp , 91
54	**Ethyl 4-tolyl sulfide**	220 1		1 5568	1 0016[17 5]	55 6			
55	**Benzyl ethyl sulfide**	222 3, 98-9[13]				84			Mono-$HgCl_2$ add comp , 84, Di-$HgCl_2$ add comp , 142
56	**3-Methylbutyl phenyl sulfide**	240-2		1 5380	0 9681	36			$PdCl_2$ add comp , 97
57	**2-Chloroethyl phenyl sulfide**	245, 121[15]		1 5838	1 1799	45			
58	**2-Chloroethyl 4-tolyl sulfide**	255-7, 150-2[20]				78			
59	**2-Hydroxyethyl 4-tolyl sulfide**	282-3, 119 20[1]				55			
60	**Di-(3-tolyl)sulfide** (*m*-Tolyl sulfide)	290, 174[12]				94	b p 215[15]	b p 150 d	

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXVI. ORGANIC DERIVATIVES OF THIOETHERS (SULFIDES)
a) Liquids 1) Noncyclic (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Sulfone	Sulfoxide	Disulfide	Miscellaneous
61	**Diphenyl sulfide** (Phenyl sulfide)	296, 157–8[18.5]	−21 5	1 6312	1 1160	128–9, b p 379	70 5	61	Disulfone of the disulfide, 193–4
62	**Di-*n*-heptyl sulfide** (*n*-Heptyl sulfide)	298				80			
63	**4-Chlorophenyl phenyl sulfide**	305–15d , 167–8[10]				34, 90			
64	**Phenyl 3-tolyl sulfide**	309 5, 164 5[11]	−6 5		1 0937[16]				
65	**Phenyl 2-tolyl sulfide**	309 9 300 5, 160 5[11]			1 1012[15]	81, al			
66	**Phenyl 4-tolyl sulfide**	311 5, 167 5[11]	15 7		1 0900[15.7]	127–8 al			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXVI. ORGANIC DERIVATIVES OF THIOETHERS (SULFIDES)

a) Liquids 2) Cyclic (Listed in order of increasing b.p.)*

No	Name	Boiling point, °C	Melting point, °C	n_D^{20}	D_4^{20}	Sulfone	$HgCl_2$ addition compound	Miscellaneous
1	**Ethylene sulfide** (Thiirane Thiacyclopropane)	55–6		1 4914	1 0046			Polymerizes rapidly
2	**2-Methylethylene sulfide** (2-Methylthiirane)	76		$1\ 473^{19}$	$0\ 946^{18}$			
3	**Thiophene**	84 12	−38 30	1 5287	1 0644			2-HgCl deriv , 182–3; 2-HgBr deriv , 169–70, 2-HgI deriv , 116–7
4	**2,2-Dimethylethylene sulfide** (2,2-Dimethylthiirane)	87, 84 6		1 4641				
5	**Trimethylene sulfide** (Thietane Thiacyclobutane)	95	−73 25	$1\ 506^{23}$	1 0200	76, w	93 5 d	Methiodide, 98 5–9 0
6	**2-Ethylethylene sulfide** (2-Ethylthiirane)	104		$1\ 475^{19}$	$0\ 930^{18}$			
7	**2-Methyltrimethylene sulfide** (2-Methylthietane)	106		1 4831	0 9571	b p 251 5–3 5		
8	**2-Methylthiophene**	112 4		1 52042	1 02183			5-HgCl deriv , 204, 5-HgBr deriv , 179–80, 5-HgI deriv , 111–2
9	**2,4-Dimethyltrimethylene sulfide** (2,4-Dimethylthietane)	113 4		$1\ 4502^{18}$	$0\ 8710^{18}$	b p 255 0 5 5		
10	**3-Methylthiophene**	115 4		1 52042	1 02183			2-HgCl deriv , 128–9, 2,5-Di-HgOOCCH$_3$ deriv , >240d
11	**2,2-Dimethyltrimethylenesulfide** (2,2-Dimethylthietane)	120		$1\ 4739^{18}$		55	118	
12	**Tetramethylene sulfide** (Thiolane Thiophane Thiacyclopentane)	121 2, 120 2 5	−96 17	1 5047	0 99869	28 36	128	Sulfoxide, 105–7[12]
13	**2-Methyltetramethylene sulfide** (2-Methylthiolane)	$132\ 5^{750}$	−100 71	1 4922	0 9555	b p 279–80^{758}	*di* 162	
14	**2-Ethylthiophene**	132 5–4 0		1 5127	$0\ 990^{24}$			5-HgCl deriv , 147–8, 5-HgI deriv , 96-7
15	**3-Ethylthiophene**	135 6		1 5146	0 9980			2-HgCl deriv , 67–8, 2,5-Di-HgCl deriv , 295–7d
16	**2,5-Dimethylthiophene**	135 5 6 0	−62 57	1 5126	0 98587			3-HgCl deriv , 156–7, 3-HgI deriv , 175
17	**2,4-Dimethylthiophene**	137 8, 140		1 5130	0 9956			5-HgCl deriv , 138–9, 5-HgI deriv , 137–9
18	**3-Methyltetramethylene sulfide** (3-Methylthiolane)	138 2	−81 10	1 4924	0 9634	1, 0 5	83	
19	**2,3-Dimethylthiophene**	140 2–1 2	−49 1 to −48 9	1 5188	1 0021			5-HgCl deriv , 218 5–9 5, 5-HgI deriv , 184 0–4 5, 4,5-Di-HgOOCCH$_3$, 237–40
20	***trans*-2,5-Dimethyltetramethylene sulfide** (*trans*-2,5-Dimethylthiolane)	142	−76 35	1 4766	0 9188	3, b p 278	111	
21	***cis*-2,5-Dimethyltetramethylene sulfide** (*cis*-2,5-Dimethylthiolane)	142 3		1 4799	0 9222	4, b p 278	*di* 180	
22	**3,4-Dimethylthiophene**	144 6		1 5212	$1\ 008_{21}^{23}$			2-HgCl deriv , 139–40 5, 2-HgBr deriv , 152, 2-HgI deriv , 142
23	**1,4-Thioxane**	148 9	−17	1 5070	1 1177	130, 105 5	171	Sulfoxide, 25, 45
24	**2-Methylpentamethylene sulfide** (2-Methylthiane)	151	−58 14	1 4905	0 9428	68 5	102	
25	**2-Isopropylthiophene**	152		1 5037	0 9673			
26	**3-Isopropylthiophene**	155 7, 157		1 5052	0 9733			5-HgCl deriv , 137
27	**3-Methylpentamethylene sulfide** (3-Methylthiane)	157–8	−60 17	1 4922	0 9473	83	136	
28	**2-Ethyltetramethylene sulfide** (2-Ethylthiolane)	157 8		1 4896	0 9451		*mono* 100, *di* 146–8	
29	**2-Propylthiophene**	157 5 9 5		1 5048	0 9683			5-HgCl deriv , 155, 5-HgSCN deriv , 169 0–9 5
30	**4-Methylpentamethylene sulfide** (4-Methylthiane)	158 6	−28 11	1 5049	0 9687	121 5	136	
31	**2-Ethyl-5-methylthiophene**	159 8 60 4	−68 6	1 5073	0 9663			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXVI. ORGANIC DERIVATIVES OF THIOETHERS (SULFIDES)
a) Liquids 2) Cyclic (Listed in order of increasing b.p.)* (Continued)

No	Name	Boiling point °C	Melting point °C	n_D^{20}	D_4^{20}	Sulfone	$HgCl_2$ addition compound	Miscellaneous
32	**2-Ethyl-3-methylthiophene**	160 0 1 5		1 5092[22 5]	0 9792[22 5]			5 HgCl deriv , 172-3, 5-HgI deriv , 156-7
33	**2,6-Dimethyl-1,4-thioxane**	160 1		1 4733		105 5		
34	**3-Propylthiophene**	160 2		1 5057	0 9716			
35	**2-Allylthiophene**	161, 158 5 9 0		1 5281[20 5]	1 0175[20 5]			
36	**3,5-Dimethyl-1,4-thioxane**	162				102		
37	**3-Ethyl-5-methylthiophene**	162 4	−60 to −59	1 5098	0 9742			
38	**2,3,5-Trimethylthiophene**	163 5, 164 5[46]		1 5131	0 9753			x-HgCl deriv , 160-1
39	**2-*tert*-Butylthiophene**	163 9	−59 2	1 49788	0 9514			
40	**3-*tert*-Butylthiophene**	168 9	−54 8	1 50149	0 9574			
41	**Hexamethylene sulfide** (Thiepane Thiacyclo heptane)	170 173 4		1 5125	0 9883	71	149	Methiodide, 141 5-2 0
42	**2,3,4-Trimethylthiophene**	172 7 160 3		1 5208	0 995			
43	**1,3-Dithiolane**(1,3-Dithiacyclopentane)	175		1 5975[15]	1 259[1]	*d*[1] 205	117, 126	Methiodide, 96, Disulfoxide, 134
44	**2-Methyl-5-propylthiophene**	179 5 80 5		1 5026				
45	**Cyclohexene sulfide** (7-Thiabicycloheptane)	180 71 5-3 5[21]		1 5309	0 9274			
46	**2-*n*-Butylthiophene**	181-2[740]		1 50896	0 9537			
47	**2,5-Diethylthiophene**	181-2, 63-6[14]		1 5036	0 962[14]			
48	**3-*n*-Butylthiophene**	181 3		1 51005	0 9570			
49	**2,3,4,5-Tetramethylthiophene**	182 4 187 9		1 5196	$0\ 9442^{21}_{21}$			
50	**3,4-Diethylthiophene**	185-7		1 5157[17]				2-HgCl deriv , 118
51	**2-Ethyl-1,3-dithiolane**	191 2				124		
52	**2,4-Dimethyltetramethylene sulfide** (2,4-Dimethylthiolane)	197 8[742]		1 4818	0 9265	b p 123 3[5]	89	
53	**3-Ethyl-2,4,5-trimethylthiophene**	204 6[748]		1 5132	0 9609			
54	**2-*n*-Octylthiophene**	257 9, 106 8[1]		1 4824	0 920			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXVI. ORGANIC DERIVATIVES OF THIOETHERS (SULFIDES)
b) Solids (Listed in order of increasing m.p.)*

No	Name	Melting point °C	Boiling point °C	Sulfone	Sulfoxide	Disulfide	Miscellaneous
1	**Ethyl 2-naphthyl sulfide**	16	170 5[15]	43 5			
2	**Ethyl hexadecyl sulfide**	19		88			
3	**Thiane** (Pentamethylene sulfide Thiacyclohexane)	19 07, 13	142	98 5 9 0			D_4^{20} 0 9849, n_D^{20} 1 5067, $HgCl_2$ add comp , 137 5, al , Methiodide, 192 subl
4	**2-Methyl-1,4-dithiane**	20		*di* 304			
5	**Didecyl sulfide** (Decyl sulfide)	27	217 8*	206 7			
6	**3-Tolyl 4-tolyl sulfide**	27 8 al	179[11]	116 ac a	72		
7	**Diundecyl sulfide** (Undecyl sulfide *n*-Hendecyl sulfide)	34 8					
8	**Di-(2-bromoethyl)sulfide** (Bromoethyl sulfide)	35		111 2			
9	**4-Iodophenyl phenyl sulfide** (4 Iododiphenyl sulfide)	35		141			
10	**2-Aminophenyl phenyl sulfide** (2-Aminodiphenyl sulfide)	35 6, al	212[25]	122, dil al			N-Benzenesulfonyl, 225 6
11	**4-Bromophenyl methyl sulfide**	37 5		56 7			
12	**Didodecyl sulfide** (*n*-Dodecyl sulfide)	40 5				34 5	
13	**Benzyl phenyl sulfide**	41 44 5, al	197[2]	146 6 5 148, al	123		
14	**Di-(4-chlorobenzyl)sulfide** (4-Chlorobenzyl sulfide)	41				59	
15	**1-Naphthyl phenyl sulfide**	41 8, aq al	220 5[11]	99 5 100 5 al			
16	**3-Nitrophenyl phenyl sulfide** (3-Nitrodiphenyl sulfide)	42 5		80 5 81			
17	**Ethyl 4-nitrophenyl sulfide**	44		138 5			
18	**Isopropyl 4-nitrophenyl sulfide**	44 5		115 3			
19	**Di-(4-methoxyphenyl)sulfide** (4-Methoxyphenyl sulfide)	46		130	96	45	Disulfone, 221, r h 210 2, s h
20	**Dibenzoyl sulfide** (Thiobenzoic anhydride, Benzoyl sulfide)	48, al				133, 128	
21	**Dibenzyl sulfide** (Benzyl sulfide)	50, chl		151 7, al bz	134 8	73	D_{50}^{20} 1 0712 $HgCl_2$ add comp , 131, HgI_2 add comp , 37 8, $FeCl_3$ add comp , 94 $PtCl_2$ add comp 159 $PtCl_4$ add comp 172d , $PtBr_2$ add comp 139 PtI_2 add comp 129
22	**2,5-Dichlorophenyl methyl sulfide**	51		88			
23	**Methyl 2-naphthyl sulfide**	51 8 64	226[11]	115 6, al	67 5		Disulfone, 166
24	**Bis(phenylthio)methane**	52		*di* 120-1			
25	**Ditetradecyl sulfide** (*n*-Tetradecyl sulfide)	53 8				46	
26	**Di-(2-diphenoxyethyl)sulfide**	54 al		108, pink, al		97	
27	**1,3-Dithiane**	54		*di* 330 308			
28	**Bis(benzylthio)methane**	55		*di* 216			
29	**4-Nitrophenyl phenyl sulfide** (4-Nitrodiphenyl sulfide)	55, yel lgr	240[25]	142, aq al			
30	**Di-*n*-octyl sulfide** (*n*-Octyl sulfide)	57		76		b p 178-83[5]	
31	**Di-(4-tolyl)sulfide** (4-Tolyl sulfide)	57 3	179[11]	158, bz	95, pet eth	48, al	
32	**2-Aminophenyl 4-aminophenyl sulfide** (2,4'-Diaminodiphenyl sulfide)	61, 62 5, aq al		124-6			Diacetyl, 208
33	**Dihexadecyl sulfide** (*n*-Hexadecyl sulfide)	61 3		103 4	99 8		
34	**2-Chloroethyl 4-nitrophenyl sulfide**	62		128			
35	**Di-(2-tolyl)sulfide** (2-Tolyl sulfide)	64, al	285, 174[15]	134 5, al	121, pet eth	38-9, al	
36	**Methyl 2-nitrophenyl sulfide**	64 5, yel , al		106			$D_4^{78.2}$ 1 2626, $n_D^{78.2}$ 1 62458, $AgNO_3$ add comp , 122, yel , al
37	**Benzyl 4-bromophenyl sulfide**	65		159			

*Derivative data given in order m p , crystal color, solvent from which crystallized

TABLE XXVI. ORGANIC DERIVATIVES OF THIOETHERS (SULFIDES)
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Sulfone	Sulfoxide	Disulfide	Miscellaneous
38	**1,2-Bis(phenylthio)ethane**	69 70		*dl* 180			
39	**Dioctadecyl sulfide** (Octadecyl sulfide)	71, 64 5				62 5	
40	**2-Phenyl-1,3-dithiane**	71-2		*dl* 265			
41	**Methyl 4-nitrophenyl sulfide**	72		141			$D_4^{80.1}$ 1 2391, $n_D^{80.1}$ 1 64008
42	**Di-(3-phenylpropyl)sulfide** (3-Phenylpropyl sulfide)	73		117		b p 165-$6^{0.03}$	
43	**Di-(2-methoxyphenyl)sulfide** (2-Anisyl sulfide)	73, al	252-3^{10}	157-8, bz		120	
44	**Di-(4-methylbenzyl)sulfide** (4-Methylbenzyl sulfide)	76		197			
45	**Cinnamyl phenyl sulfide**	78		111 2	90 1		
46	**4-(Methylthio)benzaldehyde**	78, yel , lgr	273, 153^{17}				Phenylhydrazone, 138, Thiosemicarbazone, 177-9, yel
47	**4-Nitrobenzyl phenyl sulfide**	79		209 5			
48	**1,2-Bis(tolylthio)ethane**	80 1		*dl* 200 1			
49	**2-Nitrophenyl phenyl sulfide** (2-Nitrodiphenyl sulfide)	80 2, 77, yel	210^{15}	147 5, al			
50	**Di-(2-aminobenzyl) sulfide**	81				90 1 lgr et ac	N,N'-Diformyl, 163 N,N'-Diacetyl, 209 Picrate, 203 4d
51	**4-Nitrophenyl 4-tolyl sulfide**	81 5, yel		170 1, yel			
52	**Di-(2-aminophenyl) sulfide**	87		146 7		93, al	N,N'-Diacetyl, 164 5 N,N'-Dibenzoyl, 162 3
53	**Di-(2-phenylethyl) sulfide** (2-Phenylethyl sulfide)	92 5 90		100 6	69	b p 172 $5^{0.8}$	
54	**4-Aminophenyl phenyl sulfide** (4 Aminodiphenyl sulfide)	96, lgr	243^{29}	176, al	152, w		Hydrochloride, 197 8d *N*-4-Toluenesulfonyl, 73
55	**Di-(4-amino-3-methylphenyl) sulfide**	96 25°, al					Dihydrochloride, 248-9 dil HCl N,N'-Diacetyl, 22, al , N,N'-Dibenzoyl, 233, me al , Dipicrate, 186, w
56	**Di-(4-chlorophenyl)sulfide** (4-Chlorophenyl sulfide)	98 88 90	212^{18}	148 9, subl	143	73	
57	**3-Aminophenyl 4-nitrophenyl sulfide** (3-Amino-4'-nitrodiphenyl sulfide)	99 100					*N*-Acetyl, 115-6, *N N*-Dimethyl, 83 4
58	**Di-(2-amino-5-methylphenyl) sulfide**	103 4, al				98	Dihydrochloride, 100d , al , N,N' Diacetyl, 165, al N,N'-Dibenzoyl, 185 6, al , Diurethane, 113, bz -pet eth Dipicrate, 179, bz
59	**Di-(4-aminobenzyl)sulfide**	104 5				96 8, al	N,N'-Diacetyl, 188, N,N'-Dibenzoyl, 224
60	**Di-(4-aminophenyl)sulfide**	108 9, w		178, me al	175d , al	85 106, al	N,N'-Diacetyl, 220 1 N,N' Dibenzoyl, 234
61	**Di-(1-naphthyl)sulfide**	110, al	290^{15}	187, al	166, al	91	
62	**1,4-Dithiane**	111 2	199-200	*mono* 200, *dl* >330			Methiodide, 73 4, Sulfoxide-sulfone, 279
63	**Di-(4-bromophenyl)sulfide** (4-Bromophenyl sulfide)	112, al	243^{20}	172	153, al	94 5	
64	**2,4-Dinitrophenyl phenyl sulfide** (2,4-Dinitrodiphenyl sulfide)	121, 117, bz		161			
65	**Di-(2-nitrophenyl)sulfide** (2-Nitrophenyl sulfide)	122 3, yel , al -ac a		164		198-9, ac a or bz	
66	**Benzyl 4-nitrophenyl sulfide**	123		172			
67	**Di-(3-hydroxyphenyl)sulfide** (3-Hydroxyphenyl sulfide)	130		190 1, 186-7	94 5, pet eth	95	Acetyl, 87
68	**1,3-Bis(2-nitrophenylthio)propane**	140		*dl* 156-7			
69	**Di-(2-hydroxyphenyl)sulfide** (2-Hydroxyphenyl sulfide)	142, bz		179, 164-5, bz		b p >200d	Diacetyl, 95-6, al Di-Me eth , 73
70	**1-Naphthyl 2-naphthyl sulfide** (1,2'-Dinaphthyl sulfide)	151	291 2^{15}	123			
71	**Di-(2-naphthyl)sulfide** (2-Naphthyl sulfide)	151	296^{15}	177, al	137 5 8 5	139	

*Derivative data given in order m p., crystal color, solvent from which crystallized

TABLE XXVI. ORGANIC DERIVATIVES OF THIOETHERS (SULFIDES)
b) Solids (Listed in order of increasing m.p.)* (Continued)

No	Name	Melting point °C	Boiling point, °C	Sulfone	Sulfoxide	Disulfide	Miscellaneous
72	**Di-(4-hydroxyphenyl)sulfide** (4-Hydroxyphenyl sulfide)	151, al		240 1, w	195, acet	150 1	Diacetyl, 94 55, Di-Me eth , 46, Di-Et eth 55
73	**Di-(4-nitrobenzyl)sulfide** (4-Nitrobenzyl sulfide)	158-9		260 5	212	126 5	
74	**Di-(4-nitrophenyl)sulfide** (4-Nitrophenyl sulfide)	174-5, 156 7, or , or pa yel		282, 245 225		182, ac a	
75	**Di-(3-nitrophenyl)sulfide** (3-Nitrophenyl sulfide)	193		201		84, al	
76	**Di-(2,4-dinitrophenyl)sulfide** (2,4-Dinitro phenyl sulfide)	193 7 193 4, yel , ac a		240 1		280	
77	**Di-(2,4,6-trinitrophenyl)sulfide** (Dipicryl sulfide)	230 1 226, yel		307			

* Derivative data given in order m p , crystal color, solvent from which crystallized

EXPLANATIONS AND REFERENCES TO TABLES XXVII, XXVIII AND XXIX

The dissociation of an organic carboxylic acid, phenol or the conjugate acid of an amine in aqueous solution is expressed by the equation

$$HA_{aq}^{\pm n} + H_2O \rightleftharpoons A_{aq}^{\pm n-1} + H_3O_{aq}^{+}$$

and the corresponding equilibrium constant K_e is given by

$$K_e = \frac{(a_{A\ aq}^{\pm n-1})(a_{H_3O^+})}{(a_{HA_{aq}^{\pm n}})(a_{H_2O})}$$

where the a's are the activities of the species At low electrolyte concentrations a_{H_2O} is virtually constant, and a second constant, K_a, the thermodynamic dissociation constant, is defined as

$$K_a = K_e(a_{H_2O}) = \frac{(a_{A_{aq}^{\pm n-1}})(a_{H_3O^+})}{(a_{HA_{aq}^{\pm n}})} = \frac{(c_{A_{aq}^{\pm n-1}})(c_{H_3O^+})}{(c_{HA_{aq}^{\pm n}})} \cdot \frac{f_{\pm}^2}{f_{HA_{aq}^{\pm n}}}$$

where the c's are the concentrations and the f's are the activity coefficients of the species

The dissociation constants in the Tables are given in the more convenient pK_a notation, where

$$pKa = -\log K_a$$

For Table XXVII, $HA^{\pm n}$ = RCOOH, and $A^{\pm n-1}$ = $RCOO^-$

For Table XXVIII, $HA^{\pm n}$ = ArOH, and $A^{\pm n-1}$ = ArO^-

For Table XXIX, $HA^{\pm n}$ = $RR'R''NH^+$ and $A^{\pm n-1}$ = RR'R''N(R, R' and R'' may be alkyl or aryl groups or a hydrogen atom)

For monobasic acids $pK_a = pK_1$

For dicarboxylic acids both pK_1 and pK_2 are given, pK_1 is defined above, and pK_2 is the analogous dissociation constant of the monoanion, $A^{\pm n-1}$, obtained on the first dissociation For other dibasic acids such as the conjugate acids of amino acids, or diamines, pK_1 is as defined above, and pK_2 is the dissociation constant for the species obtained after the first protonation

For a comprehensive compilation of the dissociation constants of organic acids (including phenols) in aqueous solution, as well as summary of the methods for pK determinations, *see* G Kortum, W Vogel and K Andrussow, in *Pure and Applied Chemistry*, Vol 1, Butterworths, London, 1961, pp 190–536

For a comprehensive compilation of the dissociation constants of organic bases (especially amines) in aqueous solution *see* D D Perrin, *Dissociation Constants of Organic Bases in Aqueous Solution*, Butterworths, London, 1965

For general references including methods of determination of pK, and data for both acids and bases *see* J F King, in *Elucidation of Structures by Physical and Chemical Methods*, Vol 1 (Ed K W Bently) (*Technique of Organic Chemistry*, Vol 9), Interscience, New York, 1963, Chapter 6, pp 318–401, H C Brown, D H McDaniel and O Hafliger in *Determination of Organic Structures by Physical Methods*, Vol 1 (Ed E A Braude and F C Nachod), Academic Press, New York, 1955, Chapter 14, p 567

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE XXVII. ACID DISSOCIATION CONSTANTS OF ORGANIC ACIDS IN AQUEOUS SOLUTION

(Listed in order of increasing pKa)

No	Name	T,°C	pK_1	pK_2	No	Name	T °C	pK_1	pK_2
1	**Heptafluoro-*n*-butyric acid**	25	0 17		51	**1,3,5-Benzenetricarboxylic acid**	25	2 12	3 89
2	**Trifluoroacetic acid**	25	0 23						pK_3 = 4 70
3	**Trichloroacetic acid**	25	0 63		52	**D,L-3,5-Di-iodotyrosine**	25	2 12	6 48
4	**2,4,6-Trinitrobenzoic acid**	25	0 65		53	**3-(2-Fluorophenyl)alanine**	24	2 12	9 01
5	**Tribromoacetic acid**	25	0 66		54	**3-(4-Fluorophenyl)alanine**	24	2 13	9 05
6	**3-Chlorophenylglycine**	25	1 05	3 93	55	**D,L-β-Phenylalanine**	25	2 16	9 15
7	**2,6-Dinitrobenzoic acid**	25	1 14		56	***l*-Lysine**	25	2 16	9 18
8	**Trichloroacrylic acid**	25	1 15						pK_3 = 10 79
9	**Difluoroacetic acid**	25	1 24		57	***d*-Lysine**	25	2 16	9 16
10	**Oxalic acid**	25	1 27	4 28					pK_3 = 10 81
11	**Dichloroacetic acid**	25	1 29		58	**Glutamic acid**	20	2 16	4 324
12	**2-Chloro-6-nitrobenzoic acid**	25	1 34						pK_3 = 9 96
13	**2-Bromo-6-nitrobenzoic acid**	25	1 37		59	**6,6,6-Trifluoronorleucine**	25	2 164	9 463
14	**Benzenehexacarboxylic acid**	25	1 40	2 19	60	**3-(3-Chlorophenyl)alanine**	25	2 17	8 91
				pK_3 = 3 31	61	**2-Chloro-5-nitrobenzoic acid**	25	2 17	
				pK_4 = 4 78	62	**D,L-Serine**	25	2 21	4 15
				pK_5 = 5 89	63	**Diethylmalonic acid**	25	2 21	7 29
				pK_6 = 6 96	64	**N-Propylalanine**	25	2 21	10 19
15	***d,l*-2,3-Dibromosuccinic acid**	20	1 42	3 24	65	**N-Ethylalanine**	25	2 22	10 22
16	**2,4-Dinitrobenzoic acid**	25	1 42		66	**D,L-N-Methylalanine**	25	2 22	10 19
17	***erythro*-2-Bromo-3-chlorosuccinic acid**	19	1 43	2 60	67	**2-Nitrobenzoic acid**	25	2 22	
18	***d,l*-2,3-Dichlorosuccinic acid**	20	1 46	2 86	68	**3-(2-Chlorophenyl)alanine**	25	2 23	8 94
19	***threo*-2-Bromo-3-chlorosuccinic acid**	20	1 46	2 77	69	**6-Bromo-2-methylolbenzoic acid**	20	2 25	
20	***meso*-2,3-Dibromosuccinic acid**	20	1 51	2 71	70	**6-Chloro-2-methylolbenzoic acid**	20	2 26	
21	***meso*-2,3-Dichlorosuccinic acid**	20	1 52	2 94	71	***d,l*-Valine**	25	2 286	9 744
22	**4,4,4-Trifluorovaline**	25	1 537	8 098	72	***d,l*-2-Aminobutyric acid**	25	2 29	9 83
23	**4,4,4-Trifluorothreonine**	25	1 554	7 822	73	**2-Benzyl-2-cyanopropionic acid**	25	2 29	
24	**2-Amino-4,4,4-trifluoro-*n*-butyric acid**	25	1 600	8 169	74	**2-Amino-*n*-pentanoic acid**	25	2 318	9 808
25	**2,5-Dinitrobenzoic acid**	25	1 62		75	**(3,4-Dihydroxyphenyl)alanine**	25	2 32	8 68
26	**Nitroacetic acid**	25	1 68						pK_3 = 9 88
27	**Trifluoroacrylic acid**	25	1 79		76	**2-Chloro-3-hydroxysuccinic acid**	25	2 32	
28	**Benzenepentacarboxylic acid**	25	1 80	2 73	77	**3-Hydroxyglutaric acid**	25	2 32	4 24
				pK_3 = 3 97					pK_3 = 9 56
				pK_4 = 5 25	78	***d,l*-Leucine**	25	2 32	9 74
				pK_5 = 6 46	79	***d,l*-Norleucine**	25	2 335	9 83
29	**Cyclopropane-1,1-dicarboxylic acid**	25	1 82	5 43	80	***d,l*-Alanine**	25	2 34	9 87
30	**Hydroxyproline**	25	1 82	9 66	81	***cis*-Caronic acid** (*cis*-1,1-Dimethyl-2,3-cyclopropanedicarboxylic acid)	25	2 34	8 31
31	**DL-Histidine**	25	1 82	6 04					
				pK_3 = 9 12	82	**N-Ethylglycine**	25	2 34	10 23
32	**2,3-Dinitrobenzoic acid**	25	1 85		83	**Glycine**	25	2 35	9 78
33	**2-Methyl-4-nitrobenzoic acid**	25	1 86		84	**N-Methylglycine**	25	2 35	10 18
34	**1,2,4,5-Benzenetetracarboxylic acid**	25	1 92	2 87	85	**N-Propylglycine**	25	2 35	10 19
				pK_3 = 4 49	86	**N-*n*-Butylglycine**	25	2 35	10 25
				pK_4 = 5 63	87	**N-Isobutylglycine**	25	2 35	10 12
35	***trans*-Ethylene oxide-1,2-dicarboxylic acid**	19	1 93	3 25	88	**2-Aminoisobutyric acid**	25	2 36	10 25
36	***cis*-Ethylene oxide-1,2-dicarboxylic acid**	18	1 94	3 92	89	**(Methylsulfonyl)acetic acid**	25	2 36	
37	**Maleic acid**	25	1 94	6 23	90	**2-Cyano-2-cyclohexylacetic acid**	25	2 37	
38	**Ornithine**	25	1 94	8 65	91	**2-Cyanopropionic acid**	25	2 37	
39	**2-Chloro-4-nitrobenzoic acid**	25	1 96		92	**D,L-Tryptophane**	25	2 38	9 39
40	**4-Aminosalicylic acid** (4-Amino-2-hydroxybenzoic acid)	25	1 99	3 92	93	**1,2,3,5-Benzenetetracarboxylic acid**	25	2 38	3 51
									pK_2 = 4 44
41	**2-Chloro-3-nitrobenzoic acid**	25	2 02						pK_3 = 5 81
42	**Asparagine**	25	2 05	3 87	94	**4-Aminobenzoic acid**	25	2 38	
43	**Anthranilic acid**	25	2 05	4 95	95	**2-Cyanoisobutyric acid**	25	2 42	
44	**5,5,5-Trifluoroleucine**	25	2 05	8 92	96	**Cyanoacetic acid**	25	2 46	
45	**S-Ethylcysteine**	25	2 05	8 60	97	**Pyruvic acid**	25	2'49	
46	**1,2,3,4-Benzenetetracarboxylic acid**	25	2 06	3 25	98	**O-Acetylcitric acid**	25	2 49	.
				pK_3 = 4 73	99	**3-Pentenoic acid**	25	2 51	
				pK_4 = 6 21	100	**1,2,4-Benzenetricarboxylic acid**	25	2 52	3 84
47	**Di-*n*-propylmalonic acid**	25	2 07	7 51					pK_3 = 5 20
48	**3-(4-Chlorophenyl)alanine**	25	2 08	8 96	101	**(2-Chlorovinyl)acetic acid**	25	2 54	
49	**3-(3-Fluorophenyl)alanine**	24	2 10	8 98	102	**Oxaloacetic acid**	25	2 55	4 37
50	**Arginine**	25	2 10	9 07	103	**Fluoroacetic acid**	25	2 58	

TABLE XXVII. ACID DISSOCIATION CONSTANTS OF ORGANIC ACIDS IN AQUEOUS SOLUTION

(Listed in order of increasing pKa) (Continued)

No	Name	T,°C	pK_1	pK_2	No	Name	T,°C	pK_1	pK_2
104	**Phenylmalonic acid**	25	2 58	5 03	162	**(2,4-Dichloro-6-methylphenoxy)acetic acid**	20	3 13	
105	**2-Chloro-3-hydroxybutyric acid**	25	2 58		163	**2-Cyanobenzoic acid**	25	3 14	
106	**2-Fluoroacrylic acid**	25	2 58		164	**(3-Methoxyphenoxy)acetic acid**	25	3 14	
107	**2,4-Dioxo-*n*-pentanoic acid**	25	2 58		165	**Ethyl-*n*-propylmalonic acid**	25	3 15	7 43
108	**2-Chloro-3-hydroxy-3-phenyl propionic acid**	25	2 61		166	**4,4,4-Trifluorocrotonic acid**	25	3 15	
109	**2-Chloro-6-hydroxybenzoic acid**	25	2 63		167	**(4-Iodophenoxy)acetic acid**	25	3 16	
110	**2-Butynoic acid** (Tetrolic acid)	25	2 65		168	**(2-Iodophenoxy)acetic acid**	25	3 17	
111	**1-Aminocyclohexanecarboxylic acid**	25	2 66		169	**3,3-Difluoroacrylic acid**	25	3 17	
112	**Bromosuccinic acid**	50	2 69	4 69	170	**Dimethylmalonic acid**	25	3 17	6 06
113	**3-Hydroxy-2-naphthoic acid**	25	2 71		171	**Phenoxyacetic acid**	25	3 17	
114	**5-Aminosalicylic acid** (5-Amino-2-hydroxybenzoic acid	25	2 74	5 84	172	**Iodoacetic acid**	25	3 18	
					173	**3-Iodo-2-methylolbenzoic acid**	20	3 18	
115	**Triethylsuccinic acid**	25	2 74		174	**2-Hydroxy-3-chloroisobutyric acid**	25	3 20	
116	**Salicylic acid** (2-Hydroxybenzoic acid)	30	2 75, (3 00)	12 38	175	**(4-Methoxyphenoxy)acetic acid**	25	3 21	
					176	**(4-Methylphenoxy)acetic acid**	25	3 22	
117	**2,4-Dichlorobenzoic acid**	25	2 76		177	***meso*-Tartaric acid**	25	3 22	4 82
118	**1,2,3-Benzenetricarboxylic acid**	25	2 80	4 20	178	**2-Chlorocrotonic acid**	25	3 22	
				pK_3 = 5 87	179	**2,4-Dihydroxybenzoic acid**	30	3 22	
119	**3,4-Dinitrobenzoic acid**	25	2 82		180	**(2-Methoxyphenoxy)acetic acid**	25	3 23	
120	**3,5-Dinitrobenzoic acid**	25	2 82		181	**(2-Methylphenoxy)acetic acid**	25	3 23	
121	**Guanidinoacetic acid**	25	2 82		182	**Cyclopentane-1,1-dicarboxylic acid**	25	3 23	4 08
122	**2-Bromobenzoic acid**	25	2 85		183	**3-Bromomandelic acid**	25	3 23	
123	**Malonic acid**	25	2 86	5 65	184	**3-Chloromandelic acid**	25	3 24	
124	**Chloroacetic acid**	25	2 86		185	**2,6-Dimethylbenzoic acid**	25	3 25	
125	**Ethylmethylmalonic acid**	25	2 86	6 43	186	**3-Iodomandelic acid**	25	3 26	
126	**2-Iodobenzoic acid**	25	2 86		187	**2-Fluorobenzoic acid**	25	3 27	
127	**2-Chloropropionic acid**	18	2 88		188	**3-Chloro-2-methylbenzoic acid**	25	3 27	
128	**(4-Nitrophenoxy)acetic acid**	25	2 89		189	**(4-Chloro-2-methylphenoxy)acetic acid**	25	3 28	
129	**Bromoacetic acid**	25	2 90		190	**3-Bromo-2-methylbenzoic acid**	20	3 28	
130	**2-Chlorobenzoic acid**	25	2 92		191	***cis*-3-Chloroacrylic acid**	18	3 32	
131	**(4-Cyanophenoxy)acetic acid**	25	2 93		192	***cis*-Cyclopropane-1,2-dicarboxylic acid**	24	3 33	6 47
132	**Isopropylmalonic acid**	25	2 94	5 38	193	**(2,6-Dimethylphenoxy)acetic acid**	25	3 36	
133	**(3-Nitrophenoxy)acetic acid**	25	2 95		194	**Anthraquinone-1-carboxylic acid**	20	3 37	
134	**Phthalic acid**	25	2 95	5 41	195	**3-Hydroxy-3-phenylpropionic acid**	18	3 40	
135	**2-Chloroisobutyric acid**	18	2 97		196	***d,l*-Mandelic acid**	25	3 41	
136	**3,5-Dinitro-4-methylbenzoic acid**	25	2 97		197	**Anthraquinone-2-carboxylic acid**	20	3 42	
137	**(2-Cyanophenoxy)acetic acid**	25	2 97		198	**N-Formylglycine**	19	3 43	
138	**2-Bromopropionic acid**	18	2 97		199	**2,4,6-Trimethylbenzoic acid**	25	3 44	
139	**Ethylmalonic acid**	25	2 99	5 83	200	**3-Nitrobenzoic acid**	25	3 44	
140	***n*-Propylmalonic acid**	25	2 996	5 84	201	**Cyclohexane-1,1-diacetic acid**	25	3 45	7 08
141	***d*-Tartaric acid**	25	3 00	4 34	202	**2-Phenylbenzoic acid** (Biphenyl-2-carboxylic acid)	25	3 46	
142	**Fumaric acid**	25	3 02	4 38					
143	**(3-Cyanophenoxy)acetic acid**	25	3 03		203	***meso*-2,3-Diphenylsuccinic acid**	25	3 48	
144	**Benzilic acid**	18	3 05		204	**(2,4-Dinitrophenyl)acetic acid**	25	3 50	
					205	**Tetramethylsuccinic acid**	25	3 50	7 28
146	**Methylmalonic acid**	25	3 05	5 76	206	***d,l*-2,3-Diethylsuccinic acid**	25	3 51	6 60
147	**(2-Chlorophenoxy)acetic acid**	25	3 05		207	**2-Phenoxybenzoic acid**	20	3 53	
148	**3,3,3-Trifluoropropionic acid**	25	3 06		208	**2-Hydroxy-2-phenylpropionic acid**	18	3 53	
149	**3-Aminobenzoic acid**	25	3 07	4 73					
150	**(3-Chlorophenoxy)acetic acid**	25	3 07		210	**Terephthalic acid**	25	3 54	4 46
151	**2-Hydroxy-3-chlorobutyric acid**	25	3 08		211	**2-*tert*-Butylbenzoic acid**	25	3 54	
152	**(3-Fluorophenoxy)acetic acid**	25	3 09		212	**3-Aminopropionic acid**	25	3 55	
153	**(2-Fluorophenoxy)acetic acid**	25	3 09		213	**4-Cyanobenzoic acid**	25	3 55	
154	**(4-Chlorophenoxy)acetic acid**	25	3 10		214	**3-(Methylamino)benzoic acid**	25	3 55	
155	**(3-Bromophenoxy)acetic acid**	25	3 10		215	**3-Methoxy-2-methylolbenzoic acid**	20	3 58	
156	**α-Iodopropionic acid**	18	3 11		216	***d,l*-2,3-Diphenylsuccinic acid**	25	3 58	
157	**(2-Bromophenoxy)acetic acid**	25	3 12		217	**2-Aminocyclohexanecarboxylic acid**	25	3 59	10 21
158	**3-Chlorolactic acid**	25	3 12		218	**3-Cyanobenzoic acid**	25	3 60	
159	**(4-Bromophenoxy)acetic acid**	25	3 13		219	**3-Ethoxy-2-methylolbenzoic acid**	20	3 62	
160	**(3-Iodophenoxy)acetic acid**	25	3 13		220	**Isophthalic acid**	25	3 62	4 60
161	**(4-Fluorophenoxy)acetic acid**	25	3 13		221	**3-Ethyl-3-methylglutaric acid**	25	3 62	6 70

TABLE XXVII. ACID DISSOCIATION CONSTANTS OF ORGANIC ACIDS IN AQUEOUS SOLUTION
(Listed in order of increasing pKa) (Continued)

No	Name	T °C	pK_1	pK_2
222	**3,3-Diethylglutaric acid**	25	3 62	7 12
223	***meso*-2,3-Diethylsuccinic acid**	25	3 63	6 46
224	**(2,4-Dichlorophenoxy)acetic acid**	20	3 64	
225	**Malonamic acid** (Malonic acid mono-amide)	25	3 64	
226	**2-Isopropylbenzoic acid**	25	3 64	
227	**Decahydronaphthyloxyacetic acid**	25	3 64	
228	**2-Cyclohexyloxypropionic acid**	25	3 64	
229	***trans*-3-Chloroacrylic acid**	18	3 65	
230	**9-Anthracenecarboxylic acid**	20	3 65	
231	**Ethoxyacetic acid**	18	3 65	
232	***trans*-Cyclopropane-1,2-dicarboxylic acid**	24	3 65	5 13
233	**N-Acetylglycine**	25	3 67	
234	**1-Anthracenecarboxylic acid**	20	3 68	
235	**2-Benzyl-2-phenylsuccinic acid**	20	3 69	6 49
236	**3,3-Di-*n*-propylglutaric acid**	25	3 69	7 31
237	**Cyclopentyloxyacetic acid**	25	3 70	
238	**3,3-Dimethylglutaric acid**	25	3 70	6 29
239	***cis*-3-Aminocyclohexanecarboxylic acid**	15	3 70	
240	***d,l*-N-Acetylalanine**	25	3 72	
241	**N-Propionylglycine**	25	3 72	
242	**2,3-Dimethylbenzoic acid**	25	3 74	
243	**Formic acid**	25	3 74	
244	**Phthalamic acid** (Phthalic acid mono-amide)	25	3 75	
245	**Glutaconic acid**	25	3 77	5 08
246	***meso*-2,3-Dimethylsuccinic acid**	25	3 77	5 94
247	**2-Ethylbenzoic acid**	25	3 79	
248	**3-Methylcyclopentyl-1,1-diacetic acid**	25	3 79	6 74
249	***trans*-Cyclobutane-1,2-dicarboxylic acid**	20	3 79	5 61
250	**Cyclohexyloxyacetic acid**	25	3 80	
251	**2-Hydroxybutyric acid**	18	3 80	
252	**Cyclopentyl-1,1-diacetic acid**	25	3 80	6 77
253	**3-Bromobenzoic acid**	25	3 81	
254	**3-Chlorobenzoic acid**	25	3 82	
255	***trans*-Caronic acid** (*trans*-1,1 Dimethyl-2,3-cyclopropanedicarboxylic acid)	25	3 82	5 32
256	**2,2-Diethylsuccinic acid**	25	3 84	
257	***trans*-3-Aminocyclohexanecarboxylic acid**	15	3 85	
258	**3-Iodobenzoic acid**	25	3 85	
259	**(4-Nitrophenyl)acetic acid**	25	3 85	
260	***cis*-3-Methylcyclohexyloxyacetic acid**	25	3 85	
261	**Lactic acid**	25	3 86	
262	***cis*-Cinnamic acid**	25	3 88	
263	**Hydroxyacetic acid**	25	3 89	
264	**1,2,3-Cyclohexanetricarboxylic acid**	23	3 89	4 85 pK_3 = 8 83
265	***cis*-Cyclobutane-1,2-dicarboxylic acid**	19	3 90	5 89
266	**2-Methylcyclohexyloxyacetic acid**	25	3 90	
267	**3-Fluorobenzoic acid**	25	3 90	
268	**3-Hydroxybenzoic acid**	30	3 90	9 78
269	**2-Methylbenzoic acid**	25	3 91	
270	**2,2-Diphenylglutaric acid**	20	3 91	5 38
271	**3-Phenoxybenzoic acid**	20	3 91	
272	**2-(Bromomethyl)butyric acid**	18	3 92	
273	**Diphenylacetic acid**	25	3 94	
274	**2,2-Dibenzylsuccinic acid**	20	3 96	6 66
275	**Triphenylacetic acid**	25	3 96	
276	***trans*-Cyclopentane-1,2-dicarboxylic acid**	25	3 96	5 85
277	**4-Bromobenzoic acid**	25	3 97	
278	**(3-Nitrophenyl)acetic acid**	25	3 97	
279	***cis*-Tetrahydronaphthalene-2,3-dicarboxylic acid**	20	3 98	6 47
280	**4-Chlorobenzoic acid**	25	3 98	
281	**2,5-Dimethylbenzoic acid**	25	3 98	
282	**3-Bromopropionic acid**	18	3 99	
283	**2-Hydroxy-2-methylbutyric acid**	18	3 99	
284	**3-Cyanopropionic acid**	25	3 99	
285	**3-Chloropropionic acid**	25	3 996	
286	***trans*-Tetrahydronaphthalene-2,3-dicarboxylic acid**	20	4 00	5 70
287	**(2-Nitrophenyl)acetic acid**	25	4 004	
288	**3-Aminopentanoic acid**	25	4 02	10 40
289	**4-Aminobutyric acid**	25	4 03	
290	***cis*-Cyclobutane-1,3-dicarboxylic acid**	25	4 03	5 31
291	**2-Hydroxyisobutyric acid**	18	4 04	
292	**(2-Iodophenyl)acetic acid**	25	4 04	
293	***trans*-4-Nitrocinnamic acid**	25	4 05	
294	**(2-Bromophenyl)acetic acid**	25	4 05	
295	**(2-Chlorophenyl)acetic acid**	25	4 07	
296	**2-Methoxybenzoic acid**	20	4 08	
297	**3-Methoxybenzoic acid**	25	4 09	
298	**3-Iodopropionic acid**	18	4 09	
299	***cis*-Cyclohexane-1,3-dicarboxylic acid**	16	4 10	5 46
300	**Ethylsuccinic acid**	25	4 00	
301	**Iminodipropionic acid**	30	4 11	9 61
302	**Benzylsuccinic acid**	20	4 11	5 65
303	***trans*-3-Nitrocinnamic acid**	25	4 12	
304	**4-Fluorobenzoic acid**	25	4 14	
305	**(3-Chlorophenyl)acetic acid**	25	4 14	
306	**4,4,4-Trifluorobutyric acid**	25	4 15	
307	***trans*-2-Nitrocinnamic acid**	25	4 15	
308	**3-Isopropoxybenzoic acid**	20	4 15	
309	**2-Naphthoic acid**	25	4 16	
310	**Succinic acid**	25	4 16	5 61
311	**(3-Iodophenyl)acetic acid**	25	4 16	
312	**3-Ethoxybenzoic acid**	20	4 17	
313	**2,2-Diphenyladipic acid**	20	4 17	5 80
314	**(4-Iodophenyl)acetic acid**	25	4 18	
315	**2-Anthracenecarboxylic acid**	20	4 18	
316	***trans*-Cyclohexane-1,4-dicarboxylic acid**	16	4 18	
317	**4,4,5,5,6,6,6-Heptafluorohexanoic acid**	25	4 18	
318	**2,4-Dimethylbenzoic acid**	25	4 18	
319	***trans*-Cyclohexane-1,2-dicarboxylic acid**	19	4 18	5 93
320	**(4-Bromophenyl)acetic acid**	25	4 19	
321	**(4-Chlorophenyl)acetic acid**	25	4 19	
322	**Mesaconic acid**	18	4 20	
323	**Benzoic acid**	25	4 20	
324	**3-Propoxybenzoic acid**	20	4 20	
325	**2-Ethoxybenzoic acid**	20	4 21	
326	**3,4-Diphenyladipic acid**	25	4 22	5 19
327	***trans*-2-Chlorocinnamic acid**	25	4 23	
328	**3-Fluoromandelic acid**	25	4 24	
329	**(1-Naphthyl)acetic acid**	25	4 24	
330	**(2-Isopropoxy)benzoic acid**	20	4 24	
331	**2-Propoxybenzoic acid**	20	4 24	
332	**3-Butoxybenzoic acid**	20	4 25	
333	**(4-Fluorophenyl)acetic acid**	25	4 25	
334	**Acrylic acid**	25	4 25	
335	**3-Methylglutaric acid**	25	4 25	5 41
336	**(2-Naphthyl)acetic acid**	25	4 26	
337	***cis*-Cyclopentane-1,3-dicarboxylic acid**	25	4 26	5 51
338	**5-Aminopentanoic acid**	25	4 27	

TABLE XXVII. ACID DISSOCIATION CONSTANTS OF ORGANIC ACIDS IN AQUEOUS SOLUTION
(Listed in order of increasing pKa) (Continued)

No	Name	T, °C	pK_1	pK_2	No	Name	T °C	pK_1	pK_2
339	3-Methylbenzoic acid	25	4 27		401	3-(2-Chlorophenyl)propionic acid	25	4 58	
340	2,2-Diphenylpimelic acid	25	4 28	5 39	402	3-(3-Chlorophenyl)propionic acid	25	4 58	
341	3-Ethylglutaric acid	25	4 29	5 33	403	4-Methyl-3-pentenoic acid	25	4 60	
342	Angelic acid	18	4 29		404	*cis*-3-Hydroxycyclohexanecarboxylic acid	25	4 60	
343	*trans*-3-Chlorocinnamic acid	25	4 29		405	2-Hydroxycinnamic acid	25	4 61	
344	3,5-Dimethylbenzoic acid	25	4 30		406	4-Hydroxybenzoic acid	27 8	4 61	9 31
345	3-Isopropylglutaric acid	25	4 30	5 51	407	Levulinic acid	18	4 64	
346	3-*n*-Propylglutaric acid	25	4 31	5 31	408	2-Methyl-3-hydroxybutyric acid	18	4 65	
347	Phenylacetic acid	25	4 31		409	3-(3-Methoxyphenyl)propionic acid	25	4 65	
348	*trans*-Cyclohexane-1,3-dicarboxylic acid	19	4 31	5 73	410	4-Acetylbutyric acid	18	4 66	
349	2,2-Diphenylsuberic acid	20	4 31	5 39	411	2-Methylacrylic acid	18	4 66	
350	*trans*-Cyclopentane-1,3-dicarboxylic acid	25	4 32	5 42	412	3-Phenylpropionic acid	25	4 66	
351	2,2-Diphenylazelaic acid	20	4 33	5 38	413	3-(2-Methylphenyl)propionic acid	25	4 66	
352	(3,4-Dimethoxyphenyl)acetic acid	25	4 33		414	4-Pentenoic acid	25	4 67	
353	3,4,5-Trihydroxybenzoic acid	30	4 33		415	4-Ureidobutyric acid	25	4 68	
354	*cis*-Cyclohexane-1,2-dicarboxylic acid	20	4 34	6 77	416	3-(3-Methylphenyl)propionic acid	25	4 68	
355	4-Isopropylbenzoic acid	25	4 35		417	3-(4-Methylphenyl)propionic acid	25	4 68	
356	Vinylacetic acid	25	4 35		418	(4-Isopropoxy)benzoic acid	20	4 68	
357	Glutaric acid	25	4 35	5 42	419	*trans*-2-Hydroxycyclohexanecarboxylic acid	25	4 68	
358	4-Ethylbenzoic acid	25	4 35						
359	(4-Methoxyphenyl)acetic acid	25	4 36		420	*trans*-4-Hydroxycyclohexanecarboxylic acid	25	4 68	
360	4-Methylbenzoic acid	25	4 37						
361	(4-Methylphenyl)acetic acid	25	4 37		421	3-(4-Methoxyphenyl)propionic acid	25	4 69	
362	(4-Ethylphenyl)acetic acid	25	4 37		422	2-Pentenoic acid	25	4 69	
363	4-Methoxycinnamic acid	25	4 38		423	*trans*-Crotonic acid	25	4 69	
364	*trans*-Cyclohexane-1,2-diacetic acid	20	4 38	5 42	424	4-Hydroxypentanoic acid	18	4 69	
365	(4-Isopropylphenyl)acetic acid	25	4 39		425	2-Hexenoic acid	25	4 70	
366	*trans*-4-Aminocyclohexanecarboxylic acid	25	4 39	10 55	426	4-Hexenoic acid	25	4 72	
367	3-Hydroxycinnamic acid	25	4 40		427	5-Hexenoic acid	25	4 72	
368	4-*tert*-Butylbenzoic acid	25	4 40		428	2-Ethylpentanoic acid	18	4 72	
369	*cis*-Crotonic acid	18	4 41		429	2-Ethylbutyric acid	25	4 75	
370	3,4-Di nethylbenzoic acid	25	4 41		430	4-Phenylbutyric acid	25	4 76	
371	*trans*-2-Bromocinnamic acid	25	4 41		431	Acetic acid	25	4 76	
372	*cis*-Cyclohexane-1,2-diacetic acid	20	4 42	5 45	432	Isovaleric acid	25	4 78	
373	*cis*-Cyclopentane-1,2-diacetic acid	20	4 42	5 42	433	4-Propoxybenzoic acid	20	4 78	
374	(4-*tert*-Butylphenyl)acetic acid	25	4 42		434	4,4-Dimethylpentanoic acid	18	4 79	
375	*trans*-Cyclopentane-1,2-diacetic acid	20	4 43	5 43	435	Cyclobutanecarboxylic acid	25	4 79	
376	*trans*-4-Chlorocinnamic acid	25	4 43		436	*d,l*-2-Methylpentanoic acid	18	4 79	
377	Adipic acid	25	4 43	5 42	437	5-Methyl-4-hexenoic acid	25	4 80	
378	4-Cyanobutyric acid	25	4 44		438	4-Methyl-2-pentenoic acid	25	4 80	
379	*trans*-Cinnamic acid	25	4 44		439	3-(2-Methoxyphenyl)propionic acid	25	4 80	
380	*trans*-3-Methylcinnamic acid	25	4 44		440	2-Methylbutyric acid	18	4 81	
381	3-(Acetylamino)propionic acid	25	4 45		441	*n*-Butyric acid (*n*-Butanoic acid)	25	4 82	
382	2-Ureidoisobutyric acid	25	4 46		442	*trans*-3-Hydroxycyclohexanecarboxylic acid	25	4 82	
383	4-Methoxybenzoic acid	25	4 47						
384	3-(4-Nitrophenyl)propionic acid	25	4 47		443	Nicotinic acid	25	4 82	11 98
385	Pimelic acid	25	4 48	5 42	444	Cyclopropanecarboxylic acid	25	4 83	
386	3-(1-Naphthoyl)propionic acid	20	4 48		445	*cis*-4-Aminocyclohexanecarboxylic acid	25	4 83	10 62
387	3-Methylcyclohexyl-1,1-diacetic acid	25	4 49	6 08	446	*d,l*-3-Methylpentanoic acid	18	4 84	
388	4-Methylcyclohexyl-1,1-diacetic acid	25	4 49	6 10	447	Isonicotinic acid	20	4 84	12 23
389	5,5,5-Trifluoropentanoic acid	25	4 49		448	*cis*-4-Hydroxycyclohexanecarboxylic acid	25	4 84	
390	3-Ureidopropionic acid	25	4 49		449	Isocaproic acid	18	4 84	
391	3-(2-Nitrophenyl)propionic acid	25	4 50		450	*n*-Pentanoic acid (*n*-Valeric acid)	25	4 84	
392	*trans*-2-Methylcinnamic acid	25	4 50		451	Isobutyric acid	25	4 86	
393	2-Methoxycinnamic acid	25	4 50		452	Propionic acid (Propanoic acid)	25	4 87	
394	3-Hexenoic acid	25	4 52		453	4-Hydroxyisocaproic acid	18	4 87	
395	Suberic acid	25	4 52	5 40	454	*n*-Hexanoic acid (*n*-Caproic acid)	25	4 88	
396	Azelaic acid	25	4 53	5 40	455	*n*-Heptanoic acid	25	4 89	
					456	*n*-Octanoic acid (*n*-Caprylic acid)	25	4 89	
398	Succinamic acid (Succinic acid monoamide)	25	4 54		457	Cyclohexylpropionic acid	25	4 91	
					458	*d,l*-2,3-Dimethylsuccinic acid	25	4 94	6 20
399	*trans*-4-Methylcinnamic acid	20	4 56		459	*n*-Nonanoic acid (Pelargonic acid)	25	4 94	
400	O-Acetylsalicylic acid (Aspirin)	17	4 57		460	Cyclohexylbutyric acid	25	4 95	

TABLE XXVII. ACID DISSOCIATION CONSTANTS OF ORGANIC ACIDS IN AQUEOUS SOLUTION
(Listed in order of increasing pKa) (Continued)

No	Name	T °C	pK_1	pK_2	No	Name	T °C	pK_1	pK_2
461	**Tiglic acid**	18	4 96		468	***cis*-3-Methyl-2-pentenoic acid**	25	5 15	
462	**3-(2-Naphthoyl)propionic acid**	20	4 96		469	**Itaconic acid**	18	5 54	
463	**Cyclopentanecarboxylic acid**	25	4 99		470	**Citraconic acid**	18	6 17	
464	**2,2-Dimethylbutyric acid**	18	5 03		471	**Ethylenediamine-N,N,N',N'-tetra-acetic acid**	25	6 27	10 95
465	**Trimethylacetic acid**	25	5 05						
466	**3,3-Dimethylacrylic acid** (3-Methyl-crotonic acid)	25	5 12		472	**Ethylenediamine-N,N'-diacetic acid**	30	6 42	9 46
					473	**Ethylenediamine-N,N'-dipropionic acid**	30	6 87	9 60
467	***trans*-3-Methyl-2-pentenoic acid**	25	5 13						

EXPLANATIONS AND REFERENCES TO TABLES XXVII, XXVIII AND XXIX

The dissociation of an organic carboxylic acid, phenol or the conjugate acid of an amine in aqueous solution is expressed by the equation

$$HA_{aq}^{\pm n} + H_2O \rightleftharpoons A_{aq}^{\pm n-1} + H_3O_{aq}^{+}$$

and the corresponding equilibrium constant K_e is given by

$$K_e = \frac{(a_{A\ aq}^{\pm n-1})(a_{H_3O^+})}{(a_{HA_{aq}^{\pm n}})(a_{H_2O})}$$

where the a's are the activities of the species At low electrolyte concentrations a_{H_2O} is virtually constant, and a second constant, K_a, the thermodynamic dissociation constant, is defined as

$$K_a = K_e(a_{H_2O}) = \frac{(a_{A_{aq}^{\pm n-1}})(a_{H_3O^+})}{(a_{HA_{aq}^{\pm n}})} = \frac{(c_{A_{aq}^{\pm n-1}})(c_{H_3O^+})}{(c_{HA_{aq}^{\pm n}})} \cdot \frac{f_{\pm}^2}{f_{HA_{aq}^{\pm n}}}$$

where the c's are the concentrations and the f's are the activity coefficients of the species

The dissociation constants in the Tables are given in the more convenient pK_a notation, where

$$pKa = -\log K_a$$

For Table XXVII, $HA^{\pm n}$ = RCOOH, and $A^{\pm n-1}$ = $RCOO^-$

For Table XXVIII, $HA^{\pm n}$ = ArOH, and $A^{\pm n-1}$ = ArO^-

For Table XXIX, $HA^{\pm n}$ = $RR'R''NH^+$ and $A^{\pm n-1}$ = RR'R''N(R, R' and R'' may be alkyl or aryl groups or a hydrogen atom)

For monobasic acids $pK_a = pK_1$

For dicarboxylic acids both pK_1 and pK_2 are given, pK_1 is defined above, and pK_2 is the analogous dissociation constant of the monoanion, $A^{\pm n-1}$, obtained on the first dissociation For other dibasic acids such as the conjugate acids of amino acids, or diamines, pK_1 is as defined above, and pK_2 is the dissociation constant for the species obtained after the first protonation

For a comprehensive compilation of the dissociation constants of organic acids (including phenols) in aqueous solution, as well as summary of the methods for pK determinations, *see* G Kortum, W Vogel and K Andrussow, in *Pure and Applied Chemistry*, Vol 1, Butterworths, London, 1961, pp 190–536

For a comprehensive compilation of the dissociation constants of organic bases (especially amines) in aqueous solution *see* D D Perrin, *Dissociation Constants of Organic Bases in Aqueous Solution*, Butterworths, London, 1965

For general references including methods of determination of pK, and data for both acids and bases *see* J F King, in *Elucidation of Structures by Physical and Chemical Methods*, Vol 1 (Ed K W Bently) (*Technique of Organic Chemistry*, Vol 9), Interscience, New York, 1963, Chapter 6, pp 318–401, H C Brown, D H McDaniel and O Hafliger in *Determination of Organic Structures by Physical Methods*, Vol 1 (Ed E A Braude and F C Nachod), Academic Press, New York, 1955, Chapter 14, p 567

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE XXVIII. ACID DISSOCIATION CONSTANTS OF PHENOLS IN AQUEOUS SOLUTION

(Listed in order of increasing pKa)

No	Name	T °C	pK_1	pK_2
1	**Picric acid** (2,4,6-Trinitrophenol)	25	0 29 (0 71)	
2	**4-Hydroxypyrimidine**	20	1 85	8 59
3	**2-Hydroxypyrimidine**	20	2 24	9 17
4	**4-Chloro-2,6-dinitrophenol**	25	2 97	
5	**2,6-Dinitrophenol**	25	3 71	
6	**2,4-Dinitrophenol**	25	4 09	
7	**2,6-Dinitrohydroquinone**	21	4 42	9 14
8	**8-Hydroxyquinoline**	20	5 017	9 813
9	**2,5-Dinitrophenol**	25	5 04	
10	**3,4-Dinitrophenol**	25	5 42	
11	**8-Hydroxyquinaldine**	25	5 55	10 31
12	**4-Methyl-8-hydroxyquinoline**	25	5 58	10 00
13	**3,4-Dimethyl-8-hydroxyquinoline**	25	5 80	10 05
14	**5-Formyl-2-nitrophenol** (3-Hydroxy-4-nitrobenzaldehyde)	25	6 00	
15	**5-Chloro-2-nitrophenol**	25	6 05	
16	**5-Carboethoxy-2-nitrophenol** (Ethyl 3-hydroxy-4-nitrobenzoate)	25	6 11	
17	**5-Carbomethoxy-2-nitrophenol** (Methyl 3-hydroxy-4-nitrobenzoate)	25	6 15	
18	**2,4-Dimethyl-8-hydroxyquinoline**	25	6 20	10 60
19	**3-Nitrocatechol**	25	6 68	
20	**2-Nitro-5-phenylphenol** (3-Hydroxy-4-nitrobiphenyl)	25	6 74	
21	**2-Formylphenol** (Salicylaldehyde)	25	6 79	
22	**5-Methoxy-2-nitrophenol**	25	7 09	
23	**4-Nitrophenol**	25	7 16	
24	**2-Nitrophenol**	25	7 21	
25	**2,6-Dimethyl-4-nitrophenol**	25	7 22	
26	**5-Methyl-2-nitrophenol**	25	7 25	
27	**2,6-Dichlorohydroquinone**	25	7 30	9 99
28	**Vanillin** (4-Formyl-2-methoxyphenol 4-Hydroxy-3-methoxybenzaldehyde)	25	7 396	
29	**2-Nitrohydroquinone**	21	7 63	10 06
30	**4-Formylphenol** (4-Hydroxybenzaldehyde)	25	7 66	
31	**4-(Methylsulfonyl)phenol**	25	7 83	
33	***o*-Vanillin** (2-Formyl-6-methoxyphenol, 2-Hydroxy-3-methoxybenzaldehyde)	25	7 91	
34	**4-Cyanophenol** (4-Hydroxybenzonitrile)	25	7 95	
35	**3-Formylphenol** (3-Hydroxybenzaldehyde)	25	8 00	
36	**4-Acetylphenol**	25	8 05	
37	**3,5-Dimethyl-4-(methylsulfonyl)phenol**	25	8 13	
38	**4-Cyano-3,5-dimethylphenol** (2,6-Dimethyl-4-hydroxybenzonitrile)	25	8 21	
39	**3,5-Dimethyl-4-nitrophenol**	25	8 25	
40	**4-Cyano-2,6-dimethylphenol** (3,5-Dimethyl-4-hydroxybenzonitrile)	25	8 27	
41	**2-Carboxamidophenol** (Salicylamide)	20	8 37	
42	**3-Nitrophenol**	25	8 38	
43	**4-Carbobenzyloxyphenol** (Benzyl 4-hydroxybenzoate)	25	8 41	
44	**2-Bromophenol**	25	8 42	
45	**Phloroglucinol** (1,3,5-Trihydroxybenzene)	25	8 45 (7 0)	8 88
46	**2-Iodophenol**	25	8 46	
47	**4-Carbobutoxyphenol** (*n*-Butyl 4-hydroxybenzoate)	25	8 47	
48	**4-Carbomethoxyphenol** (Methyl 4-hydroxybenzoate)	25	8 47	
49	**2-Chlorophenol**	25	8 48	
50	**4-Carboethoxyphenol** (Ethyl 4-hydroxybenzoate)	25	8 50	
51	**2-Hydroxy-3-methoxybenzylamine**	25	8 70	10 52
52	**3-Hydroxypyridine**	20	8 72	
53	**2-Fluorophenol**	25	8 82	
54	**Isovanillin** (5-Formyl-2-methoxyphenol 3-Hydroxy-4-methoxybenzaldehyde)	25	8 889	
55	**3-Hydroxy-2-methoxybenzylamine**	25	8 89	10 52
56	**4-Hydroxy-3-methoxybenzylamine**	25	8 94	10 42
57	**3-Nitro-2,4,6-trimethylphenol**	25	8 98	
58	**Sodium 4-hydroxybenzenesulfonate**	25	9 01	
59	**Pyrogallol** (1 2 3-Trihydroxybenzene)	25	9 01	11 64
60	**2-Methylhydroquinone** (Toluhydroquinone)	25	9 05	11 62
61	**3-Chlorophenol**	25	9 08 (9 02)	
62	**3-Bromophenol**	25	9 11	
63	**3-Iodophenol**	25	9 17	
64	**3-Acetylphenol**	25	9 19	
65	**4-Iodophenol**	25	9 20	
66	**Sodium 3-hydroxybenzenesulfonate**	25	9 29	
67	**1-Naphthol**	20 5	9 30 (9 85)	
68	**3-(Methylsulfonyl)phenol**	25	9 33	
69	**4-Bromophenol**	25	9 34	
70	**3-Fluorophenol**	25	9 36 (9 28)	
71	**1,4-Naphthohydroquinone** (1 4 Dihydroxy naphthalene)	26 5	9 37	10 93
72	**4-Chlorophenol**	25	9 38 (9 42)	
73	**Sodium 4-hydroxybenzoate**	20	9 39	
74	**Resorcinol** (1 3 Dihydroxybenzene)	30	9 44	11 32
75	**Catechol** (1 2-Dihydroxybenzene)	30	9 48	12 08
76	**4-Phenylphenol** (4 Hydroxybiphenyl)	22 5	9 51	
77	**3-(Methylthio)phenol**	25	9 53	
78	**4-(Methylthio)phenol**	25	9 53	
79	**2,4,6-Trimethylolphenol**	25	9 56	
80	**2-Naphthol**	19 5	9 57, (9 93)	
81	**3-Phenylphenol** (3-Hydroxybiphenyl)	22 5	9 64	
82	**3-Methoxyphenol**	25	9 65	
83	**2,6-Dimethylolphenol**	25	9 66	
84	**2-Aminophenol** (2-Hydroxyaniline)	28	9 71	
85	**2,4-Dimethylolphenol**	25	9 77	
86	**4-Methylolphenol**	25	9 82	
87	**3-Methylolphenol**	25	9 83	
88	**3-Aminophenol** (3-Hydroxyaniline)	21 5	9 87	9 92
89	**Sodium 4-hydroxybenzenephosphonate**	25	9 90	
90	**3-Ethylphenol**	28	9 90	
91	**2,6-Dimethylol-4-methylphenol**	25	9 92	
92	**2-Methylolphenol**	25	9 92	
93	**4-Fluorophenol**	25	9 92	
94	**Sodium 3-hydroxybenzoate**	20	9 94	
95	**2-Methoxyphenol**	25	9 98	
96	**Phenol**	25	9 99, (9 95)	
97	**Eugenol** (4-Allyl-2-methoxyphenol)	25	10 00	
98	**2-Phenylphenol** (2-Hydroxybiphenyl)	22 5	10 01	
99	**4-Ethylphenol**	28	10 01	
100	**3-Methylphenol** (*m*-Cresol)	25	10 09	
101	**3-Ethyl-5-methylphenol**	28	10 10	
102	**3,5-Dimethylphenol**	25	10 15	
103	**4-Methyl-2-methylolphenol**	25	10 15	
104	**4-Methoxyphenol**	25	10 20	
105	**Sodium 3-hydroxybenzenephosphonate**	25	10 2	

TABLE XXVIII. ACID DISSOCIATION CONSTANTS OF PHENOLS IN AQUEOUS SOLUTION

(Listed in order of increasing pKa)

No.	Name	T, °C	pK_1	pK_2	No	Name	T, °C	pK_1	pK_2
106	**2-Ethylphenol**	28	10 2		115	**2,6-Dimethylphenol**	25	10 59	
107	**2,5-Dimethylphenol**	24	10 22		116	**2,4,6-Trimethylphenol**	25	10 88, (10 99)	
108	**4-Methylphenol** (*p*-Cresol)	25	10 26						
109	**2-Methylphenol** (*o*-Cresol)	25	10 28		117	**Hydroquinone** (1,4-Dihydroxybenzene)	25	10 85, (9 96)	11 39
110	**4-Indanol**	25	10 32						
111	**3,4-Dimethylphenol**	25	10 32		118	**4-Hydroxypyridine**	20	11 09	
112	**2,4,5-Trimethylphenol**	25	10 45		119	**Tetramethylhydroquinone** (Durohydroquinone)	25	11 51	
113	**2,4-Dimethylphenol**	25	10 45						
114	**2,3-Dimethylphenol**	25	10 50		120	**2-Hydroxypyridine**	20	11 62	

EXPLANATIONS AND REFERENCES TO TABLES XXVII, XXVIII AND XXIX

The dissociation of an organic carboxylic acid, phenol or the conjugate acid of an amine in aqueous solution is expressed by the equation

$$HA_{aq}^{\pm n} + H_2O \rightleftharpoons A_{aq}^{\pm n-1} + H_3O_{aq}^{+}$$

and the corresponding equilibrium constant K_e is given by

$$K_e = \frac{(a_{A\ aq}^{\pm n-1})(a_{H_3O^+})}{(a_{HA_{aq}^{\pm n}})(a_{H_2O})}$$

where the a's are the activities of the species At low electrolyte concentrations a_{H_2O} is virtually constant, and a second constant, K_a, the thermodynamic dissociation constant, is defined as

$$K_a = K_e(a_{H_2O}) = \frac{(a_{A_{aq}^{\pm n-1}})(a_{H_3O^+})}{(a_{HA_{aq}^{\pm n}})} = \frac{(c_{A_{aq}^{\pm n-1}})(c_{H_3O^+})}{(c_{HA_{aq}^{\pm n}})} \cdot \frac{f_{\pm}^2}{f_{HA_{aq}^{\pm n}}}$$

where the c's are the concentrations and the f's are the activity coefficients of the species

The dissociation constants in the Tables are given in the more convenient pK_a notation, where

$$pKa = -\log K_a$$

For Table XXVII, $HA^{\pm n}$ = RCOOH, and $A^{\pm n-1}$ = $RCOO^-$

For Table XXVIII, $HA^{\pm n}$ = ArOH, and $A^{\pm n-1}$ = ArO^-

For Table XXIX, $HA^{\pm n}$ = $RR'R''NH^+$ and $A^{\pm n-1}$ = RR'R''N(R, R' and R'' may be alkyl or aryl groups or a hydrogen atom)

For monobasic acids $pK_a = pK_1$

For dicarboxylic acids both pK_1 and pK_2 are given, pK_1 is defined above, and pK_2 is the analogous dissociation constant of the monoanion, $A^{\pm n-1}$, obtained on the first dissociation For other dibasic acids such as the conjugate acids of amino acids, or diamines, pK_1 is as defined above, and pK_2 is the dissociation constant for the species obtained after the first protonation

For a comprehensive compilation of the dissociation constants of organic acids (including phenols) in aqueous solution, as well as summary of the methods for pK determinations, *see* G Kortum, W Vogel and K Andrussow, in *Pure and Applied Chemistry*, Vol 1, Butterworths, London, 1961, pp 190–536

For a comprehensive compilation of the dissociation constants of organic bases (especially amines) in aqueous solution *see* D D Perrin, *Dissociation Constants of Organic Bases in Aqueous Solution*, Butterworths, London, 1965

For general references including methods of determination of pK, and data for both acids and bases *see* J F King, in *Elucidation of Structures by Physical and Chemical Methods*, Vol 1 (Ed K W Bently) (*Technique of Organic Chemistry*, Vol 9), Interscience, New York, 1963, Chapter 6, pp 318–401, H C Brown, D H McDaniel and O Hafliger in *Determination of Organic Structures by Physical Methods*, Vol 1 (Ed E A Braude and F C Nachod), Academic Press, New York, 1955, Chapter 14, p 567

*Derivatives recommended for first trial

WARNING This is not an instruction manual References should be consulted for the preparation of derivatives

TABLE XXIX. DISSOCIATION CONSTANTS OF ORGANIC BASES IN AQUEOUS SOLUTION

(Listed in order of increasing pKa)

(The data relates to the acid dissociation constant (Ka) of the conjugate acid (BH^+) of the listed base (B))

No	Name	T °C	pK_1	pK_2	No	Name	T, °C	pK_1	pK_2
1	2,4,6-Trinitroaniline	25	−9 41		59	2-Amino-6-nitronaphthalene	25	2 62	
2	2,4-Dinitroaniline	25	−4 53		60	N,N-Dimethyl-3-nitroaniline	25	2 63	
3	2,6-Dinitro-4-methylaniline	25	−3 96		61	2-Chloroaniline	25	2 65	
4	2,4-Dichloro-6-nitroaniline	25	−3 61		62	2-Amino-4-cyanonaphthalene	25	2 66	
5	2,6-Dichloro-4-nitroaniline	20	−2 55		63	1-Amino-3-bromonaphthalene	25	2 67	
6	N-Cyanodiethylamine	25	−2 0		64	3-Bromoquinoline	25	2 69	
7	1-Amino-2-nitronaphthalene	25	−1 74		65	1-Amino-3-chloronaphthalene	25	2 69	
8	4-Chloro-2-nitroaniline	25	−1 02		66	5-Nitroquinoline	20	2 69	
9	Dicyanomethyl ethyl amine	25	−0 6		67	6-Nitroquinoline	20	2 72	
10	2-Fluoropyridine	25	−0 44		68	1-Amino-5-nitronaphthalene	25	2 73	
11	Pyrrole	25	−0 27		69	2-Amino-8-nitronaphthalene	25	2 73	
			(−3 8)		70	3-Cyanoaniline	25	2 748	
12	2-Nitroaniline	25	−0 26		71	1-Amino-8-nitronaphthalene	23	2 79	
13	Bis (cyanomethyl) amine	25	0 2		72	1-Amino-3-iodonaphthalene	25	2 82	
14	2-Chloropyridine	25	0 49,		73	3-Bromopyridine	25	2 84	
			(0 72)		74	3-Chloropyridine	25	2 84	
15	1-Amino-4-nitronaphthalene	20	0 54		75	1-Amino-6-nitronaphthalene	25	2 89	
16	Quinoxaline	20	0 56		76	4-Methyl-3-nitroaniline	25	2 96	
17	N,N-Dimethyl-4-nitroaniline	25	0 607		77	3-Cyano-N,N-dimethylaniline	25	2 969	
18	Pyrazine	27	0 65	−5 78	78	3-Fluoropyridine	25	2 97	
19	Diphenylamine	25	0 79		79	2-Amino-5-nitronaphthalene	25	3 01	
20	3-Nitropyridine	25	0 81		80	2-Methoxypyridine	25	3 06	
21	2-Bromopyridine	25	0 90		81	2-Amino-7-nitronaphthalene	25	3 10	
22	2-Cyanoaniline	25	0 95		82	1,3-Dimethylpyrazole	25	3 11	
23	2,6-Dimethyl-4-nitroaniline	22	0 98		83	2-Methoxyquinoline	20	3 16	
24	4-Nitroaniline	25	1 00		84	3-Acetylpyridine	25	3 18	
25	N-Chlorodiethylamine	25	1 02		85	4-Hydroxypyridine	20	3 20	11 12
26	2-Methyl-4-nitroaniline	24 5	1 04		86	2-Fluoroaniline	25	3 20	
27	2-Bromoquinoline	25	1 05		87	1-Amino-4-bromonaphthalene	25	3 21	
28	Tris (2-cyanoethyl) amine	25	1 1		88	3-Iodopyridine	25	3 25	
29	Pyrimidine	20	1 23		89	1-Amino-3-methoxynaphthalene	25	3 26	
			(1 31)		90	1-Amino-3-hydroxynaphthalene	25	3 30	
30	2-Amino-3-nitronaphthalene	25	1 48		91	1-Amino-5-chloronaphthalene	25	3 34	
31	3-Methyl-4-nitroaniline	25	1 50		92	2-Amino-4-chloronaphthalene	25	3 38	
32	2,5-Dichloroaniline	22	1 57		93	4-Aminofluorene	25	3 39	
33	4-Cyanoaniline	25	1 74		94	2-Amino-4-bromonaphthalene	25	3 40	
34	4-Cyano-N,N-dimethyl aniline	25	1 78		95	2-Amino-4-iodonaphthalene	25	3 41	
35	2-Iodopyridine	25	1 82		96	1-Amino-7-chloronaphthalene	25	3 48	
36	2,3-Dimethyl-4-nitroaniline	25	1 96		97	1-Amino-6-chloronaphthalene	25	3 48	
37	2,4-Dichloroaniline	25	2 00		98	Quinazoline	20	3 49	
38	1-Amino-3-nitronaphthalene	25	2 07		99	3-Chloroaniline	25	3 52	
39	3-Methoxy-5-nitroaniline	25	2 11		100	4-Bromo-2,6-dimethylaniline	25	3 54	
40	4-Aminobenzophenone (4-Benzoylaniline)	25	2 17		101	3-Methylpyrazole	25	3 56	
41	4-Aminoacetophenone (4-Acetylaniline)	25	2 19		102	3-Aminoacetophenone (3-Acetylaniline)	25	3 56	
			(2 75)		103	3-Fluoroaniline	25	3 57	
42	2-Aminoacetophenone (2-Acetylaniline)	25	2 22		104	4-Bromo-2-methylaniline	25	3 58	
43	Pyridazine	20	2 24		105	3-Bromoaniline	25	3 58	
44	1-Amino-3-cyanonaphthalene	25	2 26		106	2-(Methylthio)pyridine	20	3 59	
45	Cinnoline	20	2 27		107	3-Iodoaniline	25	3 61	
46	1,2,4-Triazole	25	2 30		108	5-Bromoquinoline	25	3 62	
47	2,4-Dibromoaniline	15	2 3		109	1-(Methylamino)naphthalene	27	3 67	
48	2,6-Dibromoaniline	25	2 34		110	2-Amino-7-chloronaphthalene	23	3 71	
49	7-Nitroquinoline	20	2 40		111	4-Bromopyridine	20	3 78	
50	2-Amino-4-nitronaphthalene	25	2 43		112	4-Iodoaniline	25	3 78	
51	Thiazole	20	2 44		113	2-Aminobiphenyl	22	3 82	
52	3-Nitroaniline	25	2 466		114	3,5-Dimethoxyaniline	25	3 82	
53	Pyrazole	25	2 48		115	4-Chloropyridine	20	3 84	
54	2-Bromoaniline	25	2 53		116	4-Bromoaniline	25	3 86	
55	1-Amino-7-nitronaphthalene	25	2 55		117	1-Aminofluorene	25	3 87	
56	8-Nitroquinoline	20	2 55		118	1-Amino-6-methoxynaphthalene	25	3 90	
57	3,5-Dimethyl-4-nitroaniline	25	2 59		119	1-Aminonaphthalene	25	3 92	
58	2-Iodoaniline	25	2 60		120	2,6-Dimethylaniline	25	3 95	

TABLE XXIX. DISSOCIATION CONSTANTS OF ORGANIC BASES IN AQUEOUS SOLUTION

(Listed in order of increasing pKa) (Continued)

(The data relates to the acid dissociation constant (Ka) of the conjugate acid (BH^+) of the listed base (B))

No	Name	T,°C	pK_1	pK_2	No	Name	T °C	pK_1	pK_2
121	8-Aminoquinoline	20	3 95		183	8-Methylquinoline	25	4 91	
122	1-Amino-5-hydroxynaphthalene	25	3 96		184	3,5-Dimethylaniline	25	4 91	
123	1-Amino-3-methylnaphthalene	25	3 96		185	3-Aminoquinoline	20	4 91	
124	1-Amino-6-hydroxynaphthalene	25	3 97		186	3-Methoxypyridine	25	4 91	
125	4-Chloroaniline	25	4 00		187	4-*tert*-Butylaniline	25	4 95	
126	3-(Methylthio)aniline	25	4 00		188	3,5-Di-*tert*-butylaniline	25	4 97	
127	4-Iodopyridine	20	4 02		189	2-Vinylpyridine	25	4 98	
128	2-Amino-4-methoxynaphthalene	25	4 05		190	1,3-Diaminobenzene (*m*-Phenylenediamine)	25	4 98	2 41
129	2-Amino-5-hydroxynaphthalene	25	4 07						
130	1-Amino-7-methoxynaphthalene	25	4 07		191	N,3-Dimethylaniline	21	5 00	
131	3-Bromo-4-methoxyaniline	23	4 08		192	2-*tert*-Butylaniline	25	5 03	
132	1-Aminoanthracene	25	4 1		193	6-Methoxyquinoline	20	5 03	
133	2-Aminonaphthalene	25	4 16		194	N,N-Dimethylaniline	25	5 068	
134	N-Allylaniline	25	4 17		195	4-Methylaniline	25	5 08	
135	3-Ethoxyaniline	25	4 17		196	3-Hydroxypyridine	25	5 10	8 60
136	1-(Ethylamino)naphthalene	25	4 18		197	N-Ethylaniline	24	5 12	
137	2-Amino-7-methoxynaphthalene	25	4 19		198	N-*n*-Butylaniline	25	5 12	
138	1-Amino-7-hydroxynaphthalene	25	4 20		199	3,5,6-Trimethylaniline	20 5	5 12	
139	3-Methoxyaniline	25	4 20		200	2-Benzylpyridine	25	5 13	
140	4-Aminobiphenyl	29	4 22		201	6-Methylquinoline	25	5 15	
141	4-Bromo-N,N-dimethylaniline	25	4 232		202	2-Amino-5,6,7,8-tetrahydronaphthalene	17	5 17	
142	3-Aminobiphenyl	17	4 25		203	3,4-Dimethylaniline	25	5 17	
143	2-Amino-7-hydroxynaphthalene	25	4 25		204	4-Ethoxyaniline	28	5 20	
144	2,3,5,6-Tetramethylaniline	25	4 30		205	4-Methylquinoline	25	5 20, (5 59)	
145	2-Bromo-N,N-dimethylaniline	25	4 31						
146	4-(Methylthio)aniline	25	4 35		206	Pyridine	25	5 25	
147	2-*n*-Propylaniline	25	4 36		207	Bis(2-cyanoethyl)amine	25	5 26	
148	Tris(2-chloroethyl)amine	25	4 37		208	7-Methylquinoline	25	5 29	
149	2-Ethylaniline	25	4 37		209	N-Cyclopentylaniline	25	5 30	
150	2,4,6-Trimethylaniline	25	4 37		210	5-Aminoindane	16	5 31	
151	3,5-Dimethylpyrazole	25	4 38		211	4-Methoxyaniline	25	5 31	
152	3-(Methylthio)pyridine	20	4 42		212	Aminoacetonitrile	25	5 34	
153	2-Isopropylaniline	25	4 42		213	N,N,3-Trimethylaniline	25	5 344	
154	N-Isobutylaniline	25	4 43		214	N,4-Dimethylaniline	23	5 36	
155	2-Ethoxyaniline	28	4 43		215	Isoquinoline	20	5 42	
156	2-Methylaniline	25	4 44		216	N-*n*-Hexylaniline	19	5 42	
157	1-Amino-5,6,7,8-tetrahydronaphthalene	16	4 47		217	5-Aminoquinoline	20	5 42	
158	Phenanthridine	20	4 48		218	2,2,2-Trichloroethylamine	20	5 47	
159	2-Methoxyaniline	25	4 52		219	Benzimidazole	25	5 53	
160	2,5-Dimethylaniline	25	4 53		220	1-Methylbenzimidazole	25	5 54	
161	1-(Cyanomethyl)pyridine	25	4 55		221	3-Ethylpyridine	25	5 56	
162	(Cyanomethyl) diethyl amine	25	4 55		222	1-Ethylbenzimidazole	25	5 59	
163	Bis(2-Cyanoethyl) ethyl amine	25	4 55		223	6-Aminoquinoline	20	5 59	
164	2-(Dimethylamino)naphthalene	25	4 566		224	N-Cyclohexylaniline	25	5 60	
165	Aniline	25	4 603		225	4-Vinylpyridine	25	5 62	
166	5-Methylquinoline	25	4 62		226	N,N,4-Trimethylaniline	25	5 627	
167	N,2-Dimethylaniline	23	4 62		227	3-Methylpyridine	25	5 63	
168	2-Aminofluorene	25	4 64		228	4-Methylbenzimidazole	25	5 65	
169	2-Amino-6-methoxynaphthalene	25	4 64		229	N,N-Di-*n*-propylaniline	23	5 68	
170	4-Fluoroaniline	25	4 65		230	2-Methylquinoline	25	5 69	
171	3-*tert*-Butylaniline	25	4 66		231	1-Isopropylbenzimidazole	25	5 71	
172	3-Isopropylaniline	25	4 67		232	3-Isopropylpyridine	25	5 72	
173	2,3-Dimethylaniline	25	4 70		233	2-*tert*-Butylpyridine	25	5 76	
174	3-Methylaniline	25	4 70		234	N-Isopropylaniline	25	5 77	
175	3-Ethylaniline	25	4 70		235	5-Methylbenzimidazole	25	5 78	
176	1,2-Diaminobenzene (*o*-Phenylenediamine)	25	4 74	0 6	236	3-*tert*-Butylpyridine	25	5 82	
177	N-*n*-Propylaniline	25	4 79		237	2-Isopropylpyridine	25	5 83	
178	Quinoline	25	4 81		238	4-Ethylpyridine	25	5 87	
179	3-Aminofluorene	25	4 82		239	2-Ethylpyridine	25	5 89	
180	1-(Dimethylamino)naphthalene	28	4 83		240	2-Methylpyridine	25	5 94	
181	N-Methylaniline	25	4 848		241	4-(Methylthio)pyridine	20	5 94	
182	2,4-Dimethylaniline	25	4 89		242	2-Hexylpyridine	25	5 95	

TABLE XXIX. DISSOCIATION CONSTANTS OF ORGANIC BASES IN AQUEOUS SOLUTION

(Listed in order of increasing pKa) (Continued)

(The data relates to the acid dissociation constant (Ka) of the conjugate acid (BH^+) of the listed base (B))

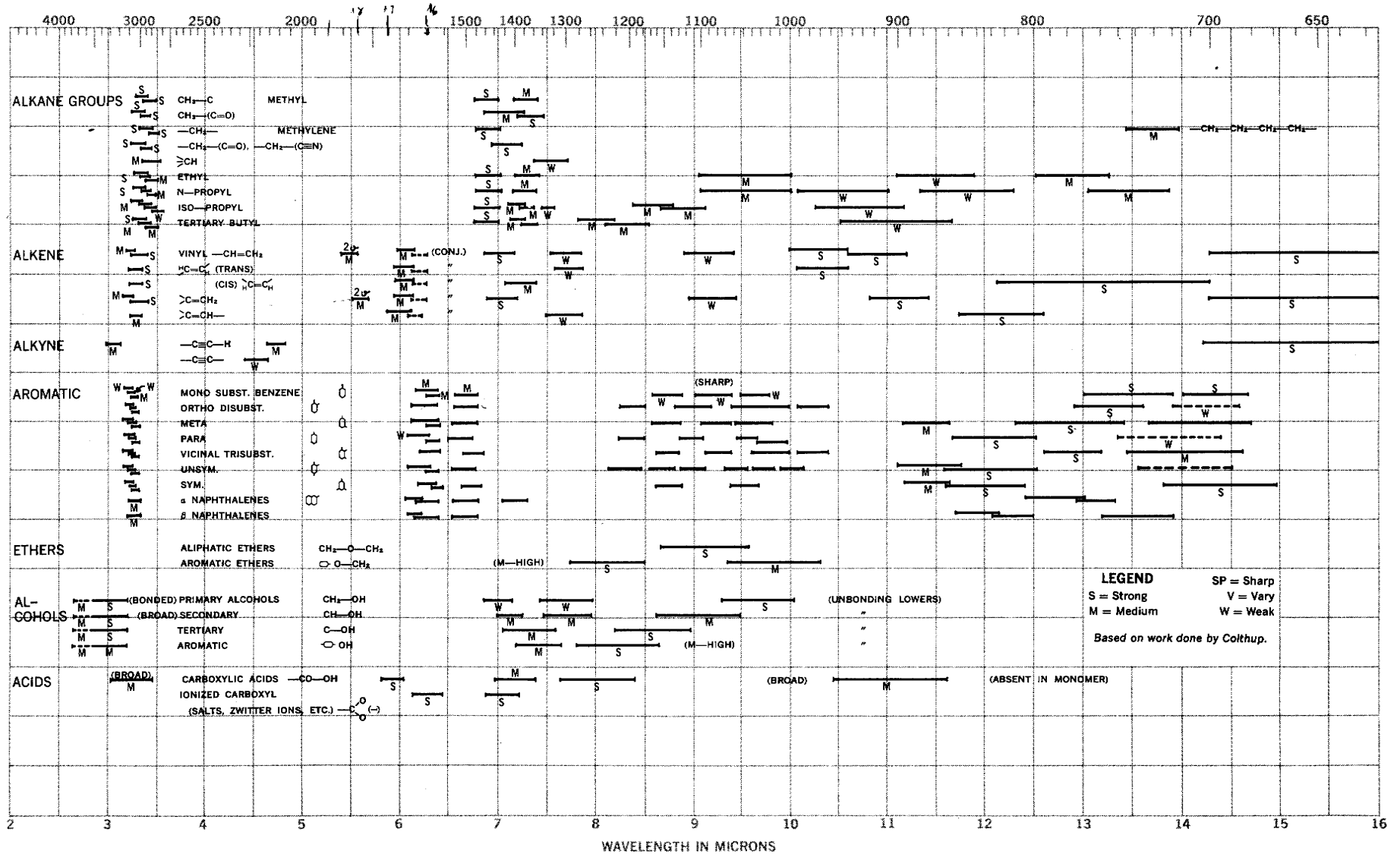
No	Name	T °C	pK_1	pK_2	No	Name	T °C	pK_1	pK_2
243	2-*n*-Propylpyridine	25	5 97		305	Bis(2-hydroxyethyl)amine	25	8 88	
244	4-*tert*-Butylpyridine	25	5 99		306	N,N-Dimethylbenzylamine	25	8 91	
245	2-Pentylpyridine	25	6 00		307	3-Bromopropylamine	21	8 93	
246	4-Isopropylpyridine	25	6 02		308	1,2-Bis(dimethylamino)ethane	30	8 97	5 85
247	4-Methylpyridine	25	6 03		309	1-(Aminoethyl)benzene	25	9 08	
248	3-Aminopyridine	25	6 03		310	2-Acetoxyethylamine	25	9 1	
249	N,N,2-Trimethylaniline	25	6 11		311	4-Aminopyridine	25	9 114	
250	N,2,6-Trimethylaniline	25	6 12		312	4-Aminoquinoline	20	9 13	
					313	(3-Cyanopropyl) diethyl amine	25	9 13	
252	2-Methylbenzimidazole	25	6 19		314	3-Methoxybenzylamine	25	9 15	
253	1,4-Diaminobenzene (*p*-Phenylenediamine)	25	6 2	2 67	315	2-Methylbenzylamine	25	9 19	
254	2-Isopropylbenzimidazole	25	6 21		316	1-Aminoindane	22 5	9 21	
255	2-Ethylbenzimidazole	25	6 27		317	*trans*-1-Amino-2-hydroxycyclopentane	25	9 28	
256	N,N-Di-*n*-butylaniline	19	6 30		318	Diallylamine	25	9 29	
257	2,5-Dimethylpyridine	25	6 40		319	Dimethyl (2-hydroxyethyl) amine	20	9 31	
258	2-Phenylimidazole	25	6 40		320	3-Methylbenzylamine	25	9 33	
259	Bis(2-chloroethyl)methyl amine	25	6 43		321	Benzylamine	25	9 35, (9 62)	
260	4-Methoxyquinoline	30	6 45						
261	3,4-Dimethylpyridine	25	6 46		322	4-Methylbenzylamine	25	9 36	
262	4-Methoxypyridine	25	6 47		323	3,4-Dimethoxybenzylamine	25	9 39	
263	Bis(2-chloroethyl) ethyl amine	25	6 55		324	2,3-Dimethoxybenzylamine	25	9 41	
264	1,2-Dimethylbenzimidazole	25	6 55		325	2-(Phenethylamino)ethylamine	25	9 44	6 59
265	2,3-Dimethylpyridine	25	6 57		326	N,N-Diethylbenzylamine	25	9 44	
266	2,6-Dimethylpyridine	25	6 60		327	4-Methoxybenzylamine	25	9 47	
267	7-Aminoquinoline	20	6 61		328	2-(Methylthio)ethylamine	20	9 49	
268	N,N-Diethylaniline	22	6 61		329	2-Hydroxyethylamine	25	9 498	
269	4-Ethoxypyridine	20	6 67		330	2-(Dimethylamino)ethylamine	25	9 53	6 63
270	2-Aminopyridine	25	6 71		331	N-Methylbenzylamine	25	9 54	
271	2,4-Dimethylpyridine	25	6 77		332	1,2-Bis(diethylamino)ethane	25	9 55	6 18
272	Imidazole	25	6 95		333	2-Aminoindane	21 5	9 57	
273	N-*tert*-Butylaniline	25	7 00		334	N-Propylbenzylamine	25	9 58	
274	(2-Cyanoethyl) dimethyl amine	29	7 0		335	1,2,3-Triaminopropane	20	9 59	7 95, pK_3 = 3 72
275	2-Benzyl-2-pyrroline	25	7 06						
276	2-Aminoquinoline	20	7 30						
277	N,N-Di-isopropylaniline	25	7 37		336	2-Methoxyethylamine	20	9 61	
278	N-Methylmorpholine	25	7 38		337	5-Bromo-*n*-pentylamine	21	9 62	
279	2,4,6-Trimethylpyridine	25	7 43		338	*trans*-1-Amino-2-hydroxycyclohexane	25	9 63	
280	4-Methylimidazole	25	7 518		339	1-Amino-1,2,3,4-tetrahydronaphthalene	20	9 63	
281	1,3-Triazine	25	7 6		340	N-Ethylbenzylamine	25	9 64	
282	N-Ethylmorpholine	25	7 67		341	3,3,3-Trichloro-*n*-propylamine	20	9 65	
283	2-Cyanoethylamine	29	7 7		342	1-Allylpiperidine	25	9 65	
284	Tris(2-hydroxyethyl)amine	25	7 762		343	2-Methoxybenzylamine	25	9 70	
285	2-Methylimidazole	25	7 85		344	*cis*-1-Amino-2-hydroxycyclopentane	25	9 70	
286	N-Methylaziridine	25	7 86		345	2-(Furfurylamino)ethylamine	20	9 72	6 20
287	N-*n*-Butylaziridine	25	7 86		346	*cis*-1-Amino-2-hydroxycyclohexane	25	9 72	
288	2-Ethyl-2-pyrroline	25	7 87		347	Piperazine	25	9 81	5 55
289	2,3,5,6-Tetramethylpyridine	20	7 90		348	Trimethylamine	25	9 81	
290	2-Cyclohexyl-2-pyrroline	25	7 91		349	Phenethylamine ((2-Aminoethyl)benzene)	25	9 84	
291	N-Ethylaziridine	24	7 93		350	Diethyl 2-hydroxyethyl amine	20	9 87	
292	Aziridine	25	8 01		351	1-Methyl-3-pyrroline	25	9 88	
293	N,2-Diethylaziridine	25	8 18		352	1,2-Diaminoethane (1,2-Ethylenediamine)	25	9 928	6 848
294	2-Ethylaziridine	25	8 29		353	*cis*-1,2-Diaminocyclohexane	20	9 93	6 13
295	Triallylamine	25	8 31		354	2-Amino-1,2,3,4-tetrahydronaphthalene	17	9 93	
296	Morpholine	25	8 33		355	Tri-*n*-butylamine	25	9 93	
297	2,4-Dimethylimidazole	25	8 36		356	4,4,4-Trichloro-*n*-butylamine	20	9 93	
298	2-Bromoethylamine	24	8 49		357	*trans*-1,2-Diaminocyclohexane	20	9 94	6 47
299	Bis(2-hydroxyethyl) methyl amine	25	8 52		358	3-Hydroxypropylamine	25	9 96	
300	1,2-Bis(furfurylamino)ethane	20	8 61	5 74	359	*meso*-2,3-Diaminobutane	25	9 97	6 92
301	2,2-Dimethylaziridine	25	8 64		360	*d,l*-2,3-Diaminobutane	25	10 00	6 91
302	*trans*-2,3-Dimethylaziridine	24	8 69		361	1,2-Diaminopropane (1,2-Propylenediamine)	25	10 00	7 13
303	*cis*-2,3-Dimethylaziridine	23	8 72						
304	(2-Chloroethyl) diethyl amine	25	8 80		362	*cis*-Neobornylamine	25	10 01	

TABLE XXIX. DISSOCIATION CONSTANTS OF ORGANIC BASES IN AQUEOUS SOLUTION

(Listed in order of increasing pKa) (Continued)

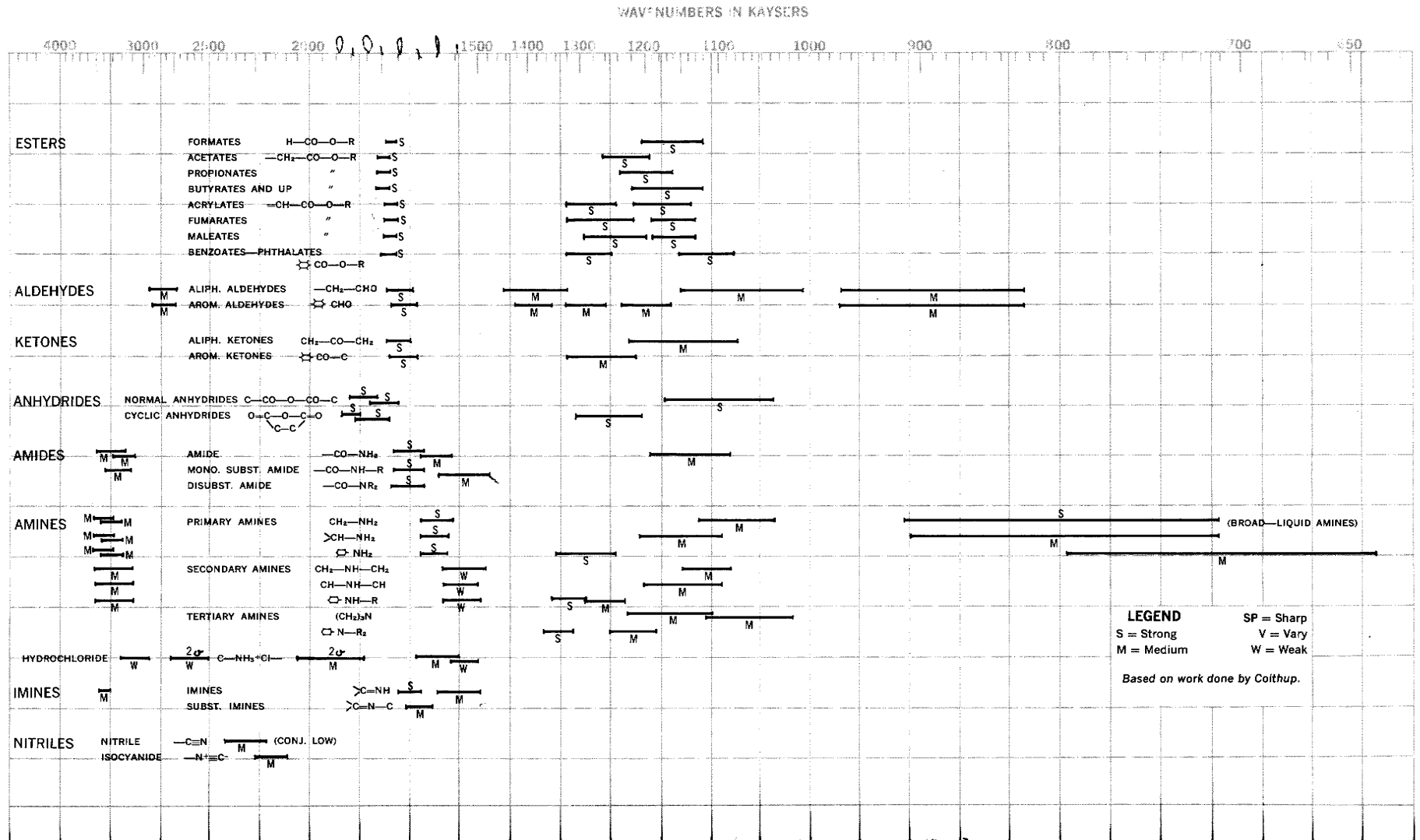
(The data relates to the acid dissociation constant (Ka) of the conjugate acid (BH^+) of the listed base (B))

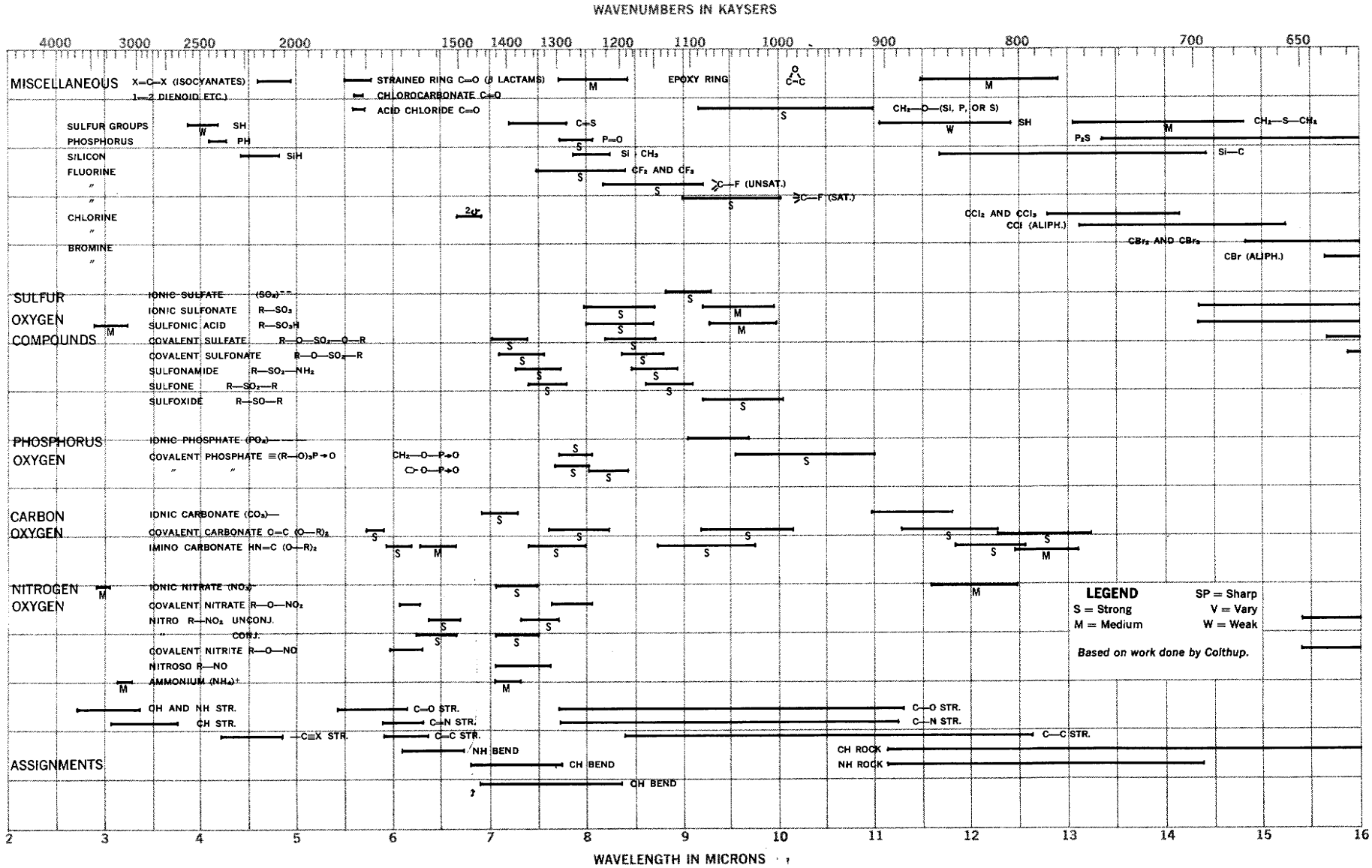
No	Name	T °C	pK_1	pK_2	No	Name	T,°C	pK_1	pK_2
363	2-(Diethylamino)ethylamine	25	10 02	7 07	417	*n*-Pentylamine	25	10 63	
364	1-Methylpiperidine	25	10 08		418	*n*-Undecylamine (*n*-Hendecylamine)	25	10 63	
365	Dimethyl isobutyl amine	20	10 08		419	*n*-Nonylamine	25	10 64	
366	5,5,5-Trichloro-*n*-pentylamine	20	10 12		420	Acridine	25	10 65	
367	2-(Methylamino)ethylamine	20	10 15	6 86	421	*n*-Octylamine	25	10 65	
368	*cis*-1,2,6-Trimethylpiperidine	30	10 15		422	Methylamine	25	10 657	
369	2,2-Dimethyl-*n*-propylamine	25	10 15		423	1-Ethyl-2-methylpiperidine	25	10 66	
370	1,2-Bis(methylamino)ethane	25	10 16	7 40	424	*n*-Heptylamine	25	10 66	
371	Dimethyl propyl amine	20	10 16		425	2-Aminoheptane	25	10 67	
372	Dimethyl ethyl amine	20	10 16		426	Cyclohexylamine	25	10 68	
373	*trans*-Bornylamine	25	10 17		427	*tert*-Butylamine	25	10 68	
374	1,2,2,4-Tetramethylpiperidine	30	10 18		428	*tert*-Butyl dimethyl amine	20	10 69	
375	*n*-Butyl dimethyl amine	25	10 19		429	*n*-Propylamine	25	10 69	
376	1,2-Dimethylpyrrolidine	26	10 20		430	1,2,2,6-Tetramethylpiperidine	30	10 70	
377	1,2-Dimethylpiperidine	25	10 22		431	Ethylamine	25	10 70	
378	1,5-Diaminopentane	25	10 25	9 13	432	Isobutylamine	25	10 72	
379	Tri-*n*-propylamine	25	10 26		433	3-(Trimethylsilyl)-*n*-propylamine	25	10 73	
380	1,2-Bis(propylamino)ethane	25	10 27	7 53	434	Dimethylamine	25	10 73	
381	2-(Butylamino)ethylamine	25	10 30	7 53	435	Triethylamine	25	10 75	
382	1,3-Diaminopropane (1,3-Propylenediamine)	25	10 30	8 29	436	2-Cyclohexylpyrrolidine	25	10 76	
					437	1,4-Diaminobutane	20	10 80	9 35
383	2-Benzylpyrrolidine	25	10 31		438	Di-isobutylamine	21	10 91	
384	Tri-isobutylamine	25	10 32		439	1,6-Diaminohexane	25	10 93	9 83
385	N-Methylpyrrolidine	25	10 32		440	Di-isoamylamine	27 8	10 94	
386	2-(propylamino)ethylamine	25	10 34	7 54	441	Quinuclidine	25	10 95	
387	4-Hydroxy-*n*-butylamine	20	10 35		442	2-Methylpiperidine	25	10 95	
388	1,2-Bis(isopropylamino)ethane	25	10 40	7 59	443	2-(Trimethylsilyl)ethylamine	25	10 97	
389	1-*n*-Propylpiperidine	26 5	10 41		444	Di-*n*-tridecylamine	25	11 00	
390	3-Aminopentane	25	10 42		445	Di-*n*-octadecylamine	25	11 00	
391	3-Aminocyclohexene	25	10 42		446	1,8-Diaminooctane	20	11 00	10 1
392	1-*n*-Butylpiperidine	26	10 43		447	Di-*n*-propylamine	25	11 00	
393	1-Ethylpiperidine	23	10 45		448	Di-*n*-dodecylamine	25	11 00	
394	1,2-Bis(ethylamino)ethane	25	10 46	7 70	449	Di-*n*-pentadecylamine	25	11 00	
395	Diethyl methyl amine	20	10 46		450	Di-*n*-hexylamine	25	11 01	
396	5-Hydroxy-1-pentylamine	23	10 46		451	Di-*n*-octylamine	25	11 01	
397	Dimethyl isopropyl amine	20	10 47		452	2,2,4-Trimethylpiperidine	30	11 04	
398	*trans*-1-Amino-4-methylcyclohexane	25	10 48		453	Cyclohexyl methyl amine	25	11 04	
399	(Aminomethyl)cyclohexane	25	10 49		454	Diethylamine	25	11 04	
400	*cis*-1-Amino-2-methylcyclohexane	25	10 49		455	2,2,6,6-Tetramethylpiperidine	25	11 07	
401	2-Aminooctane	25	10 49		456	Azepine	25	11 07	
402	*trans*-1-Amino-2-methylcyclohexane	25	10 51		457	*cis*-2,6-Dimethylpiperidine	25	11 07	
403	*cis*-1-Amino-3-methylcyclohexane	25	10 56		458	3-Methylpiperidine	25	11 07	
404	2-(Ethylamino)ethylamine	25	10 56	7 63	459	Piperidine	25	11 123	
405	Dimethyl *sec*-butyl amine	20	10 57		460	Di-isopropylamine	21	11 13	
406	6-Hydroxy-*n*-hexylamine	21	10 60		461	Di-*n*-pentylamine	26	11 16	
407	6-Bromo-*n*-hexylamine	21	10 60		462	2,2,6-Trimethylpiperidine	30	11 21	
408	1-Aminoheptadecane	25	10 60		463	(*tert*-Butylamino)cyclohexane	25	11 23	
409	1-Aminodocosane	25	10 60		464	Di-*n*-butylamine	25	11 25	
410	1-Aminooctadecane	25	10 60		465	1,2,2,4,4-Pentamethylpiperidine	25	11 25	
411	1-Aminopentadecane	25	10 61		466	Pyrrolidine	25	11 27	
412	*n*-Butylamine	25	10 61		467	Azetidine	25	11 29	
413	1-Aminohexadecane	25	10 61		468	Isopropylamine	25	11 54, (10 63)	
414	*trans*-1-Amino-3-methylcyclohexane	25	10 61						
415	1-Aminotetradecane	25	10 62		469	1,2-Dimethyl-2-pyrroline	25	11 90	
416	2-(Isopropylamino)ethylamine	25	10 62	7 70	470	Acetamidine (Methylamidine)	25	12 40	



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INFRARED CORRELATION CHART No. 1 (Con't.)

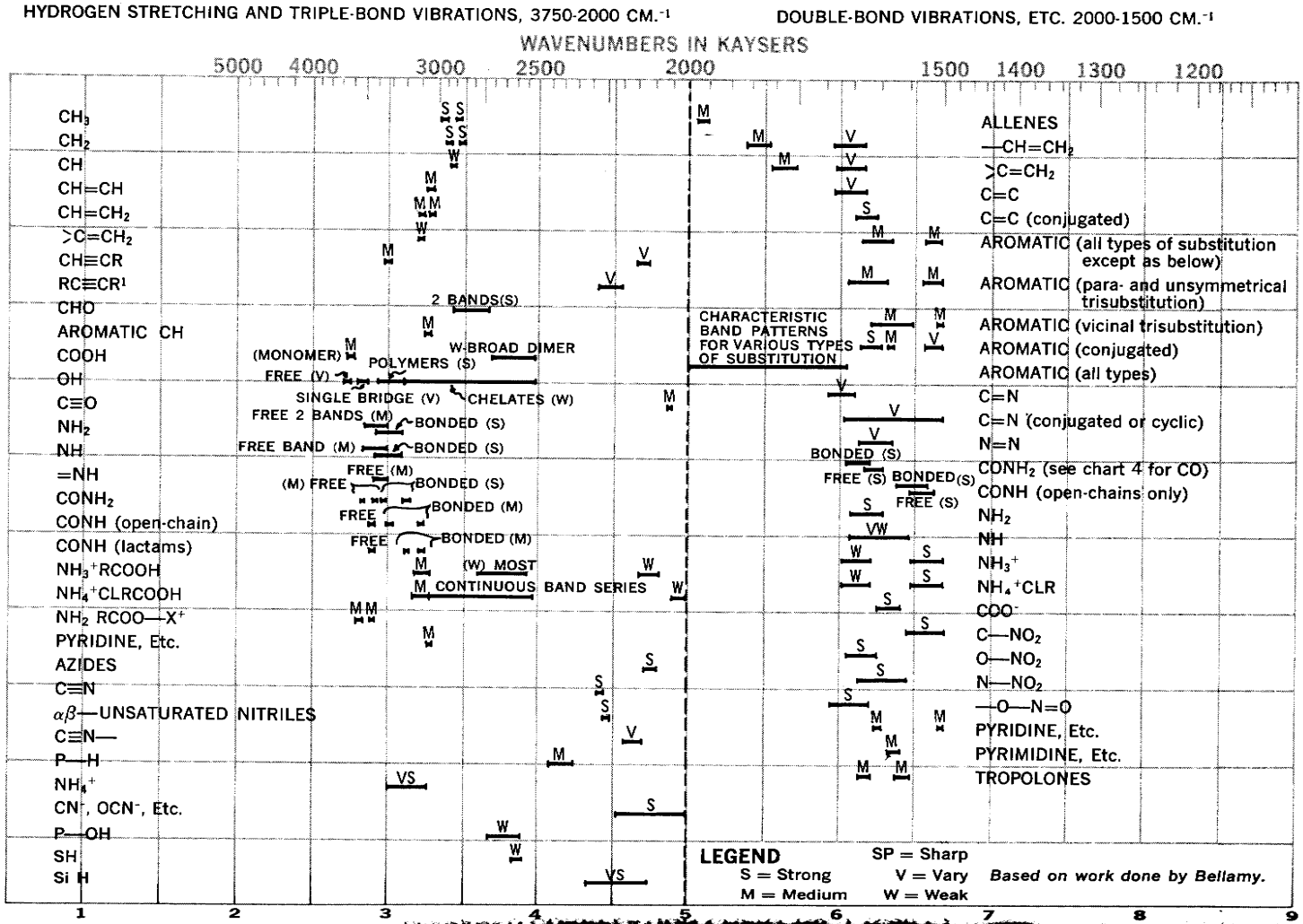



WAVENUMBERS IN KAYSERS
4000
3000
2500
2000
1500
1400
1300
1200
1100
1000
900
800
700
650
MISCELLANEOUS
X=C=X (ISOCYANATES)
1—2 DIENOID ETC.)
STRAINED RING C=O (β LACTAMS)
CHLOROCARBONATE C=O
ACID CHLORIDE C=O
EPOXY RING
SULFUR GROUPS
SH
PHOSPHORUS
PH
SILICON
SiH
FLUORINE
CHLORINE
BROMINE
C=S
P=O
Si—CH3
CF2 AND CF3
C—F (UNSAT.)
C—F (SAT.)
CH2—O—(Si, P, OR S)
SH
CH2—S—CH3
P2S
Si—C
CCl2 AND CCl3
CCl (ALIPH.)
CBr2 AND CBr3
CBr (ALIPH.)
SULFUR
OXYGEN
COMPOUNDS
IONIC SULFATE (SO4)=
IONIC SULFONATE R—SO3
SULFONIC ACID R—SO3H
COVALENT SULFATE R—O—SO2—O—R
COVALENT SULFONATE R—O—SO2—R
SULFONAMIDE R—SO2—NH2
SULFONE R—SO2—R
SULFOXIDE R—SO—R
PHOSPHORUS
OXYGEN
IONIC PHOSPHATE (PO4)≡
COVALENT PHOSPHATE ≡(R—O)3P→O
CH2—O—P→O
C—O—P→O
CARBON
OXYGEN
IONIC CARBONATE (CO3)=
COVALENT CARBONATE O=C (O—R)2
IMINO CARBONATE HN=C (O—R)2
NITROGEN
OXYGEN
IONIC NITRATE (NO3)−
COVALENT NITRATE R—O—NO2
NITRO R—NO2 UNCONJ.
CONJ.
COVALENT NITRITE R—O—NO
NITROSO R—NO
AMMONIUM (NH4)+
LEGEND
S = Strong
M = Medium
SP = Sharp
V = Vary
W = Weak
Based on work done by Colthup.
OH AND NH STR.
CH STR.
C≡X STR.
C=O STR.
C=N STR.
C—C STR.
NH BEND
CH BEND
OH BEND
C—O STR.
C—N STR.
C—C STR.
CH ROCK
NH ROCK
ASSIGNMENTS
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
WAVELENGTH IN MICRONS

INFRARED CORRELATION CHART No. 2

Prepared from information supplied by Beckman Instruments

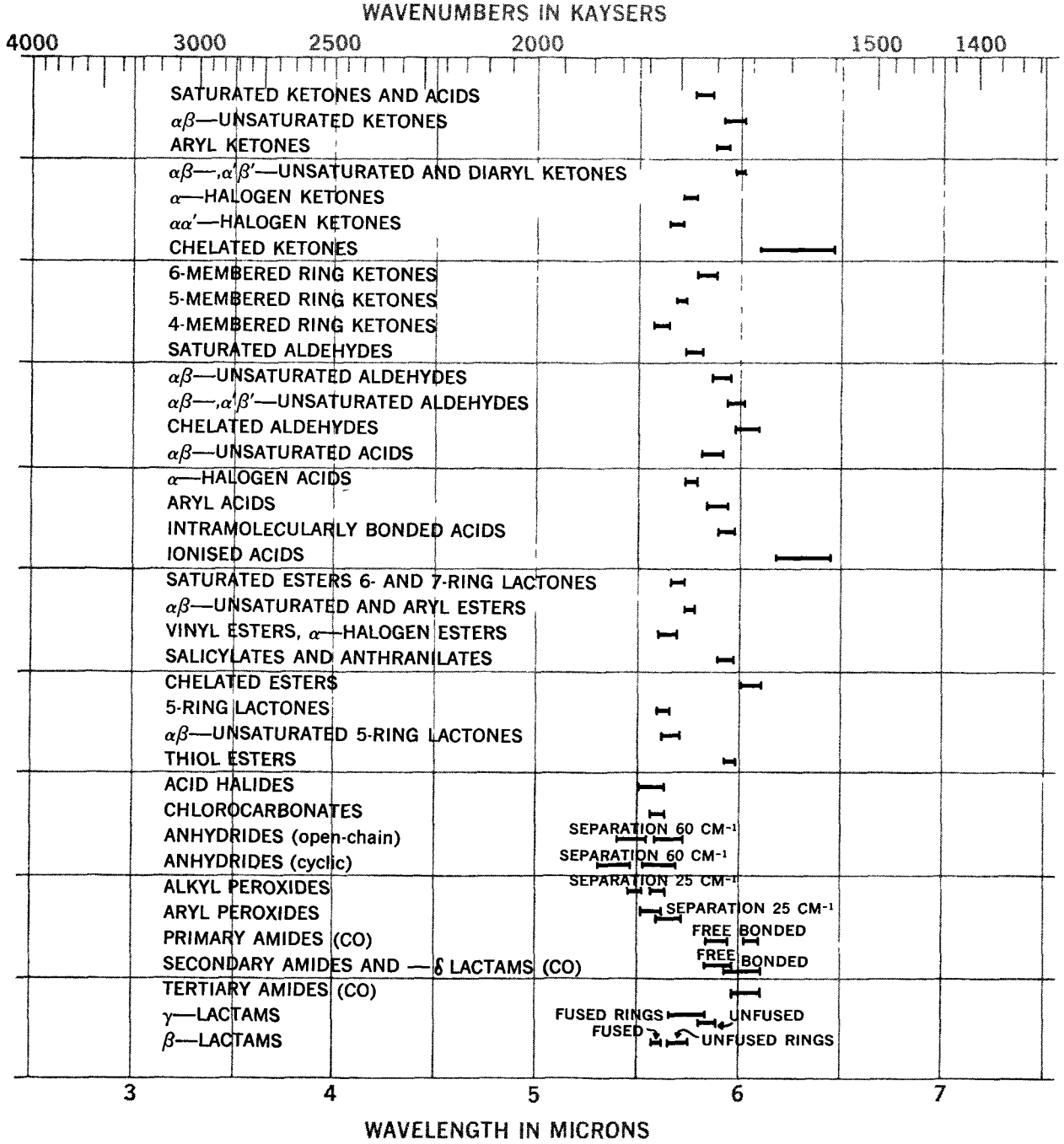
This chart presents some information regarding structure, double-bond vibrations, hydrogen stretching and triple-bond vibrations.



INFRARED CORRELATION CHART No. 3

Prepared from information supplied by Beckman Instruments

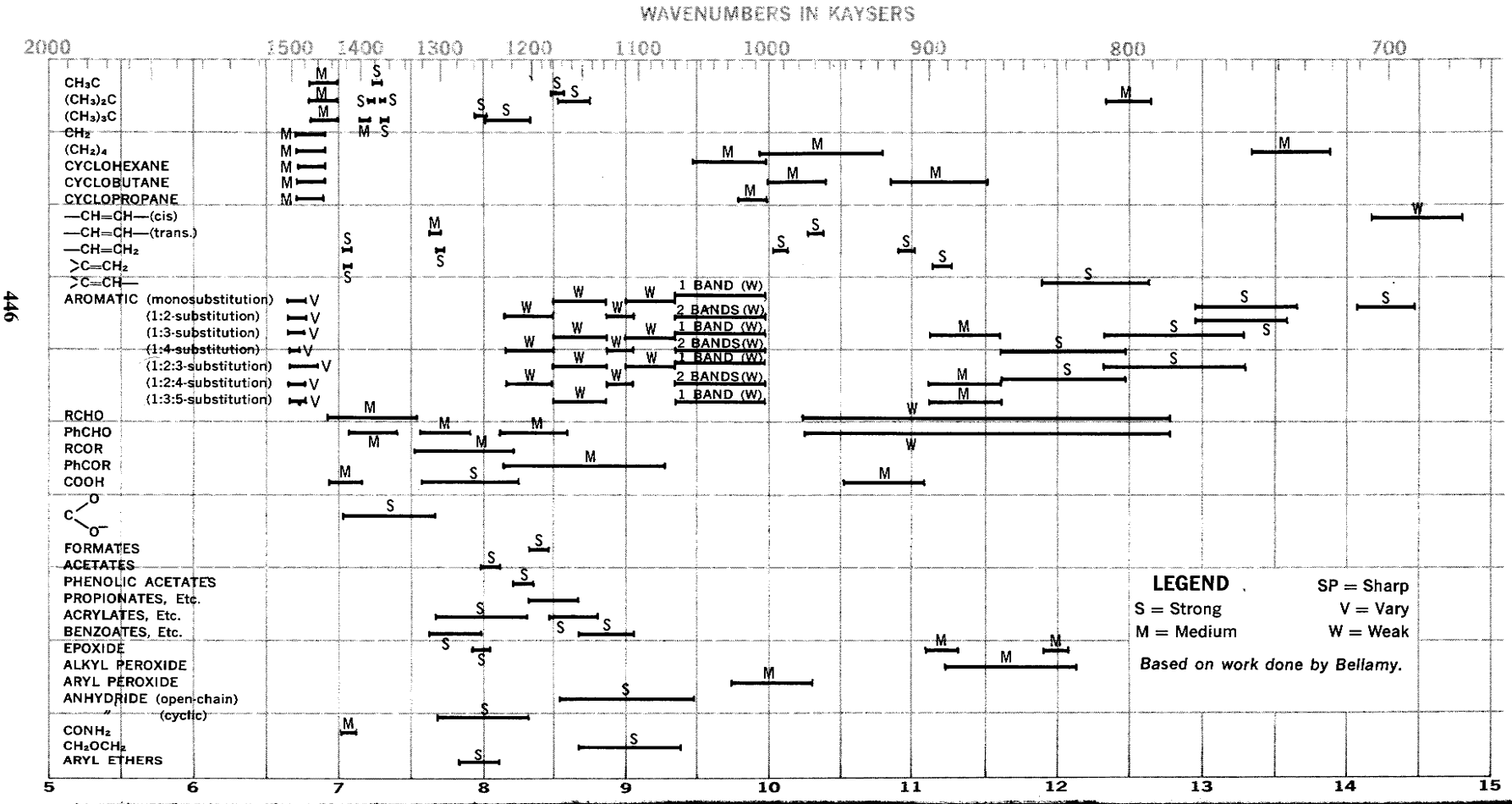
This chart presents some correlations between structure and the carbonyl vibrations of some classes of organic compounds. In all cases the absorption bands are strong and fall within the range of 1900-1500 cm^{-1}.



INFRARED CORRELATION CHART No. 4

Prepared from information supplied by Beckman Instruments

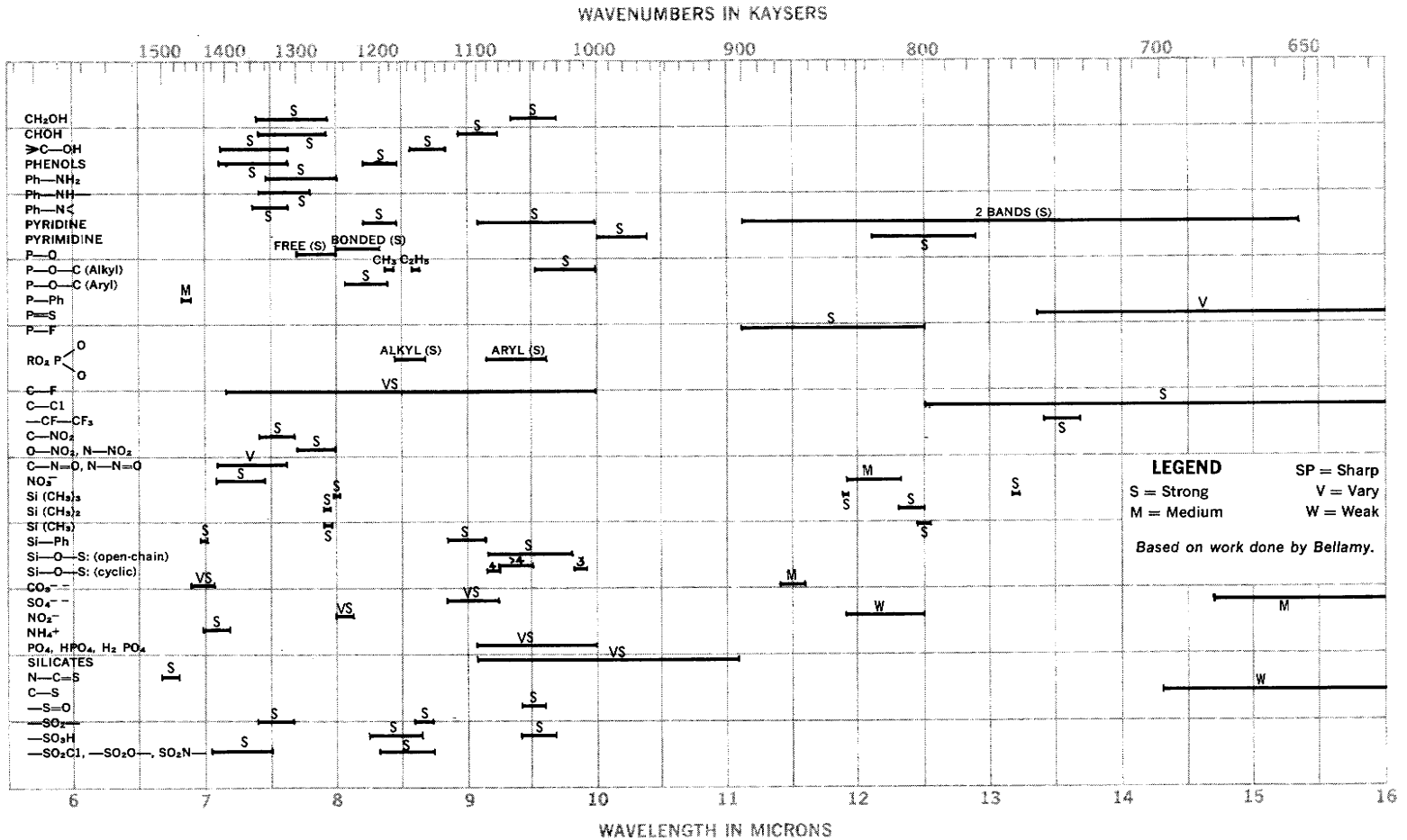
This chart presents some correlations between structure and single-bond vibrations for a number of classes of compounds having absorption between 1500-650 cm^{-1}.



INFRARED CORRELATION CHART No. 4 (Con't.)

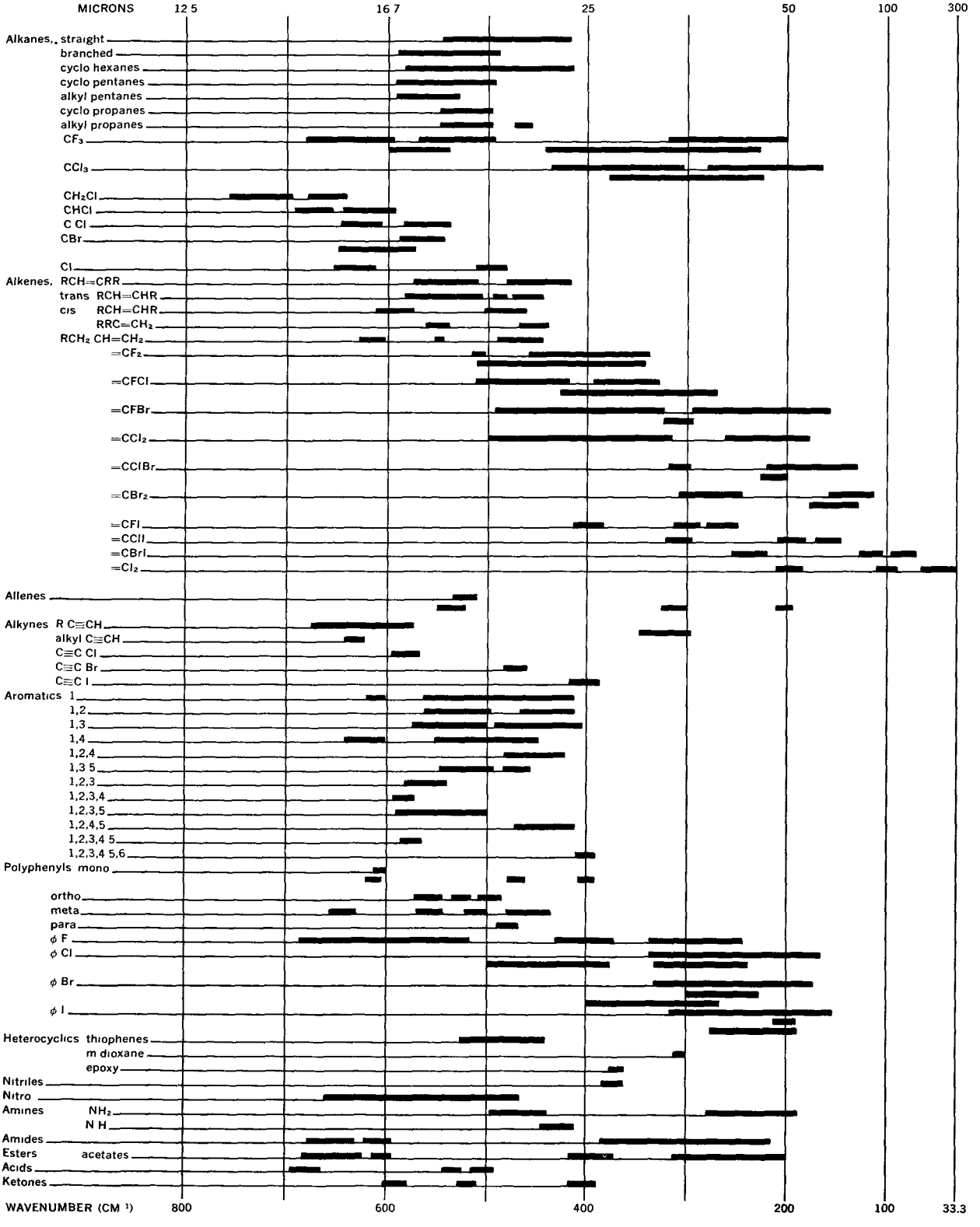
Prepared from information supplied by Beckman Instruments

This chart presents some correlations between structure and single-bond vibrations for a number of classes of compounds having absorption between 1500-650 cm^{-1}.

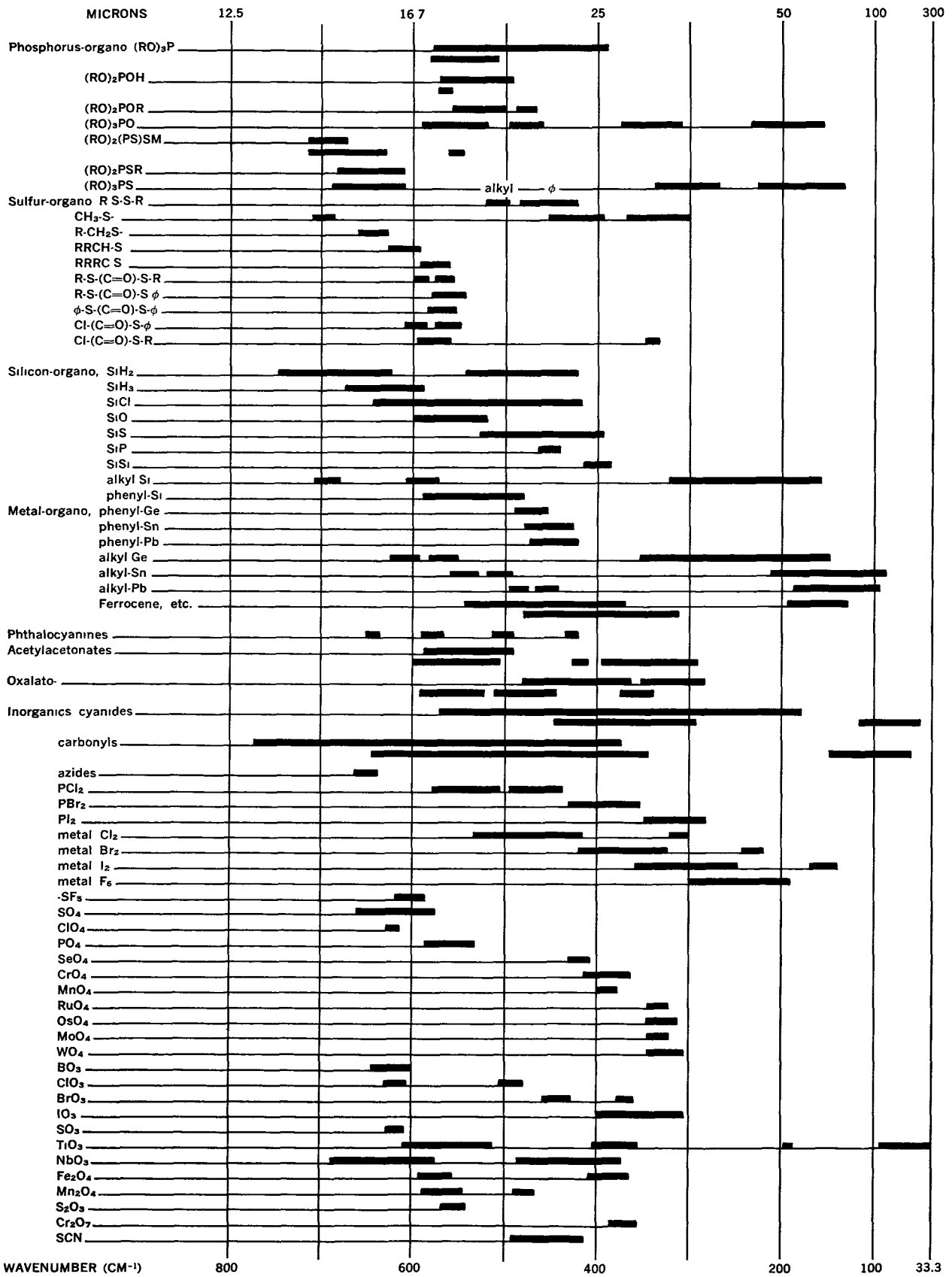


FAR INFRARED VIBRATIONAL FREQUENCY CORRELATION CHART

Based on evidence compiled by James E. Stewart of Beckman Instruments.
This chart shows the vibrational frequency correlation in the far infrared region. Because research is continuing in the far infrared region, this chart is not all-inclusive.



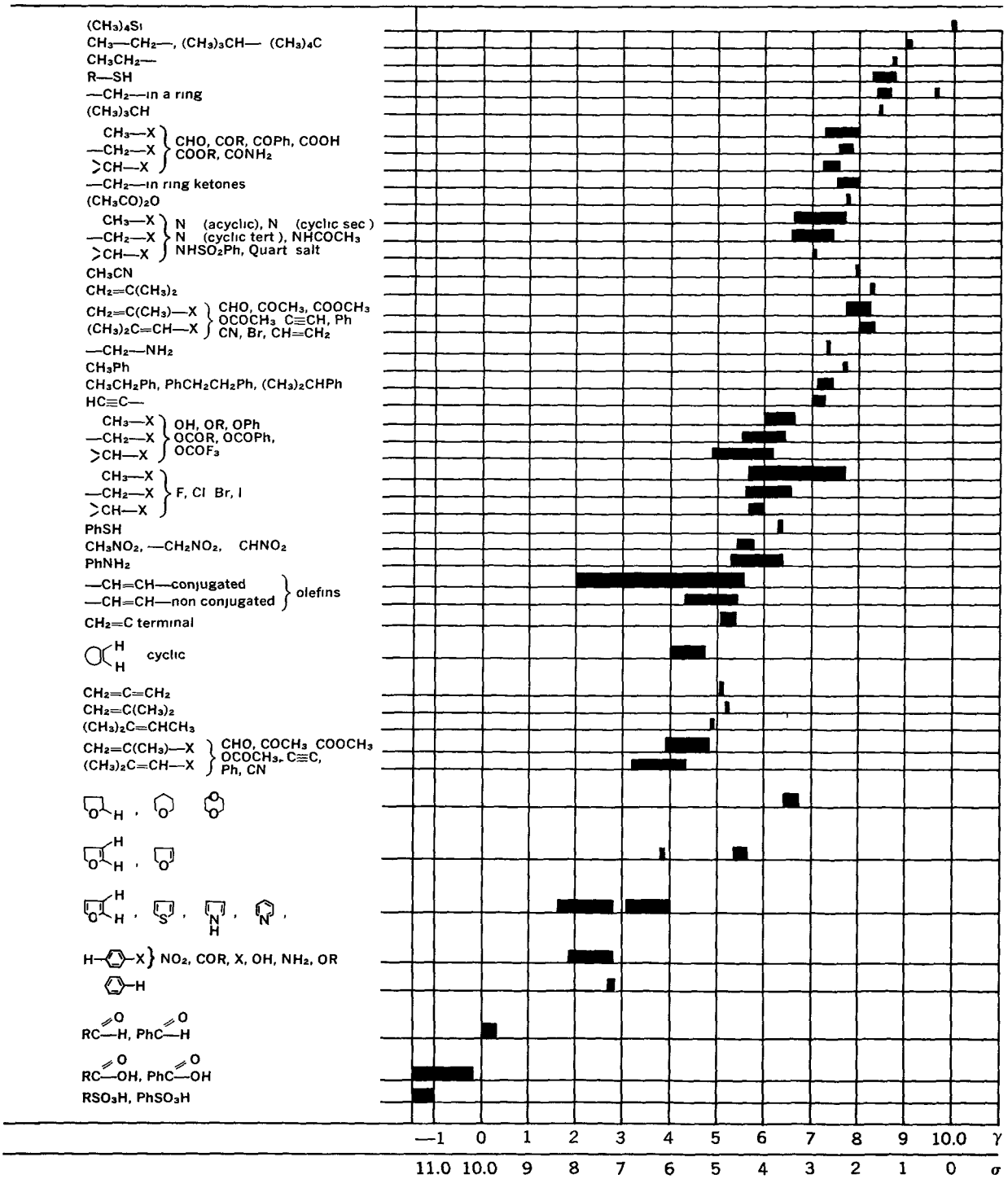
FAR INFRARED VIBRATIONAL FREQUENCY CORRELATION CHART (Con't.)



CHARACTERISTIC NMR SPECTRAL POSITIONS FOR HYDROGEN IN ORGANIC STRUCTURES

By permission from Erno Mohacsi, J. of Chemical Education, 41, 38 (1964)

This table is useful for quick qualitative determination of proton spectrum lines by providing a tabulation of line positions obtained using tetramethylsilane as an internal reference. The listing has been kept as simple as possible for this purpose. The proton spectrum lines are arranged according to the chemical shift relative to tetramethylsilane and are given in values of τ and σ. The purpose of this table is to supplement tables available in standard references and to summarize information available in the literature.



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MISCIBILITY OF ORGANIC SOLVENT PAIRS

Table A

Doctor J. S. Drury

Industrial and Engineering Chemistry Vol. 44, No. 11, Nov. 1952

(Reprinted by permission)

The classifications were made by shaking together 5 ml. of each of the solvents listed in a test table for 1 minute, then allowing the mixture to settle. If no interfacial meniscus was observed, the solvent pair was considered miscible. If such a meniscus was present, the solvent pair was regarded as immiscible. The classification of immiscible is a qualitative one since solvent pairs may exhibit some degree of partial miscibility while existing as separate phases. Solvent pairs possessing a pronounced degree of partial miscibility are designated by the symbol Is.

Compound number	Compounds	Acetone	Acetyl acetone	2-Amino-2-methyl-1-propanol	Aniline	Benzaldehyde	Benzene	Benzin	Benzyl alcohol	Butyl acetate	Butyl alcohol	*n*-Butyl ether	Capryl alcohol	Carbon tetrachloride	Diacetone alcohol	Diethanolamine	Diethyl cellosolve	Diethyl ether	Dimethylaniline	Ethyl alcohol	Ethyl benzoate	Ethylene glycol	2-Ethylhexanol	Formamide	Furfuryl alcohol	Glycerol	Hydroxyethylethylenediamine	Isoamyl alcohol	Methyl isobutyl ketone	Nitromethane	Dibutoxytetraethylene glycol	Pyridine	Triethanolamine	Trimethylene glycol
1	Acetone	. .	M	M	. .	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	I	M	M	M	M	M	M	. .	M
2	Acetyl acetone	M	. .	R	. .	M	M	M	M	M	M	M	M	M	M	R	M	M	M	M	M	M	M	M	M	I	R	M	M	M	M	M	. .	M
3	Adiponitrile	M	M	M	M	. .	M	. .	M	M	M	I	. .	I	M	. .	M	I	M	M	M	I	I	M	M	I	M	I	M	. .	M	M	M	M
4	2-Amino-2-methyl-1-propanol	M	R	. .	. .	M	M	I	M	M	M	Is	M	M	R	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	. .	M
5	Benzaldehyde	M	M	M	. .	. .	M	M	M	M	M	M	M	M	M	I	M	M	M	M	M	Is	M	M	M	Is	R	M	M	M	M	M	. .	M
6	Benzene	M	M	M	. .	M	. .	M	M	M	M	M	M	M	Is	I	M	M	M	M	M	I	M	I	M	I	I	M	M	I	M	M	. .	I
7	Benzin	M	M	I	. .	M	M	. .	I	M	M	M	M	M	I	I	M	M	M	M	M	M	M	I	I	I	Is	M	M	M	M	M	. .	I
8	Benzonitrile	M	M	M	M	. .	M	. .	M	M	M	M	. .	M	M	. .	M	M	M	M	M	I	M	I	M	I	M	M	M	. .	M	M	M	I
9	Benzothiazole	M	M	M	M	. .	M	. .	M	M	M	M	. .	M	M	. .	M	M	M	M	M	M	M	I	M	I	M	M	M	. .	M	M	M	M
10	Benzyl alcohol	M	M	M	. .	M	M	I	. .	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	. .	M
11	Benzyl mercaptan	M	M	I	M	. .	M	. .	M	M	M	M	. .	M	M	. .	M	M	M	M	M	I	M	I	M	I	M	M	M	. .	M	M	R	I
12	Butyl acetate	M	M	M	. .	M	M	M	M	. .	M	M	M	M	M	I	M	M	M	M	M	Is	M	I	M	I	I	M	M	M	M	M	. .	Is
13	Butyl alcohol	M	M	M	. .	M	M	M	M	M	. .	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	. .	M
14	*n*-Butyl ether	M	M	Is	. .	M	M	M	M	M	M	. .	M	M	M	I	M	M	M	M	M	I	M	I	M	I	I	M	M	I	M	M	. .	I
15	Capryl alcohol	M	M	M	. .	M	M	M	M	M	M	M	. .	M	M	M	M	M	M	M	M	M	M	I	M	I	M	M	M	Is	M	M	. .	M
16	Carbon tetrachloride	M	M	M	. .	M	M	M	M	M	M	M	M	. .	Is	I	M	M	M	M	M	I	M	I	M	I	I	M	M	M	M	M	. .	I
17	Diacetone alcohol	M	M	R	. .	M	Is	I	M	M	M	M	M	Is	. .	M	M	M	M	M	M	M	M	M	M	I	R	M	M	M	M	M	. .	M
18	Diethanolamine	M	R	M	. .	I	I	I	M	I	M	I	M	I	M	. .	I	I	Is	M	M	M	M	M	M	M	M	M	I	I	I	M	. .	M
19	Diethyl Cellosolve	M	M	M	. .	M	M	M	M	M	M	M	M	M	M	I	. .	M	M	M	M	M	M	M	M	I	I	M	M	M	M	M	. .	M
20	Diethyl ether	M	M	M	. .	M	M	M	M	M	M	M	M	M	M	I	M	. .	M	M	M	I	M	I	M	I	I	M	M	M	M	M	. .	I
21	Dimethylaniline	M	M	M	. .	M	M	M	M	M	M	M	M	M	M	Is	M	M	. .	M	M	I	M	I	M	I	I	M	M	M	M	M	. .	I
22	Di-*N*-propylaniline	M	M	I	M	. .	M	. .	M	M	M	M	. .	M	I	. .	M	M	M	M	M	I	M	I	M	I	I	M	M	. .	M	M	I	I
23	Ethyl alcohol	M	M	M	. .	M	M	M	M	M	M	M	M	M	M	M	M	M	M	. .	M	M	M	M	M	M	M	M	M	M	M	M	M	. .	M
24	Ethyl benzoate	M	M	M	. .	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	. .	I	M	I	M	I	M	M	M	M	M	M	. .	Is
25	Ethyl isothiocyanate	M	M	R	M	. .	M	. .	M	M	M	M	. .	M	M	. .	M	M	M	M	M	I	M	I	M	I	R	M	M	. .	M	M	M	I
26	Ethyl thiocyanate	M	M	M	M	. .	M	. .	M	M	M	M	. .	M	M	. .	M	M	M	M	M	I	M	I	M	I	M	M	M	. .	M	M	M	I
27	Ethylene glycol	M	M	M	. .	Is	I	M	M	Is	M	I	M	I	M	M	M	I	I	M	I	. .	M	M	M	M	M	M	I	I	M	M	. .	M
28	2-Ethylhexanol	M	M	M	. .	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	. .	I	M	I	M	M	M	I	M	M	. .	M
29	Formamide	M	M	M	. .	M	I	I	M	I	M	I	I	I	M	M	M	I	I	M	I	M	I	. .	M	M	M	M	Is	M	M	M	. .	M
30	Furfuryl alcohol	M	M	M	. .	M	M	I	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	. .	M	M	M	M	M	M	M	. .	M
31	Glycerol	I	I	M	. .	I	I	I	M	I	M	I	I	I	I	M	I	I	I	M	I	M	I	M	M	. .	M	I	I	I	I	M	. .	M
32	Hydroxyethylethylenediamine	M	R	M	. .	R	I	Is	M	I	M	I	M	I	R	M	I	I	I	M	M	M	M	M	M	M	. .	M	M	M	M	M	. .	M
33	Isoamyl alcohol	M	M	M	. .	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	I	M	. .	M	M	M	M	. .	M
34	Isoamyl sulfide	M	M	I	M	. .	M	. .	M	M	M	M	. .	M	I	. .	M	M	M	M	M	I	M	I	I	I	I	M	M	. .	M	M	I	I
35	Isobutyl mercaptan	M	M	M	M	. .	M	. .	M	M	M	M	. .	M	M	. .	M	M	M	M	M	I	M	I	M	I	I	M	M	. .	M	M	R	R
36	Methyl disulfide	M	M	M	M	. .	M	. .	M	M	M	M	. .	M	M	. .	M	M	M	M	M	I	M	I	M	I	I	M	M	. .	M	M	I	R
37	Methyl isobutyl ketone	M	M	M	. .	M	M	M	M	M	M	M	M	M	M	I	M	M	M	M	M	I	M	Is	M	I	M	M	. .	M	M	M	. .	I
38	Nitromethane	M	M	M	. .	M	I	M	M	M	M	I	Is	M	M	I	M	M	M	M	M	I	I	M	M	I	M	M	M	. .	M	M	. .	I
39	Dibutoxytetraethylene glycol	M	M	M	. .	M	M	M	M	M	M	M	M	M	M	I	M	M	M	M	M	M	M	M	M	I	M	M	M	M	. .	M	. .	M
40	Pyridine	M	M	M	. .	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	. .	. .	M
41	Tri-*n*-butylamine	M	M	I	I	. .	M	. .	M	M	M	M	. .	M	I	. .	M	M	M	M	M	I	M	I	M	I	I	M	M	. .	M	M	I	I
42	Trimethylene glycol	M	M	M	. .	M	I	I	M	Is	M	I	M	I	M	M	M	I	I	M	Is	M	M	M	M	M	M	I	I	M	M	. .	. .

MISCIBILITY OF ORGANIC SOLVENT PAIRS (Continued)

Tables B and C

W. M. Jackson and J. S. Drury

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The classifications were made at 20°C in the following manner. One-milliliter portions of each solvent comprising a pair were shaken together for approximately a minute. If no interfacial meniscus was observed after the contents of the tube were allowed to settle, the solvent pair was considered to be miscible, M. If a meniscus was observed without apparent change in the volume of either solvent, the pair was regarded as immiscible, I. This classification is a qualitative one since solvent pairs may exhibit various degrees of partial miscibility while existing as separate phases. If an obvious change occurred in the volume of each solvent but a meniscus was present, the pair was classified as partially miscible, S. The designation R indicates that the two solvents reacted.

Table B

Compound number	Compounds	Acetone	Isoamyl acetate	*n*-Amyl cyanide	Benzene	Benzyl ether	2-Bromoethyl acetate	Chloroform	Cinnamaldehyde	Di-*n*-amylamine	Di-*n* butyl carbonate	Diethylacetic acid	Diethylenetriamine	Diethyl formamide	Diisobutyl ketone	Diisopropylamine	Di-*n*-propyl aniline	Ethyl alcohol	Ethyl benzoate	Ethyl ether	Ethyl phenylacetate	Heptadecanol[a]	3-Heptanol	*n*-Heptyl acetate	*n*-Hexyl ether	Methyl isopropyl ketone	4-Methyl *n*-valeric acid	*o*-Phenetidine	Sulfuric acid (concd.)	Tetradecanol[a]	Tri-*n*-butyl phosphate	Triethylene glycol	Triethylenetetramine	2,6,8-Trimethyl 4-nonanone	Compound number
1	Acetone		M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	R	M	M	M	M	M	1
2	Isoamyl acetate	M		M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	R	M	M	I	M	M	2
3	*n*-Amyl cyanide	M	M		M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	R	M	M	M	M	M	3
4	Benzene	M	M	M		M	S	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	I	M	M	S	M	M	4
5	Benzyl ether	M	M	M	M		M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	R	M	M	I	M	M	5
6	2-Bromoethyl acetate	M	M	M	S	M		M	M	R	M	M	R	R	M	R	M	M	M	M	M	M	M	M	S	M	M	M	R	M	M	M	R	M	M	6
7	Chloroform	M	M	M	M	M	M		M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	I	M	M	M	R	M	M	7
8	Cinnamaldehyde	M	M	M	M	M	M	M		M	M	M	R	M	M	M	M	M	M	M	M	M	M	M	M	M	M	R	R	M	M	M	R	M	M	8
9	Di-*n*-amylamine	M	M	M	M	M	R	M	M		M	R	I	R	M	M	M	M	M	M	M	M	M	M	M	M	M	M	R	M	M	S	I	M	M	9
10	Di-*n*-butyl carbonate	M	M	M	M	M	M	M	M	M		M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	R	M	M	I	I	M	M	10
11	Diethylacetic acid	M	M	M	M	M	M	M	M	R	M		R	M	M	R	M	M	M	M	M	M	M	M	M	M	M	M	R	M	M	M	R	M	M	11
12	Diethylenetriamine	M	M	M	M	M	R	M	M	R	I	M	R		R	M	M	M	M	M	M	M	M	R	I	R	R	M	R	M	M	M	M	I	M	12
13	Diethyl formamide	M	M	M	M	M	R	M	M	R	M	M	M	R		M	M	M	M	M	M	M	M	M	I	M	M	M	R	M	M	M	R	M	M	13
14	Diisobutyl ketone	M	M	M	M	M	M	M	M	M	M	M	M	M	M		M	M	M	M	M	M	M	M	M	M	M	M	R	M	M	I	M	M	M	14
15	Diisopropylamine	M	M	M	M	M	R	M	M	M	M	R	M	R	M	M	M	M	M	M	M	M	M	M	M	M	M	R	M	M	M	M	M	M	M	15
16	Di-*n*-propylaniline	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	R	M	M	I	M	M	M	16
17	Ethyl alcohol	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M		M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	17
18	Ethyl benzoate	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M		M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	18
19	Ethyl ether	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M		M	M	M	M	M	M	M	M	R	M	M	I	M	M	M	19
20	Ethyl phenylacetate	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M		M	M	M	M	M	M	M	R	M	M	M	M	M	M	20
21	Heptadecanol[a]	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M		M	M	M	M	M	M	R	M	M	I	M	M	M	21
22	3-Heptanol	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M		M	M	M	M	M	R	M	M	M	M	M	M	22
23	*n*-Heptyl acetate	M	M	M	M	M	M	M	M	M	M	M	R	M	M	M	M	M	M	M	M	M	M		M	M	M	M	R	M	M	I	R	M	M	23
24	*n*-Hexyl ether	M	M	M	M	M	S	M	M	M	M	M	I	I	M	M	M	M	M	M	M	M	M	M		M	M	M	R	M	M	I	I	M	M	24
25	Methyl isopropyl ketone	M	M	M	M	M	M	M	M	M	M	M	R	M	M	M	M	M	M	M	M	M	M	M	M		M	M	R	M	M	M	R	M	M	25
26	4-Methyl-*n*-valeric acid	M	M	M	M	M	M	M	M	M	M	M	R	M	M	R	M	M	M	M	M	M	M	M	M	M		M	R	M	M	M	R	M	M	26
27	*o*-Phenetidine	M	M	M	M	M	M	M	R	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M		R	M	M	M	M	M	M	27
28	Sulfuric acid (concd.)	R	R	R	I	R	R	I	R	R	R	R	R	R	R	R	R	M	M	R	R	R	R	R	R	R	R	R		R	R	R	R	R	R	28
29	Tetradecanol[a]	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	R		M	I	M	M	M	29
30	Tri-*n*-butyl phosphate	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	R	M		M	M	M	M	30
31	Triethylene glycol	M	I	M	S	I	M	M	M	S	I	M	M	M	I	M	I	M	M	I	M	I	M	I	I	M	M	M	R	I	M		M	I	I	31
32	Triethylenetetramine	M	M	M	M	M	R	M	R	I	I	R	M	R	M	M	M	M	M	M	M	M	M	R	I	R	R	M	R	M	M	M		I		32
33	2,6,8-Trimethyl 4-nonanone	M	M	M	M	M	M	M	M	M	M	M	I	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	R	M	M	I	I			33

[a] Union Carbide name.

MISCIBILITY OF ORGANIC SOLVENT PAIRS (Continued)

Table C

Compound number	Compounds	Acetone	Isoamyl acetate	n-Amyl cyanide	Anisaldehyde	Benzene	Benzyl ether	Chloroform	o-Cresol	Diisobutyl ketone	Diethylacetic acid	Diethyl formamide	Di-n-propyl aniline	Ethyl alcohol	Ethyl ether	3-Heptanol	n-Heptyl acetate	n-Hexyl ether	α-Methylbenzylamine	α-Methylbenzyldiethanolamine	α-Methylbenzyldimethylamine	α-Methylbenzylethanolamine	2-Methyl-5-ethylpyridine	Methyl isopropyl ketone	4-Methyl-n-valeric acid	o-Phenetidine	2-Phenylethylamine	Isopropanolamine	Pyridine	Salicylaldehyde	Tetradecanol[a]	Tri-n-butyl phosphate	Triethylenetetramine	2,6,8-Trimethyl 4-nonanone
1	1,3-Butylene glycol	M	I	M	I	I	I	M	M	I	M	M	I	M	S	M	I	I	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	I
2	2,3-Butylene glycol	M	M	M	M	S	I	M	M	M	M	M	I	M	M	M	M	I	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	I
3	2-Chloroethanol	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	R	M	M	M	R	M	M	M	R	R	M	M	M	M	M	M	M
4	3-Chloro-1,2-propanediol	M	M	M	M	I	M	M	M	M	M	M	I	M	M	M	M	I	R	M	M	M	M	M	M	M	R	R	M	M	S	M	R	S
5	Dibutyl hydrogen phosphite	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
6	Diethylene glycol dibutyl ether	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	R	M	S	M	M	M	M	M	R	R	M	M	M	M	R	M	M
7	Diethylene glycol diethyl ether	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
8	Diethylene glycol monobutyl ether	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
9	Diethylene glycol monoethyl ether	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	I	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
10	Diethylene glycol monomethyl ether	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	I	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
11	Dipropylene glycol	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	I	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
12	Ethylene diacetate	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	I	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
13	Ethylene glycol	M	I	I	I	I	I	S	M	I	M	M	I	M	I	M	I	I	M	M	M	M	I	M	M	M	M	M	I	I	S	M	I	
14	Ethyl glycol ethylbutyl ether	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
15	Ethylene glycol monobutyl ether	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
16	Ethylene glycol monoethyl ether	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
17	Ethylene glycol monomethyl ether	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
18	Ethylene glycol monophenyl ether	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
19	Glycerol	I	I	I	I	I	I	I	M	I	I	M	I	M	I	I	I	I	M	M	I	M	M	I	I	I	M	M	M	I	I	I	M	I
20	1,2-Propanediol	M	M	M	M	I	I	M	M	I	M	M	I	M	S	M	I	I	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	I
21	1,3-Propanediol	M	I	I	I	I	I	M	M	I	M	M	I	M	I	M	I	I	M	M	M	M	M	M	M	M	M	M	M	I	S	M	M	I
22	Triethylene glycol	M	I	M	M	S	I	M	M	I	M	M	I	M	I	M	I	I	M	M	M	M	M	M	M	M	M	M	M	M	I	M	M	I
23	Triethyl phosphate	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
24	Trimethylene chlorohydrin	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	R	M	M	M	R	M	M	M	R	R	M	M	M	M	R	M	

[a] Union Carbide name.

EMERGENT STEM CORRECTION FOR LIQUID-IN-GLASS THERMOMETERS

Accurate thermometers are calibrated with the entire stem immersed in the bath which determines the temperature of the thermometer bulb. However, for reasons of convenience it is common practice when using a thermometer to permit its stem to extend out of the apparatus. Under these conditions both the stem and the mercury in the exposed stem are at a temperature different from that of the bulb. This introduces an error into the observed temperature. Since the coefficient of thermal expansion of glass is less than that of mercury, the observed temperature will be less than the true temperature if the bulb is hotter than the stem and greater than the true temperature, providing the thermal gradient is reversed. For exact work the magnitude of this error can only be determined by experiment. However, for most purposes it is sufficiently accurate to apply the following equation which takes into account the difference of the thermal expansion of glass and mercury:

$$T_c = T_o + F \times L(T_o - T_m)$$

Where T_c = corrected temperature

T_o = observed temperature

T_m = mean temperature of exposed stem. The mean temperature of the exposed stem may be determined by fastening the bulb of a second thermometer against the midpoint of the exposed liquid column.

L = the length of the exposed column in degrees above the surface of the substance whose temperature is being determined.

F = correction factor. For approximate work and when the liquid in the thermometer is mercury a value for F of 0.00016 is generally used. For more accurate work with mercury filled thermometers values as given in the following table are used. For thermometers filled with organic liquids it is customary to use 0.001 for the value of F.

Values of F for various glasses

Tm°C.	Corning 0041	Corning 8800	Corning 8810	Jena 16 III	Jena 59 III
50	0.000157	0.000166	0.000156	0.000158	0.000164
150	0.000159	0.000167	0.000157	0.000158	0.000165
250	0.000163	0.000168	0.000161	0.000161	0.000170
350	0.000168	0.000173	0.000166	.....	0.000177

Handbook of tables for Organic Compound Identification, © 1967 CRC

CORRECTION OF BOILING POINTS TO STANDARD PRESSURE

By H. B. Hass and R. F. Newton

This correction may be made by using the equation:

$$\Delta t = \frac{(273.1 + t)(2.8808 - \log p)}{\phi + .15(2.8808 - \log p)} \tag{1}$$

where Δt = degrees C to be added to the observed boiling point.
t = the observed boiling point.
$\log p$ = the logarithm of the observed pressure in millimeters of mercury.
ϕ = the entropy of vaporization at 760 mm.

The value of ϕ may be estimated from the graph and the table. Substances not included in the table may be classified by grouping them with compounds which bear a close physical or structural resemblance to them.

Example 1. Benzene boils at 20°C. at 75 mm pressure. What is its normal boiling point? We do not find benzene in the table but we find hydrocarbons in group 2, and a group 2 compound with a boiling point of 20° has a ϕ of 4.6.

Substituting in the equation

$$\Delta t = \frac{(273.1 + 20)(2.8808 - 1.8751)}{4.60 + .15(2.8808 - 1.8751)} = 62°$$

Adding this to 20° gives 82° as a first approximation.

The graph shows that the ϕ for a compound of group 2 boiling at 82° is 4.72 instead of 4.60 which we originally used. Since ϕ is in the denominator, this increase will lower our Δt by the ratio, 4.60/4.72, or the corrected Δt is $62 \times 4.60/4.72 = 60.4$. Adding Δt to t, gives 80.4° as a second approximation.

The formula can best be used in a slightly different form when the reverse calculation is desired, *i.e.*, when one calculates the vapor pressure at a given temperature, lower than the normal boiling point.

$$2.8808 - \log p = \frac{\phi \Delta t}{273.1 + t - .15\Delta t} \tag{2}$$

Example 2. Alcohol boils at 78.4°C. What is its vapor pressure at 20°C.? Substituting in equation 2:

$$2.8808 - \log p = \frac{6.06 \times 58.4}{293.1 - (.15 \times 58.4)} = 1.245$$

$$\log p = 2.8808 - 1.245 = 1.6358$$

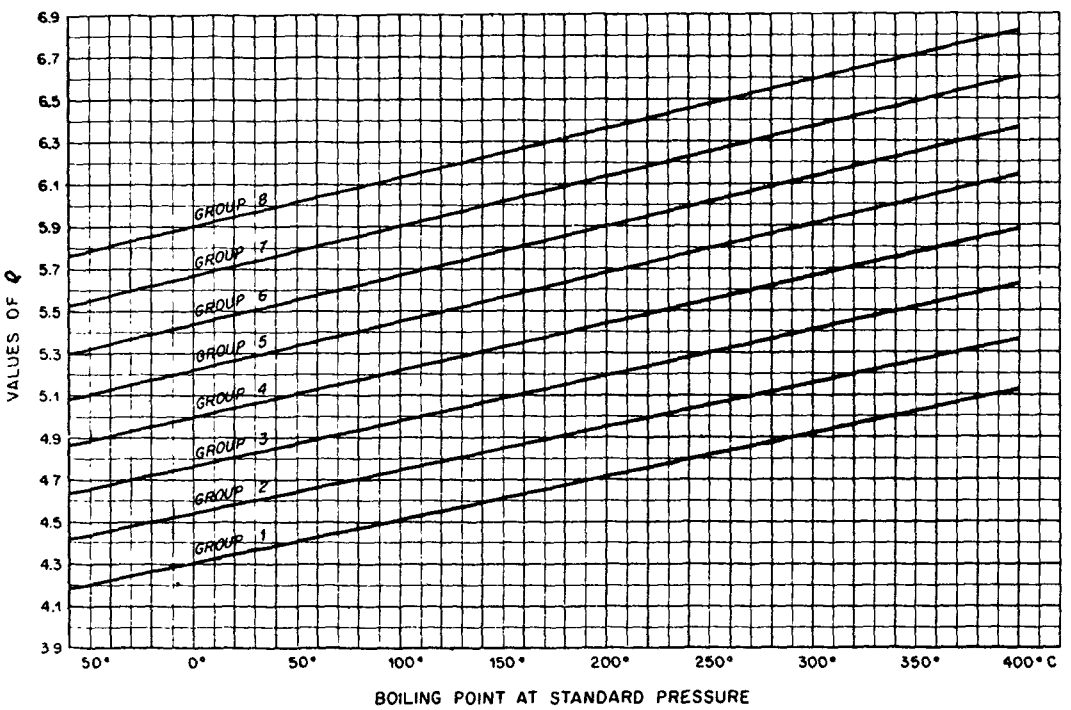
$$p = 43.2 \text{ mm.}$$

Here no second approximation is necessary, since the correct value of ϕ was taken immediately, the normal boiling point having been known.

Compound	Group	Compound	Group
Acetaldehyde	3	Benzyl alcohol	5
Acetic acid	4	Butylethylene	1
Acetic anhydride	6	Butyric acid	7
Acetone	3	Camphor	2
Acetophenone	4	Carbon monoxide	1
Amines	3	Carbon oxysulfide	2
n-Amyl alcohol	8	Carbon suboxide	2
Anthracene	1	Carbon sulfoselenide	2
Anthraquinone	1	*m.p.* Chloroanilines	3
Benzaldehyde	2	Chlorinated derivatives	Same group as though Cl was H
Benzoic acid	5		
Benzonitrile	2	*o.m.p.* Cresols	4
Benzophenone	2	Cyanogen	4

CORRECTION OF BOILING POINTS (Continued)

Compound	Group	Compound	Group
Cyanogen chloride	3	Methyl benzoate	3
Dibenzyl ketone	2	Methyl ether	3
Dimethyl amine	4	Methyl ethyl ether	3
Dimethyl oxalate	4	Methyl ethyl ketone	2
Dimethyl silicane	2	Methyl fluoride	3
Esters	3	Methyl formate	4
Ethanol	8	Methyl salicylate	2
Ethers	2	Methyl silicane	1
Ethylamine	4	α,β Naphthols	3
Ethylene glycol	7	Nitrobenzene	3
Ethylene oxide	3	Nitromethane	3
Formic acid	3	o.m.p. Nitrotoluenes	2
Glycol diacetate	4	o.m.p. Nitrotoluidines	2
Halogen derivatives	Same group as though halogen were hydrogen.	Phenanthrene	1
		Phenol	5
		Phosgene	2
Heptylic acid	7	Phthalic anhydride	2
Hydrocarbons	2	Propionic acid	5
Hydrogen cyanide	3	*n*-Propyl alcohol	8
Isoamyl alcohol	7	Quinoline	2
Isobutyl alcohol	8	Sulfides	2
Isobutyric acid	6	Tetranitromethane	3
Isocaproic acid	7	Trichloroethylene	1
Methane	1	Valeric acid	7
Methanol	7	Water	6
Methyl amine	5		



MOLECULAR ELEVATION OF THE BOILING POINT

(Most values from Hoyt, C.S. and Fink, C.K., Journal of Physical Chemistry, Vol. 41, No. 3., March, 1937.)
Molecular elevation of the boiling point showing the elevation of the boiling point in degrees C due to the addition of one gram molecular weight of the dissolved substance to 1000 grams of any one of the solvents below. The correction in the last column gives the number of degrees to be subtracted for each mm. of difference between the barometric reading and 760 mm.

Solvent	K_B	Barometric Correction per mm.
Acetic acid	3.07	0.0008
Acetone	1.71	0.0004
Aniline	3.52	0.0009
Benzene	2.53	0.0007
Bromobenzene	6.26	0.0016
Carbon bisulfide	2.34	0.0006
Carbon tetrachloride	5.03	0.0013
Chloroform	3.63	0.0009
Cyclohexane	2.79	0.0007
Ethanol (ethyl alcohol)	1.22	0.0003
Ethyl acetate	2.77	0.0007
Ethyl ether	2.02	0.0005
n-Hexane	2.75	0.0007
Methanol (methyl alcohol)	0.83	0.0002
Methyl acetate	2.15	0.0005
Nitrobenzene	5.24	0.0013
n-Octane	4.02	0.0010
Phenol	3.56	0.0009
Toluene	3.33	0.0008
Water	0.512	0.0001

MOLECULAR DEPRESSION OF THE FREEZING POINT

Showing the depression of the freezing point due to the addition of one gram molecular weight of solute, for various solvents.

Solvent	Depression for one gram molecular weight dissolved in 1000 grams, °C	Solvent	Depression for one gram molecular weight dissolved in 1000 grams, °C
Acetic acid	3.90	Diphenyamine	8.60
Acetophenone	5.65	Diphenyl ether	8.00
Aniline	5.87	Ethylene dibromide	11.80
Anthracene	14.65	Ethyl ether	11.79
Anthraquinone	14.80	Formic acid	2.77–2.80
Benzene	4.90–5.23	Hexachlorobenzene	20.75
Benzoic acid	7.85–8.79	Menthol	12.4
Benzophenone	9.88	Naphthalene	6.90–7.10
d-Bromocamphor	11.87	*β*-Naphthol	11.25
Bromoform	14.25	Nitrobenzene	6.89–7.10
tert-Butyl alcohol	12.80	Phenenthrene	12.0
Camphor	49.80	Phenol	7.20–7.50
Carbazole	12.30	Phenylhydrazine	5.86
Carbon disulfide	3.83	Pyridine	4.97
Carbon tetrachloride	29.8–34.8	Stearic acid	4.50
Chloroform	4.67–4.90	Triphenylmethane	12.45
Cyclohexane	20.0–20.30	Urethane	5.00–5.14
Dicyclohexyl	14.50	Water	1.85–1.87
m-Dinitrobenzene	10.60	*p*-Xylene	4.30
Diphenyl	8.00–8.35		

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CARBOHYDRATES

These data for carbohydrates were compiled originally for the Biology Data Book by M L Wolfram, G G Maher and R G Pagnucco (1964) Data are reproduced here by permission of the copyright owners of the above publication, the Federation of American Societies for Experimental Biology, Washington, D C pp 351–359

All data are for crystalline substances, unless otherwise specified Selection of substances was restricted to natural carbohydrates found free (or in chemical combination and released on hydrolysis) and to biological oxidation products of the natural carbohydrates The nomenclature conforms with that of the British-American report as published in the *Journal of Organic Chemistry*, 28 281 (1963) Substances have been arranged alphabetically under the name of the parent sugar within groups formulated according to increasing carbon content (excluding carbon in substituents), with synonymous common names in parentheses **Melting Point:** b p = boiling point, d = decomposes, s = sinters **Specific Rotation** was determined in water at concentrations of 1–5 g per 100 ml of solution and at 20°–25°C, unless otherwise specified, other temperatures or wavelengths are shown in brackets *c* = grams solute per 100 ml of solution

Part I. NATURAL MONOSACCHARIDES: ALDOSES AND KETOSES

	Substance (Synonym)	Chemical Formula	Melting Point °C	Specific Rotation $[\alpha]_D$
	(A)	(B)	(C)	(D)
	Aldoses			
1	D-Glyceraldehyde	$C_3H_6O_3$		+13 5 ± 0 5 (syrup)
2	D-Glyceraldehyde, 3-deoxy-3,3-*C*-bis-(hydroxymethyl)- (Cordycepose)	$C_5H_{10}O_4$		−26 (*c* 0 6, C_2H_5OH
3	D-Glyceraldehyde, 3,3-bis(*C*-hydroxymethyl)- (Apiose)	$C_5H_{10}O_5$		+5 6 (*c* 10) [15°] syrup
4	β-D-Arabinose	$C_5H_{10}O_5$	155	−175 → −103
5	D-Arabinose, 2-*O*-methyl-	$C_6H_{12}O_5$	Syrup	−102
6	α-L-Arabinose	$C_5H_{10}O_5$	158 amorphous	+55 4 → +105
7	β-L-Arabinose	$C_5H_{10}O_5$	160	+190 6 → +104 5
8	DL-Arabinose	$C_5H_{10}O_5$	163 5–164 5	None
9	α-L-Lyxose	$C_5H_{10}O_5$	105	+5 8 → +13 5
10	L-Lyxose, 5-deoxy-3-*C*-formyl- (Streptose)	$C_6H_{10}O_5$		
11	L-Lyxose, 3-*C*-formyl- (Hydroxystreptose)	$C_6H_{10}O_6$		
12	Pentose, 4,5-anhydro-5-deoxy-D-*erythro*-	$C_5H_8O_3$		
13	Pentose, 2-deoxy-D-*erythro*-	$C_5H_{10}O_4$	96–98	−91 → −58
14	D-Ribose	$C_5H_{10}O_5$	87	−23 1 → −23 7
15	D-Ribose, 2-*C*-hydroxymethyl- (Hamamelose)	$C_6H_{12}O_6$		−7 1 [λ578]
16	α-D-Xylose	$C_5H_{10}O_5$	145	+93 6 → +18 8
17	D-Xylose, 5-deoxy-	$C_5H_{10}O_4$		+16
18	β-D-Xylose, 2-*O*-methyl-	$C_6H_{12}O_5$	137–138	−21 → +34
19	α-D-Xylose, 3-*O*-methyl-	$C_6H_{12}O_5$	95	+45 → +19
20	D-Allose, 6-deoxy-	$C_6H_{12}O_5$	140–143 146–148	+1 6 [18°] (*c* 0 6) −4 7 → 0
21	D-Allose, 6-deoxy-2,3-di-*O*-methyl- (Mycinose)	$C_8H_{16}O_5$	102–106	−46 → −29
22	Amicetose (a trideoxy hexose)	$C_6H_{12}O_3$	Oil, b p 65–70	+28 6 ($CHCl_3$)
23	Antiarose	$C_6H_{12}O_5$		Levo
24	α-D-Galactose	$C_6H_{12}O_6$	167	+150 7 → +80 2
25	β-D-Galactose	$C_6H_{12}O_6$	143–145	+52 8 → +80 2
26	D-Galactose, 3,6-anhydro-	$C_6H_{10}O_5$		+21 3 [10°]
27	α-D-Galactose, 6-deoxy- (D-Fucose, Rhodeose)	$C_6H_{12}O_5$	140–145	+127 → +76 3 (*c* 10)
28	D-Galactose, 6-deoxy-3-*O*-methyl- (Digitalose)	$C_7H_{14}O_5$	106[1], 119[2]	+106

	Substance (Synonym)	Chemical Formula	Melting Point °C	Specific Rotation $[\alpha]_D$
	(A)	(B)	(C)	(D)
	Aldoses (Con t)			
29	D-Galactose, 6-deoxy-4-*O*-methyl-	$C_7H_{14}O_5$	131–132	+82
30	D-Galactose, 6-deoxy-2,3-di-*O*-methyl-	$C_8H_{16}O_5$		+73
31	α-D-Galactose, 3-*O*-methyl-	$C_7H_{14}O_6$	144–147	+150 6 → +108 6
32	α-D-Galactose, 6-*O*-methyl-	$C_7H_{14}O_6$	122–123	+117 → +77 3
33	L-Galactose	$C_6H_{12}O_6$		*See* D-Galactose
34	α-L-Galactose, 3,6-anhydro-	$C_6H_{10}O_5$		−39 4 → −25 2
35	α-L-Galactose, 6-deoxy- (L-Fucose)	$C_6H_{12}O_5$	145	−124 1 → −76 4
36	L-Galactose, 6-deoxy-2-*O*-methyl-	$C_7H_{14}O_5$	149–150	−75 ± 4 (*c* 0 5)
37	L-Galactose, 6-sulfate	$C_6H_{12}O_9S$		−47 (*c* 0 2) (Na salt)
38	DL-Galactose	$C_6H_{12}O_6$	143–144, 163	None (racemic)
39	α-D-Glucose	$C_6H_{12}O_6$	146, 83 (H_2O)	+112 → +52 7
40	β-D-Glucose	$C_6H_{12}O_6$	148–150	+18 7 → +52 7
41	D-Glucose, 6-acetate	$C_7H_{14}O_7$	135	+48
42	D-Glucose, 2,3-di-*O*-methyl-	$C_8H_{16}O_6$	85–86, 121	+50
43	D-Glucose, 6-*O*-benzoyl- (Vaccinin)	$C_{13}H_{16}O_7$	Amorphous	+48 (C_2H_5OH)
44	α-D-Glucose, 6-deoxy- (Chinovose, Epirhamnose, Glucomethylose, Isorhamnose, Isorhodeose Quinovose)	$C_6H_{12}O_5$	139–140	+73 3 → +29 7 (*c* 8)
45	α-D-Glucose, 6-deoxy-3-*O*-methyl- (D-Thevetose)	$C_7H_{14}O_5$	116	+84 → +33
46	D-Glucose, 6-sulfonic acid, 6-deoxy- (6-Sulfoquinovose)	$C_6H_{12}O_8S$	173–174	+87[3]
47	D-Glucose, 3-*O*-methyl-	$C_7H_{14}O_6$	162–167	+98 → +59 5
48	α-L-Glucose	$C_6H_{12}O_6$	141–143	−95 5 → −51 4
49	L-Glucose, 6-deoxy-3-*O*-methyl- (L-Thevetose)	$C_7H_{14}O_5$	126–129	−36 9 ± 2
50	D-Gulose, 6-deoxy-	$C_6H_{12}O_5$		
51	Hexose, 2-deoxy-D-*arabino*-[4]	$C_6H_{12}O_5$	148	+46 6 [18°]
52	Hexose, 2,6-dideoxy-3-*O*-methyl-D-*arabino*- (D-Oleandrose)	$C_7H_{14}O_4$		−11
53	Hexose, 3,6-dideoxy-D-*arabino*- (Tyvelose)	$C_6H_{12}O_4$		+24 ± 2
54	Hexose, 2,6-dideoxy-3-*O*-methyl-L-*arabino*- (L-Oleandrose)	$C_7H_{14}O_4$	62–63	+11 9 ± 2 5
55	Hexose, 3,6-dideoxy-L-*arabino*- (Ascarylose)	$C_6H_{12}O_4$		−24 ± 2
56	Hexose, 2,6-dideoxy-3-*O*-methyl-D-*lyxo*- (Diginose)	$C_7H_{14}O_4$	90–92	+56 ± 4
57	Hexose, 2,6-dideoxy-L-*lyxo*- (L-Fucose, 2-deoxy-)	$C_6H_{12}O_4$	103–106	−61 6
58	Hexose, 2,6-dideoxy-3-*O*-methyl-L-*lyxo*-	$C_7H_{14}O_4$	78–85	−65
59	Hexose, 2,6-dideoxy-D-*ribo*- (Digitoxose, D-Altrose, 2,6-dideoxy-)	$C_6H_{12}O_4$	110	+46 4
60	Hexose, 2,6-dideoxy-3-*O*-methyl-D-*ribo*- (Cymarose)	$C_7H_{14}O_4$	93	+52
61	Hexose, 3,6-dideoxy-D-*ribo*- (Paratose)	$C_6H_{12}O_4$		+10 ± 2 (*c* 0 9)
62	Hexose, 4,6-dideoxy-3-*O*-methyl-D-*ribo*- (D-Gulose, 4,6-dideoxy-3-*O*-methyl-, Chalcose)	$C_7H_{14}O_4$	96–99	+120 → +76
63	Hexose, 2,6-dideoxy-D-*xylo*- (Boivinose)	$C_6H_{12}O_4$	96–98	−3 9 → +3 9

	Substance (Synonym)	Chemical Formula	Melting Point °C	Specific Rotation $[\alpha]_D$
	(A)	(B)	(C)	(D)
	Aldoses (Con't)			
64	Hexose, 2,6-dideoxy-3-*O*-methyl-D-*xylo*- (Sarmentose)	$C_7H_{14}O_4$	78–79	+12 → +15 8
65	Hexose, 3,6-dideoxy-D-*xylo*- (Abequose)	$C_6H_{12}O_4$		−3 2 ± 0 6
66	Hexose, 2,6-dideoxy-3-*C*-methyl-L-*xylo*- (Mycarose)	$C_7H_{14}O_4$	129–129	−31 1
67	Hexose, 2,6-dideoxy-3-*C*-methyl-3-*O*-methyl-L-*xylo*-(Cladinose)	$C_8H_{16}O_4$	oil, b p 120–132 (0 25 mm)	−23 1
68	Hexose, 3,6-dideoxy-L-*xylo*- (Colitose)	$C_6H_{12}O_4$		+4 (H_2O), −51 ± 2 (CH_3OH)
69	D-Idose[5]	$C_6H_{12}O_6$		
70	L-Idose, 1,6-anhydro-	$C_6H_{10}O_5$		
71	α-D-Mannose	$C_6H_{12}O_6$	133	+29 3 → +14 5
72	β-D-Mannose	$C_6H_{12}O_6$	132	−16 3 → +14 5
73	D-Mannose, 6-deoxy- (D-Rhamnose)	$C_6H_{12}O_5$	86–90	−7 0
74	α-L-Mannose, 6-deoxy-monohydrate (L-Rhamnose)	$C_6H_{14}O_6$	93–94	−8 6 → +8 2
75	β-L-Mannose, 6-deoxy-	$C_6H_{12}O_5$	123–125	+38 4 → +8 9
76	L-Mannose, 6-deoxy-2-*O*-methyl-	$C_7H_{14}O_5$		
77	L-Mannose, 6-deoxy-3-*O*-methyl- (L-Acofriose)	$C_7H_{14}O_5$	114–115	+30 [18°]
78	L-Mannose, 6-deoxy-2,4-di-*O*-methyl-	$C_8H_{16}O_5$	82	−19 [16°]
79	L-Mannose, 6-deoxy-5-*C*-methyl-4-*O*-methyl-(Noviose)	$C_8H_{16}O_5$	128–130	+19 9 (50% C_2H_5OH)
80	Rhodinose (a 2,3,6-trideoxyhexose)	$C_6H_{12}O_3$		−11 ± 1 6
81	D-Talose	$C_6H_{12}O_6$	128–132	+16 9
82	D-Talose, 6-deoxy- (D-Talomethylose)	$C_6H_{12}O_5$	129–131	+20 6
83	L-Talose, 6-deoxy- (L-Talomethylose)	$C_6H_{12}O_5$	116–118	−19 5 ± 2 [18°]
84	L-Talose, 6-deoxy-2-*O*-methyl- (L-Acovenose)	$C_7H_{14}O_5$		−19 4
85	Heptose, D-*glycero*-D-*galacto*-	$C_7H_{14}O_7$	139–140	+47 → +64 (*c* 0 5)
86	Heptose, D-*glycero*-D-*manno*-	$C_7H_{14}O_7$		
87	Heptose, D-*glycero*-L-*manno*-	$C_7H_{14}O_7$		
	Ketoses			
88	Dihydroxyacetone	$C_3H_6O_3$	80 (dimer)	None
89	Tetrulose, L-*glycero*-[8] (L-Erythrulose, Ketoerythritol, L-Threulose)	$C_4H_8O_4$	Syrup	+12
90	Pentulose, D-*erythro*- (Adonose, D-Ribulose)	$C_5H_{10}O_5$	Syrup	+16 6 [27°]
91	Pentulose, L-*erythro*- (L-Ribulose)	$C_5H_{10}O_5$		−16 6
92	Pentulose, D-*threo*- (D-Xylulose)	$C_5H_{10}O_5$		−33
93	Pentulose, 5-deoxy-D-*threo*-	$C_5H_{10}O_4$		−5 ± 1 (CH_3OH)
94	Pentulose, L-*threo*- (L-Xylulose, L-Lyxulose, Xyloketose)	$C_5H_{10}O_5$	Syrup	+33 1
95	Hexulose, β-D-*arabino*-(β-D-Fructose, Levulose)	$C_6H_{12}O_6$	102–104[7]	−133 5 → −92
96	Hexulose, 6-deoxy-D-*arabino*- (D-Rhamnulose)	$C_6H_{12}O_5$		−13 ± 2
97	Hexulose, D-*lyxo*- (D-Tagatose)	$C_6H_{12}O_6$	131–132	+2 7 → −4, −5
98	5-Hexulose, D-*lyxo*	$C_6H_{12}O_6$	158	−86 6
99	Hexulose, 6-deoxy-L-*lyxo*- (L-Fuculose)	$C_6H_{12}O_5$		

Part I. NATURAL MONOSACCHARIDES: ALDOSES AND KETOSES (Continued)

	Substance (Synonym)	Chemical Formula	Melting Point °C	Specific Rotation $[\alpha]_D$
	(A)	(B)	(C)	(D)
	Ketoses (Con't)			
100	Hexulose, D-*ribo*- (D-Psicose)	$C_6H_{12}O_6$	Amorphous	+4 7
101	Hexulose, L-*xylo*- (L-Sorbose)	$C_6H_{12}O_6$	159–161	−43 1
102	Hexulose, 6-deoxy-L-*xylo*-	$C_6H_{12}O_5$	88	−25 ± 2 (*c* 0 7)
103	Heptulose, D-*altro*- (Sedoheptulose, Sedoheptose)	$C_7H_{14}O_7$	Amorphous	+2 5 (*c* 10)
104	Heptulose·hemihydrate, L-*galacto*- (Perseulose)	$C_7H_{14}O_7 \cdot \frac{1}{2}H_2O$	110–115	−90 → −80
105	Heptulose, L-*gulo*-	$C_7H_{14}O_7$		−28
106	Heptulose, D-*ido*-	$C_7H_{14}O_7$	172	−34 ± 8 (*c* 0.3)
107	Heptulose, D-*manno*- (Mannoketoheptose, D-Mannotagatoheptose)	$C_7H_{14}O_7$	152	+29.4
108	Heptulose, D-*talo*-	$C_7H_{14}O_7$		
109	Octulose, D-*glycero*-L-*galacto*-	$C_8H_{16}O_8$		−57, −43.4 → −13 4
110	Octulose, D-*glycero*-D-*manno*-	$C_8H_{16}O_8$		+20 (CH_3OH)

[1] Original melting point. [2] Melting point after four-months' storage [3] As a methyl glycoside cyclohexylamine salt. [4] Included because of speculations concerning it in biological processes. [5] Either D-idose or L-altrose is in the polysaccharide varianose. [6] Early literature refers to this as D-erythrose. [7] The $\cdot\frac{1}{2}H_2O$ and $\cdot 2H_2O$ forms also exist.

Part II. NATURAL MONOSACCHARIDES: AMINO SUGARS

	Substance (Synonym)	Chemical Formula	Melting Point °C	Specific Rotation $[\alpha]_D$
	(A)	(B)	(C)	(D)
	Aldosamines			
1	D-Ribose, 3-amino-3-deoxy-	$C_5H_{11}NO_4$	158–158.5 d.	−24 6 (hydrochloride)
2	D-Galactose, 2-amino-2-deoxy- (Galactosamine; Chondrosamine)	$C_6H_{13}NO_5$	185	+121 → +80 (hydrochloride)
3	α-L-Galactose, 2-amino-2,6-dideoxy- (L-Fucosamine)	$C_6H_{13}NO_4$	192–193 d.	−119 → −92 [27°] (hydrochloride)
4	α-D-Glucose, 2-amino-2-deoxy- (Glucosamine; Chitosamine)	$C_6H_{13}NO_5$	88	+100 → +47.5
5	β-D-Glucose, 2-amino-2-deoxy-	$C_6H_{13}NO_5$	110–111	+28 → +47.5
6	D-Glucose, 3-amino-3-deoxy- (Kanosamine)	$C_6H_{13}NO_5$	128 d.	+19 [14°]
7	D-Glucose, 6-amino-6-deoxy-	$C_6H_{13}NO_5$	161–162 d.	+23 → +50.1 (hydrochloride)
8	D-Glucose, 2,6-diamino-2,6-dideoxy- (Neosamine C)	$C_6H_{14}N_2O_4$	>230	+61.5 (dihydrochloride)
9	D-Glucose, 3,6-dideoxy-3-dimethylamino- (Mycaminose)	$C_8H_{17}NO_4$	115–116	+31 (hydrochloride)
10	D-Glucose, 4,6-dideoxy-4-dimethylamino-	$C_8H_{17}NO_4$	192–193	+45.5 (hydrochloride)
11	L-Glucose, 2-deoxy-2-methylamino-	$C_7H_{15}NO_5$	130–132	−64
12	D-Gulose, 2-amino-1,6-anhydro-2-deoxy-	$C_6H_{11}NO_4$	250–260 d.	+41 ± 2 (hydrochloride)
13	D-Gulose, 2-amino-2-deoxy-	$C_6H_{13}NO_5$	152–162 d.	+5.6 → −18.7 (hydrochloride)

Part II. NATURAL MONOSACCHARIDES: AMINO SUGARS (Continued)

	Substance (Synonym)	Chemical Formula	Melting Point °C	Specific Rotation $[\alpha]_D$
	(A)	(B)	(C)	(D)
	Aldosamines (Con't)			
14	Hexose, 3,4,6-trideoxy-3-dimethylamino-D-*xylo*- (Desosamine, Picrocine)	$C_8H_{17}NO_3$	189–191 d	+49 5 (*c* 10) (hydrochloride)
15	Hexose, a 4-acetamido-2-amino-2,4,6-trideoxy-	$C_8H_{16}N_2O_4$	216–219	+115 → +94 [26°] (*c* 0 05)
16	Hexose, an amino-deoxy-3-*O*-carboxyethyl-	$C_9H_{17}NO_7$		
17	Hexose, a 2,6-diamino-2,6-dideoxy- (Neosamine B, Paramose)	$C_6H_{14}N_2O_4$	135–150 d	+17 5 (*c* 0 9 (hydrochloride)
18	Hexose, a 3-dimethylamino-2,3,6-trideoxy- (Rhodosamine)	$C_8H_{17}NO_3$		
19	D-Mannose, 2-amino-2-deoxy- (Mannosamine)	$C_6H_{13}NO_5$	142 d	−4 3 (*c* 9) (hydrochloride)
20	D-Mannose, 3-amino-3,6-dideoxy- (Mycosamine)	$C_6H_{13}NO_4$	162	−11 5 (hydrochloride)
21	D-Talose, 2-amino-2-deoxy- (Talosamine)	$C_6H_{13}NO_5$	151–153	+3 4 → −5 7 (*c* 0 9) (hydrochloride)
22	L-Talose, 2-amino-2,6-dideoxy- (Pneumosamine)	$C_6H_{13}NO_4$	162–163	+6 9 → +10 4 (hydrochloride)
	Ketosamines			
23	Pentulose, 1-(*o*-carboxyanilino)-1-deoxy-D-*erythro*-	$C_{12}H_{14}NO_6$		
24	Hexulose, 1-(*o*-carboxyanilino)-1-deoxy-D-*arabino*-	$C_{13}H_{16}NO_7$		
25	Hexulose, 5-amino-5-deoxy-L-*xylo*-	$C_6H_{13}NO_5$	174–176	−62
26	Hexulose, 6-deoxy-6-(*N*-methylacetamido)-L-*xylo*-	$C_9H_{17}NO_6$		

Part III. NATURAL ALDITOLS AND INOSITOLS (with Inososes and Inosamines)

	Substance (Synonym)	Chemical Formula	Melting Point °C	Specific Rotation $[\alpha]_D$
	(A)	(B)	(C)	(D)
	Alditols			
1	Glycerol	$C_3H_8O_3$	20	None
2	Glycerol, 1-deoxy- (1,2-Propane-diol)[1]	$C_3H_8O_2$	Oil, b p 188–189	None (racemic)
3	Erythritol	$C_4H_{10}O_4$	118–120	None (meso)
4	Erythritol, 1,4-dideoxy- (2,3-Butyleneglycol)	$C_4H_{10}O_2$	25, 34	None (meso)
5	D-Threitol, 1,4-dideoxy-	$C_4H_{10}O_2$	19	−13 0
6	L-Threitol, 1,4-dideoxy-	$C_4H_{10}O_2$		+10 2
7	DL-Threitol, 1,4-dideoxy-	$C_4H_{10}O_2$	7 6	None (racemic)
8	D-Arabinitol	$C_5H_{12}O_5$	103	+7 82 (*c* 8, borax solution)
9	L-Arabinitol	$C_5H_{12}O_5$	101–102	−32 (*c* 0 4, 5% molybdate)
10	Ribitol (Adonitol)	$C_5H_{12}O_5$	102	None (meso)
11	Galactitol (Dulcitol)	$C_6H_{14}O_6$	186–188	None (meso)

CARBOHYDRATES (Continued)
Part III. NATURAL ALDITOLS AND INOSITOLS
(with Inososes and Inosamines) (Continued)

	Substance (Synonym)	Chemical Formula	Melting Point °C	Specific Rotation $[\alpha]_D$
	(A)	(B)	(C)	(D)
	Alditols (Con't)			
12	D-Glucitol (Sorbitol)	$C_6H_{14}O_6$	112	−1.8 [15°]
13	D-Glucitol, 1,5-anhydro- (Polygalitol)	$C_6H_{12}O_5$	140–141	+42.4
14	L-Iditol	$C_6H_{14}O_6$	73.5	−3 5 (*c* 10)
15	D-Mannitol	$C_6H_{14}O_6$	166	−0.21
16	D-Mannitol, 1,5-anhydro- (Styracitol)	$C_6H_{12}O_5$	157	−49.9
17	Heptitol, D-*glycero*-D-*galacto*- (Heptitol, L-*glycero*-D-*manno*-; Perseitol)	$C_7H_{16}O_7$	183–185, 188	−1.1
18	Heptitol, D-*glycero*-D-*gluco*- (Heptitol, L-*glycero*-D-*talo*-; β-Sedoheptitol)	$C_7H_{16}O_7$	131–132	+46 (5% NH_4 molybdate)
19	Heptitol, D-*glycero*-D-*manno*- (Heptitol, D-*glycero*-D-*talo*-; Volemitol)	$C_7H_{16}O_7$	153	+2.65
20	Octitol, D-*erythro*-D-*galacto*-	$C_8H_{18}O_8$. H_2O	169–170	−11 (5% NH_4 molybdate)
	Inositols			
21	Betitol (a dideoxy inositol)	$C_6H_{12}O_4$	224	
22	Bioinosose (*scyllo*-Inosose; *myo*-Inosose-2, a deoxy keto inositol)	$C_6H_{10}O_6$	198–200	None (meso)
23	*h*-Bornesitol (a *myo*-inositol monomethyl ether)	$C_7H_{14}O_6$	200	+31.6
24	*l*-Bornesitol (a *myo*-inositol monomethyl ether)	$C_7H_{14}O_6$	205–206	−32.1
25	Conduritol (a 2,3-dehydro-2,3-dideoxyinositol)	$C_6H_{10}O_4$	142–143	None (meso)
26	Cordycepic acid (a tetrahydroxycyclohexanecarboxylic acid)[2]	$C_7H_{12}O_6$		
27	Dambonitol (a *myo*-inositol dimethyl ether)	$C_8H_{16}O_6$	206	None (meso)
28	DL-Inositol	$C_6H_{12}O_6$	253	None (racemic)
29	*d*-Inositol	$C_6H_{12}O_6$		+60
30	*l*-Inositol	$C_6H_{12}O_6$	240	−65
31	Laminitol (a *C*-methyl *myo*-inositol)	$C_7H_{14}O_6$	266–269	−3
32	Liriodendritol (a *myo*-inositol dimethyl ether)	$C_8H_{16}O_6$	224	−25
33	*muco*-Inositol monomethyl ether	$C_7H_{14}O_6$	322–325	
34	*myo*-Inositol (*meso*-Inositol)	$C_6H_{12}O_6$	217–218	None (meso)
35	*d*-*myo*-Inosose-1 (a deoxy keto inositol)	$C_6H_{10}O_6$	138–139	+19.6
36	Mytilitol (a *C*-methyl *scyllo*-inositol)	$C_7H_{14}O_6$	259	None (meso)
37	*neo*-Inosamine-2 (a deoxy amino inositol)	$C_6H_{13}O_5N$	239–241 d.	None (meso)
38	*d*-Ononitol (a *myo*-inositol monomethyl ether)	$C_7H_{14}O_6$	172	+6.6
39	*h*-Pinitol (a *dextro*-inositol monomethyl ether)	$C_7H_{14}O_6$	186	+65.5
40	*l*-Pinitol (a *levo*-inositol monomethyl ether)	$C_7H_{14}O_6$	186	−65
41	*l*-Quebrachitol (a *levo*-inositol monomethyl ether)	$C_7H_{14}O_6$	190–191	−80.2 [28°]
42	*d*-Quercitol (a deoxy *dextro*-inositol)	$C_6H_{12}O_5$	235	+24.2
43	*d*-Quinic acid (a trideoxy carboxy *dextro*-inositol)	$C_7H_{12}O_6$	164	+44 (*c* 10)

CARBOHYDRATES (Continued)

Part III. NATURAL ALDITOLS AND INOSITOLS (with Inososes and Inosamines) (Continued)

	Substance (Synonym)	Chemical Formula	Melting Point °C	Specific Rotation $[\alpha]_D$
	(A)	(B)	(C)	(D)
	Inositols (Con't)			
44	*l*-Quinic acid (a trideoxy carboxy *levo*-inositol)	$C_7H_{12}O_6$	162	−42.1
45	Quinic acid, 5-dehydro-	$C_7H_{10}O_6$	140–142 (138 s.)	−82.4 [28°]
46	Scyllitol (*scyllo*-Inositol; Cocositol)	$C_6H_{12}O_6$	352–353	None (meso)
47	Sequoyitol (a *myo*-inositol monomethyl ether)	$C_7H_{14}O_6$	234–235	None (meso)
48	Shikimic acid (a 3,4-anhydro-quinic acid)	$C_7H_{10}O_5$	183–184	−200 [16°]
49	Shikimic acid, 5-dehydro-	$C_7H_8O_5$	150–152	−57.5 [28°] (EtOH)
50	Streptamine (2,4-diaminodideoxy-scyllitol)	$C_6H_{14}O_4N_2$	88, 210–250 d.	None (meso)
51	Streptamine, 2-deoxy-	$C_6H_{14}O_3N_2$	.....	None (meso)
52	Streptadine (1,3-Dideoxy-1,3-diguanidino-scyllitol)	$C_8H_{18}N_6O_4$	.....	None (meso)
53	Viburnitol (a deoxy *levo*-inositol)[3]	$C_6H_{12}O_5$	174	−73.9

[1] The 1-phosphate ester of this diol is said to occur in brain tissue and sea-urchin eggs. [2] Strong evidence that cordycepic acid is really D-mannitol. [3] Not an enantiomorph of *d*-quercitol; other isomeric relationship is involved.

Part IV. NATURAL ALDONIC, URONIC, AND ALDARIC ACIDS

	Substance (Synonym)	Chemical Formula	Melting Point °C	Specific Rotation $[\alpha]_D$
	(A)	(B)	(C)	(D)
	Aldonic Acids			
1	D-Glyceric acid	$C_3H_6O_4$	Gum	Dextro
2	L-Glyceric acid	$C_3H_6O_4$	Gum	Levo
3	D-Arabinonic acid	$C_5H_{10}O_6$	114–116	+10.5 (*c* 6)
4	L-Arabinonic acid	$C_5H_{10}O_6$	118–119	−9.6 → −41.7[1]
5	L-Arabinonic-1,4-lactone	$C_5H_8O_5$	97–99	−72
6	D-Ribonic acid	$C_5H_{10}O_6$	112–113	−17.0
7	D-Xylonic acid	$C_5H_{10}O_6$	.....	−2.9 → +20.1[1]
8	L-Xylonic acid	$C_5H_{10}O_6$	.....	−91.8[1]
9	D-Altronic acid	$C_6H_{12}O_7$	.....	+11.5 → +24.8[1] (Ca salt, *N* HCl)
10	D-Galactonic acid	$C_6H_{12}O_7$	122	−11.2 → +57.6[1]
11	D-Gluconic acid	$C_6H_{12}O_7$	130–132 (110–112 s.)	−6.7 → +11.9[1]
12	L-Gulonic acid	$C_6H_{12}O_7$	Exists only in soln.	[ca. 0°]
13	Hexsonic acid, 2-deoxy-D-*arabino*-	$C_6H_{12}O_6$	93–95	+68 (lactone)
14	2-Hexulosonic acid, D-*arabino*-	$C_6H_{10}O_7$	.....	−81.7 (Na salt)
15	2-Hexulosonic acid, 3-deoxy-D-*erythro*-	$C_6H_{10}O_6$	.....	−29.2 (*c* 6, Ca salt)
16	2-Hexulosonic acid, D-*lyxo*-	$C_6H_{10}O_7$	169	−5
17	5-Hexulosonic acid, D-*arabino*-	$C_6H_{10}O_7$	108–109	.....
18	5-Hexulosonic acid, D-*xylo*-	$C_6H_{10}O_7$	.....	−14.5
19	D-Mannonic acid	$C_6H_{12}O_7$	.....	−15.6
20	D-Gluconic acid, *O*-β-D-galactopyranosyl- (1 → 4)- (Lactobionic acid)	$C_{12}H_{22}O_{12}$	.....	+25.1 (Ca salt)

Part IV. NATURAL ALDONIC, URONIC, AND ALDARIC ACIDS (Continued)

	Substance (Synonym)	Chemical Formula	Melting Point °C	Specific Rotation $[\alpha]_D$
	(A)	(B)	(C)	(D)
	Uronic Acids			
21	L-Lyxuronic acid	$C_5H_8O_6$		
22	β-D-Galacturonic acid	$C_6H_{10}O_7$	160	+27 → +55 6
23	α-D-Galacturonic acid·monohydrate	$C_6H_{12}O_8$	159–160 (110–115 s)	+97 9 → +50 9
24	D-Galacturonic acid, 2-amino-2-deoxy-	$C_6H_{11}O_6N$	160 d.	+84 5 (pH 2 HCl)
25	β-D-Glucuronic acid	$C_6H_{10}O_7$	156	+11 7 → +36.3
26	D-Glucuronic acid, 2-amino-2-deoxy-	$C_6H_{11}O_6N$	120–172 d.	+55
27	D-Glucuronic acid, 3-*O*-methyl-	$C_7H_{12}O_7$	Syrup	+6
28	L-Guluronic acid	$C_6H_{10}O_7$		
29	L-Iduronic acid	$C_6H_{10}O_7$		+30
30	β-D-Mannuronic acid	$C_6H_{10}O_7$	165–167	−47 9 → −23.9
31	α-D-Mannuronic acid·monohydrate	$C_6H_{12}O_8$	110 s , 120–130 d.	+16 → −6 1 (*c* 6.8)
	Aldaric Acids			
32	D-Tartaric acid	$C_4H_6O_6$	170	−15
33	L-Tartaric acid	$C_4H_6O_6$	170	+15 [15°]
34	L-Malic acid	$C_4H_6O_5$	100	−2 3 (*c* 8.4)

[1] Equilibrates with the lactone.

FATS AND OILS

These data for fats and oils were compiled originally for the Biology Data Book by H. J. Harwood, and R. P. Geyer. 1964. Data are reproduced here by permission of the copyright owners of the above publication, the Federation of American Societies for Experimental Biology, Washington, D C. pp. 380–382.

Values are typical rather than average, and frequently were derived from specific analyses for particular samples (especially the constituent fatty acids). Extreme variations may occur, depending on a number

	Fat or Oil	Source	Constants				
			Melting (or Solidification) Point, °C	Specific Gravity (or Density)	Refractive Index $n_D^{40°}$	Iodine Value	Saponification Value
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
	Land Animals						
1	Butterfat	*Bos taurus*	32 2	0 911$^{40°/15°}$	1 4548	36 1	227
2	Depot fat	*Homo sapiens*	(15)	0 918$^{15°}$	1 4602	67 6	196 2
3	Lard oil	*Sus scrofa*	(30 5)	0 919$^{15°}$	1 4615	58 6	194 6
4	Neat's-foot oil	*B. taurus*		0 910$^{25°}$	1 464$^{25°}$	69–76	190–199
5	Tallow, beef	*B. taurus*				49 5	197
6	Tallow, mutton	*Ovis aries*	(42 0)	0 945$^{15°}$	1 4565	40	194
	Marine Animals						
7	Cod-liver oil	*Gadus morhua*		0 925^{25}	1 481$^{25°}$	165	186
8	Herring oil	*Clupea harengus*		0 900$^{60°}$	1 4610$^{60°}$	140	192
9	Menhaden oil	*Brevoortia tyrannus*		0 903$^{60°}$	1 4645$^{60°}$	170	191
10	Sardine oil	*Sardinops caerulea*		0 905$^{60°}$	1 4660$^{60°}$	185	191
11	Sperm oil, body	*Physeter macrocephalus*				76–88	122–130
12	Sperm oil, head	*P. macrocephalus*				70	140–144
13	Whale oil	*Balaena mysticetus*		0 892^{60}	1 460$^{60°}$	120	195
	Plants						
14	Babassu oil	*Attalea funifera*	22–26	(0 893$^{60°}$)	1 443$^{60°}$	15 5	247
15	Castor oil	*Ricinus communis*	(−18 0)	0 961$^{15°}$	1 4770	85 5	180 3
16	Cocoa butter	*Theobroma cacao*	34 1	0 964$^{15°}$	1 4568	36 5	193 8
17	Coconut oil	*Cocos nucifera*	25 1	0 924$^{15°}$	1 4493	10 4	268
18	Corn oil	*Zea mays*	(−20 0)	0 922$^{15°}$	1 4734	122 6	192 0
19	Cotton seed oil	*Gossypium hirsutum*	(−1 0)	0 917$^{25°}$	1 4735	105 7	194 3
20	Linseed oil	*Linum usitatissimum*	(−24 0)	0 938$^{15°}$	1 4782$^{25°}$	178 7	190 3
21	Mustard oil	*Brassica hirta*		0 9145$^{15°}$	1 475	102	174
22	Neem oil	*Melia azadirachta*	−3	0 917$^{15°}$	1 4615	71	194 5
23	Niger-seed oil	*Guizotia abyssinica*		0 925$^{15°}$	1 471	128 5	190
24	Oiticica oil	*Licania rigida*		0 974$^{25°}$		140–180	
25	Olive oil	*Olea europaea sativa*	(−6 0)	0 918$^{15°}$	1 4679	81 1	189 7
26	Palm oil	*Elaeis guineensis*	35 0	0 915$^{15°}$	1 4578	54 2	199 1
27	Palm-kernel oil	*E. guineensis*	24 1	0 923$^{15°}$	1 4569	37 0	219 9
28	Peanut oil	*Arachis hypogaea*	(3 0)	0 914$^{15°}$	1 4691	93 4	192 1
29	Perilla oil	*Perilla frutescens*		(0 935$^{15°}$)	1 481$^{25°}$	195	192
30	Poppy-seed oil	*Papaver somniferum*	(−15)	0 925$^{15°}$	1 4685	135	194
31	Rapeseed oil	*Brassica campestris*	(−10)	0 915$^{15°}$	1 4706	98 6	174 7
32	Safflower oil	*Carthamus tinctorius*		(0 900$^{60°}$)	1 462$^{60°}$	145	192
33	Sesame oil	*Sesamum indicum*	(−6 0)	0 919$^{25°}$	1 4646	106 6	187 9
34	Soybean oil	*Glycine soja*	(−16 0)	0 927$^{15°}$	1 4729	130 0	190 6
35	Sunflower-seed oil	*Helianthus annuus*	(−17 0)	0 923$^{15°}$	1 4694	125 5	188 7
36	Tung oil	*Aleurites fordi*	(−2 5)	0 934$^{15°}$	1 5174$^{25°}$	168 2	193 1
37	Wheat-germ oil	*Triticum aestivum*				125	

[1] Caproic. [2] Capryli. [3] Capric. [4] Butyric. [5] Decenoic. [6] C_{12} monoethenoic. [7] C_{14} monoethenoic. [8] Gadoleic plus erucic. [9] C_{12} n-pentadecanoic. [10] C_{17} margaric. [11] 12-Methyl tetradecanoic. [12] C_{20} polyethenoic.

of variables such as source, treatment, and age of a fat or oil **Specific Gravity** (column D) was calculated at the specified temperature (degrees centigrade) and referred to water at the same temperature, unless otherwise specified **Density**, shown in parentheses (column D), was measured at the specified temperature (degrees centigrade) **Refractive Index** (column E) was measured at 50°C, unless otherwise specified

Constituent Fatty Acids, g/100 g total fatty acids

	Saturated						Unsaturated				
	Lauric	Myristic	Palmitic	Stearic	Arachidic	Other	Palmitoleic	Oleic	Linoleic	Linolenic	Other
	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)
1	2 5	11 1	29 0	9 2	2 4	2 0[1], 0 5[2], 2 3[3]	4 6	26 7	3 6		3 6[4], 0 1[5], 0 1[6], 0.9 7 1 4[8], 1 0[9], 1 0[10], 0 4[11]
2		2 7	24 0	8 4			5	46 9	10 2		2 5[8]
3		1 3	28 3	11 9			2 7	47 5	6		0 2[7], 2 1[8]
4			17–18	2 3				74 76			
5		6 3	27 4	14 1				49 6	2 5		
6		4 6	24 6	30 5				36 0	4 3		
7		5 8	8 4	0 6			20 0	←29 1→			25 4[12], 9 6[13]
8		7 3	13 0	Trace			4 9			20 7	30 1[12], 23 2[13]
9		5 9	16 3	0 6	0 6		15 5			29 6	19 0[12], 11 7[13], 0 8[14]
10		3 1	14 6	3 2			11 8	←17 8→			18 1[12], 14 0[13], trace[7], 15 4[15]
11	1	5	6 5				26 5	37	19		1[13], 4[7], 19[16]
12	16	14	8	2		3 5[3]	15	17	6 5		4[6], 14[7], 6 5[16]
13	0 2	9 3	15 6	2 8			14 4	35 2			13 6[12], 5 9[13], 2 5[7], 0 2[17]
14	44 1	15 4	8 5	2 7	0 2	0 2[1], 4 8[2], 6 6[3]		16 1	1 4		
15	←2 4→							7 4	3 1		8 7[18]
16			24 4	35 4				38 1	2 1		
17	45 4	18 0	10 5	2 3	0 4[19]	0 8[1], 5 4[2], 8 4[3]	0 4	7 5	Trace		
18		1 4	10 2	3 0			1 5	49 6	34 3		
19		1 4	23 4	1 1	1 3		2 0	22 9	47 8		
20			6 3	2 5	0 5			19 0	24 1	47 4	0 2[11]
21		1 3[20]						27 2[20]	16 6[20]	1 8[20]	1 1[11], 1 0[21], 51 0[22]
22		2 6[20]	14 1[20]	24 0[20]	0 8[20]			58 5[20]			
23		3 3[20]	8 2[20]	4 8[20]	0 5[20]			30 3[20]	57 3[20]		
24	←11 3[23]→							6 2			82 5[21]
25		Trace	6 9	2 3	0 1			84 4	4 6		
26		1 4	40 1	5 5				42 7	10 3		
27	46 9	14 1	8 8	1 3		2 7[2], 7 0[3]		18 5	0 7		
28			8 3	3 1	2 4			56 0	26 0		3 1[11], 1 1[21]
29	←9 6[23]→							17 8		17 5	
30			4 8[20]	2 9[20]				30 1[20]	62 2[20]		
31			1					32	15	1	50[22]
32	←6 8[23]→							18 6	70 1	3 4	
33			9 1	4 3	0 8			45 4	40 4		
34	0 2	0 1	9 8	2 4	0 9		0 4	28 9	50 7	6 5	0 1[7]
35			5 6	2 2	0 9			25 1	66 2		
36	←4 6[23]→							4 1	0 6		90 7[25]
37	←16 0[23]→							28 1	52 3	3 6	

[13] C_{22} polyethenoic [14] Behenic [15] C_{14} polyethenoic [16] Gadoleic [17] C_{24} polyethenoic. [18] Ricinoleic. [19] Includes behenic and lignoceric [20] Percent by weight [21] Lignoceric [22] Erucic [23] Includes behenic [24] Licanic [25] Eleostearic

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WAXES

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Specific Gravity (column C) was calculated at the specified temperature, degrees centigrade, and referred to water at the same temperature **Density.** shown in parentheses (column C), and **Refractive Index** (column D) were measured at the specified temperature, degrees centigrade

	Wax	Melting Point °C	Specific Gravity or (Density)	Refractive Index $n\frac{°C}{D}$	Iodine Value	Acid Value	Saponification Value
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
1	Bamboo leaf	79–80	(0 961$^{25°}$)		7 8[1]	14 5	43 4
2	Bayberry (myrtle)	46 7–48 8	(0 985$^{15°}$)	1 436$^{80°}$	2 9[2]–3 9[3]	3 5	20 5–21 7
3	Beeswax, crude	62–66	(0 927–0 970$^{15°}$)	1 439–1 483$^{40°}$	6 8–16 4[2]	16 8–35 8	89 3–149 0
4	Beeswax, white, U S P	61–69	(0 959–0 975$^{15°}$)	1 447–1 465$^{65°}$	7–11[3]	17–24	90–96
5	Beeswax, yellow	62–65	(0 960–0 964$^{15°}$)	1 443–1 449$^{65°}$	6–11	18–24	90–97
6	Candelilla, refined	67–69	(0 982–0 986$^{15°}$)	1 454–1 463$^{85°}$	14 4–20 4	12 7–18 1	35–86
7	Cape berry[4]	40 5–45 0	(1 004–1 007$^{15°}$)	1 450$^{45°}$	0 6–2 4	2 5–3 7	211–215
8	Carandá	79 7–84 5	(0 990$^{25°}$)		8 0–8 9	5 0–9 5	64 5–78 5
9	Carnauba	83–86	0 990–1 001$^{15°}$	1 467–1 472$^{40°}$	7 2–13 5	2 9–9 7	78–95
10	Castor oil, hydrogenated	83–88	(0 980–0 990$^{20°}$)		2 5–8 5	1 0–5 0	177–181
11	Chinese insect	81 5–84 0	0 950–0 970$^{15°}$	1 457$^{40°}$	1 4	0 2–1 5	73–93
12	Cotton	68–71	0 959$^{15°}$		24 5	32	70 6
13	Cranberry	207–218	(0 970–0 975$^{15°}$)		44 2–53 2[2]	42 2–59 1	131–134
14	Douglas-fir bark	59 0–72 8	(1 030$^{25°}$)	1 468$^{80°}$	25 8–62 5	58 6–80 7	112–200
15	Esparto	67 5–78 1	0 988$^{15°}$		22–23	22 7–23 9	69 8–79 3
16	Flax	61 5–69 8	0 908–0 985$^{15°}$		21 6–28 8	17 5–48 3	77 5–101 5
17	Ghedda, E Indian beeswax	60 5–66 4	0 956–0 973$^{15°}$	1 440$^{50°}$	5 6–12 6	5 8–7 9	84 5–118 3
18	Indian corn	80–81			4 2[2]	1 9	120 3
19	Japan wax	48–53	0 975–0 993$^{15°}$		4 5–12 5	6–20	206 5–237 5
20	Jojoba	11 2–11 8	0 864–0 899$^{25°}$	1 465$^{25°}$	81 7–88 4[2]	0 2–0 6	92 2–95 0
21	Madagascar	88			3 2–5 3	17 7–28 0	140 0–159 6
22	Microcrystalline, amber	64–91	0 913–0 943$^{15°}$	1 424–1 452$^{80°}$	0	0	0
23	Microcrystalline, white	71–89	0 928–0 941$^{15°}$	1 441$^{80°}$	0	0	0
24	Montan, crude	76–86	(1 010–1 020$^{25°}$)		13 9–17 6	22 7–31 0	59 4–92 0
25	Montan, refined	77–84	(1 010–1 030$^{25°}$)		10–14	24–43	72–103
26	Orange peel	44 0–46 5	0 985$^{15°}$	1 502$^{20°}$	115 7[2]	48 3	120 9
27	Ouricury, refined	79 0–83 8	1 053$^{15°}$		6 9–7 8[2]	3 4–21 1	61 8–85 8
28	Ozocerite, refined	74 4–75 0	0 907–0 920$^{15°}$		0	0	0
29	Palm	74–86	(0 991–1 045$^{15°}$)		8 9–16 9[2]	5 0–10 6	64 5–104 0
30	Paraffin, American	49–63	0 896–0 925$^{15°}$	1 442–1 448$^{80°}$	0	0	0
31	Peat wax, natural	73–76	0 980$^{15°}$		16–40	60 0–73 3	73 9–136 0
32	Rice bran, refined	75 3–79 9		1 469$^{30°}$	11 1–19 4	15–17	56 9–104 4
33	Shellac wax	79–82	0 971–0 980$^{15°}$		6 0–8 8[3]	12 1–24 3	63 8–83 0
34	Sisal hemp	74–81	1 007–1 010$^{15°}$		28–29[2]	16–19[2]	56–58
35	Sorghum grain	77–82			15 7–20 9	10 1–16 2	16–44
36	Spanish moss	79–80			33 0	25 0	120 4
37	Spermaceti	42–50	0 905–0 945$^{15°}$	1 440$^{70°}$	4 8–5 9	2 0–5 2	108–134
38	Sugarcane, crude	52–67	0 988–0 998$^{25°}$		32–84	24–57	128–177
39	Sugarcane, double-refined	77–82	0 961–0 979$^{25°}$	1 510$^{25°}$	13–29	8–23	55–95
40	Wool wax, refined	36–43	0 932–0 945$^{15°}$	1 478–1 482$^{40°}$	15 0–46 9	5 6–22 0	80–127

[1] Wijs test [2] Hanus test [3] Hubl test [4] *Myrica cordifolia*

Handbook of tables for Organic Compound Identification, © 1967 CRC

DIAMAGNETIC SUSCEPTIBILITIES OF ORGANIC COMPOUNDS

Compiled by George W Smith

The following table contains values for the molar susceptibility of χ_M, specific susceptibility χ and volumetric susceptibility k. The cgs Gaussian system of units is employed. In the Gaussian units the relation between magnetic induction B and magnetic field strength H is

$$B = H + 4\pi I \qquad (1)$$

where I is the magnetization or magnetic moment per unit volume. Actually the quantities involved in equation (1) are all vectors but one may assume that all three are collinear, a reasonable assumption for organic diamagnetic substances in the liquid state. For crystals I may vary with crystal orientation. Equation (1) may be rewritten

$$B = H + 4\pi kH = (I + 4\pi k)H \qquad (2)$$

Here, K is the magnetic susceptibility often called the volumetric susceptibility and is a unitless quantity.

Other susceptibilities of use to chemists and physicists are the specific or mass susceptibility which is defined

$$\chi = k/\rho \qquad (3)$$

where ρ is the density of the sample in grams per cc., and the molar susceptibility which is defined as

$$\chi_M = M\chi = Mk/\rho \qquad (4)$$

where M is the molecular weight of the substance in grams.

Temperatures, when listed, are enclosed in parentheses and are listed in degrees C.

Literature references for values contained in this table may be found in General Motors Research Laboratories publication GMR-317.

Compound	$-\chi_M \times 10^6$	$-\chi \times 10^6$	$-k \times 10^6$	Compound	$-\chi_M \times 10^6$	$-\chi \times 10^6$	$-K \times 10^6$
Acenaphthanthracene	184	73		Amyl iodide	(118 7)	5996 (18°)	(910) (20°)
Acenaphthene	109 3	(709)	(726) (99°)	n-Amyl methyl ketone	80 50	705_3	(580) (15°)
Acetal	81 39	688 (32°)	(568) (32°)	Amyl nitrate	(76 4)	574	
Acetaldehyde	22 70	515_3	(403) (18°)	iso-Amyl propionate	101 73	705_4 (25°)	(609) (25°)
Acetamide	34 1	577	(618) (20°)	n-Amyl valerate	124 55	723_9	(638) (0°)
Acetic acid	31 54	525 (32°)	(551) (32°)	Anethole	(96 0)	648	(644) (15°)
Acetic anhydride	(52 8)	517	(562) (15°)	Aniline	62 95	(676)	(691) (20°)
Acetoaminofluorene	(141)	63		Anisidine	(80 5)	654	(72) (20°)
Acetone	33 7_8	581_4	(460) (20°)	Anisole	72 79	(673)	(672) (15°)
Acetonitrile	28 0	(682)	(534) (20°)	Anthanthrene	204 2	739	
Acetonylacetone	62 51	547_6	(531) (20°)	Anthanthrone	178 1	581	
Acetophenone	72 05	599_8	(615) (20°)	Anthracene	(130)	731	(914) (27°)
Acetophenone oxime	79 9_0	592_0		Anthracenedinitrile	154 6	(678)	
Acetophenone oxime-O-methyl ether	92 3_1	618_8		Anthracenonitrile	142 1	(700)	
Acetoxime	44 4_9	607_6	(480) (20°)	Anthraquinone	(119 6)	575	(825) (20°)
Acetoxime-O-benzyl ether	104 8_9	642		Anthrazine	245 7	646	
Acetoxime-O-methyl ether	54 8	629_8		Arabinose	85 70	571	(905) (20°)
Acetylacetone	54 88	548_1	(535) (20°)	Arbutoside	158 0	(589)	
Acetyl chloride	38 9	496	(548) (20°)	Asarone	131 4	(631)	(735) (18°)
Acetylene	12 5	(480)		Asparagine	69 5	(526)	(812) (15°)
Acetylphenylacetylene	86 9	508		Aspartic acid	64 2 ± 4	(482)	(800) (12°)
Acetylthiophene	71 7	(568)		Aurin	(161 4)	556	
Acridine	(123 3)	688	(757) (20°)	p-Azoanisole	(147 7)	610	
Adonitol	91 30	600		Azobenzene	(106 8)	586	611 (70 5°)
Alanine	50 5	(567)		p-Azophenetole	(171 7)	635	
Allyl acetate	(56 7)	566	(525) (20°)	m-Azotoluene	(127 8)	608	643 (58°)
Allyl alcohol	36 70	632	540 (20°)	Azulene	98 5	768	
1-Allylpyrrole	73 80	685 (20°)		Barbituric acid (Anh.)	53 8	(420)	
Aminoazobenzene	(118 3)	600		Barbituric acid ($2H_2O$)	78 6	(4 79)	
Aminoazotoluene	(142 2)	631		Benzalazine	(123 7)	594	
o-Aminoazotoluene	(138)	61 ± 02		Benzaldehyde	60 78	(573)	(602) (15°)
α-Aminobutyric acid	62 1	(602)		Benzaldoxime	(69 8)	576	(639) (20°)
Aminomethyldiethyldiazine	114 8	(696)		Benzamide	(72 3)	597	(801) (4°)
4-Aminostilbene	122 5	(628)		Benzanthrone	142 9	620	
2-Aminothiazole	56 0	564		Benzene	54 84	702 (32°)	611
n-Amyl acetate	89 06	684_2	5979 (20 7°)	Benzidine	110 9	603	(754) (20°)
iso-Amyl acetate	89 40	687	599 (20°)	Benzil	(118 6)	564	616 (100°)
n-Amyl alcohol	(67 5)	766	(624) (20°)	Benzoic acid	70 28	(575)	(728) (15°)
γ-Amyl alcohol	(71 0)	8060	(655) (25°)	Benzoic anhydride	(124 9)	552	(662) (15°)
Inactive Amyl alcohol	69 06	783_3 (25°)		Benzonitrile	65 19	(632)	(638) (15°)
iso-Amyl alcohol	68 96	782_3 (25°)	(64) (15°)	Benzophenone	109 60	601_3	(66) (50°)
sec-Amyl alcohol	69 1	785	(635) (20°)	3,4-Benzopyrene	135 7	538	
tert-Amyl alcohol	(70 9)	804	(654) (15°)	Benzopyrene	194 0		
n-Amylamine	69 4	(796)	(606) (20°)	Benzoyl acetone	(95 0)	586	(639) (60°)
iso-Amylamine	71 6	(821)	(616) (20°)	Benzoyl chloride	(75 8)	539 (20°)	(657) 15°)
n-Amylbenzene	112 55	(759)	(652) (20°)	Benzyl acetate	93 18	(620)	(655) (16°)
iso-Amyl bromide	(88 7)	587	(706) (20°)	Benzyl alcohol	71 83	(664)	(697) (15°)
iso-Amyl-n-butyrate	113 52	717_4 (25°)	(616) (25°)	Benzylamine	75 26	(702)	(690) (19°)
iso-Amyl chloride	(79 0)	741	(662) (20°)	Benzyl chloride	81 98	(647)	(713) (18°)
iso-Amyl cyanide	73 4	(755)	(609) (20°)	Benzyl formate	81 43	(598)	(646) (20°)
iso-Amylene	53 7	766		Benzylideneaniline	(100 4)	554	
Amylene bromide	(114 5)	498		Benzylidene chloride	(97 9)	608	(763) (14°)
Amylene chloride	(95 2)	675		Benzylidenemethylamine	(73 1)	613	
iso-Amyl ether	(129)	813	(635) (15°)	Benzyl methyl ketone	83 44	621_9	(624) (20°)
iso-Amyl formate	78 38	674_8	(591) (25°)	Bibenzyl	(126 8)	696	671 (54 5°)
Amylidene chloride	(93 4)	662					

Compound	$-\chi_M \times 10^6$	$-\chi \times 10^6$	$-K \times 10^6$
3,4-Bis (p-hydroxyphenyl)-2,4-hexadiene	(157)	59	
m,m -Bitolyl	(127 4)	6993 (27 4°)	(699) (16°)
m,m'-Bitolyl sulfide	(140 0)	6530 (27 4°)	
Borneol	126 0	(817)	(826) (20°)
Bromobenzene	78 92	5030 (20°)	(753) (20°)
Bromobenzenediazocyanide	86 88	(414)	
Bromochloromethane	55 0 ± 6	(425)	(846) (19°)
Bromodichloromethane	66 3 ± 3	(405)	(812) (15°)
Bromoform	82 60	327	948 (20°)
Bromonaphthalene	(123 8)	598	
α-Bromonaphthalene	115 90	560	840 (20°)
m-Bromotoluene	(93 4)	546	(770) (20°)
Bromotrichloromethane	73 1 ± 7	(369)	(758) (0°)
Butane	57 4	(988)	
iso-Butane	51 7	(890)	
1 4-Butanediol	61 5	(682)	(696) (20°)
2-Butene (cis)	42 6	(759)	
2 Butene (trans)	43 3	(772)	
1-Butene 3 4-diacetate	95 5	(555)	
2-Butene-1 4 diacetate (cis)	95 2	(553)	
2-Butene 1 4 diacetate trans)	95 1	(552)	
2-Butene 1 4 diol (cis)	54 3	(616)	
2-Butene 1 4 diol (trans)	53 5	(607)	
n-Butyl acetate	77 47	666_6 (25°)	(583) (25°)
iso Butyl acetate	78 52	676_9	(584) (25°)
n-Butyl alcohol	56 536 (20°)	(7627)	(6176) (20°)
iso-Butyl alcohol	57 704 (20°)	(7785)	(624) (20°)
sec Butyl alcohol	57 683 (20°)	(7782)	(629) (20°)
tert-Butyl alcohol	57 42	774 (25°)	(611) (20°)
n-Butylamine	58 9	(805)	(596) (20°)
iso-Butylamine	59 8	(818)	(599) (20°)
9 Butyl anthracene	176 0	(751)	
n Butylbenzene	100 79	(751)	(646) (20°)
iso-Butylbenzene	101 81	(759)	(648) (20°)
tert Butylbenzene	102 5	(764)	(662) (20°)
n Butyl benzoate	116 69	654_8	(656) (25°)
Butyl bromide	77 14	563 (20°)	(730) (20°)
iso-Butyl bromide	79 88	583 (20°)	(737) (20°)
1-n Butyl chloride	67 10	725	642 (20°)
2-n-Butyl chloride	67 40	728	635 (20°)
n-Butyl cyanide	(62 8)	7358 (27 4°)	(606) (20°)
tert-Butyl cyclohexane	115 09	8205	6670 (20°)
1,4-Butyl diacetate	103 4	(594)	
n Butyl ethyl ketone	80 73	707_0	(579) (20°)
n Butyl formate	65 83	644_7	(571) (25°)
iso Butyl formate	66 79	654_9	(574) (25°)
iso Butylideneazine	(95 8)	683	
Butyl iodide	(93 6)	5086 (18°)	(822) (20°)
iso-Butyl methyl ketone	70 05	699_5	(561) (20°)
tert-Butyl methyl ketone	69 86	697_9	(558) (16°)
n Butyl perfluor n-butyrate	126 7	(469)	
p tert Butylphenol	108 0	(719)	(653) (114°)
Butyl sulfide	(113 7)	7774 (27 4°)	(652) (16°)
Butyl thiocyanate	(79 38)	6891 (27 4°)	(659) (25°)
2 Butyne 1 4 diacetate	95 9	(564)	
2 Butyne 1 4 dibenzoate	169 0	(561)	
2 Butyne-1 4-diol	50 3	(584)	
n Butyraldehyde	46 08	639_4	(522) (20°)
iso-Butyraldehyde	46 38	643_6	(511) (20°)
iso Butyraldoxime	56 1•	644_3	(576) (20°)
n-Butyric acid	55 10	625	598 (20°)
iso Butyric acid	56 06	636_3 (25°)	(601) (25°)
Butyronitrile	49 4	(715)	(569) (15°)
Butyrylphenylacetylene	(106 4)	618	
Cacodyl	(99 9)	476	(689) (15°)
Cacodylic acid	(79 9)	579	
Camphor	(103)	68	(67) (25°)
Camphoric acid	129 0	(644)	(791) (20°)
Camphoric anhydride	(113)	620	(740) (20°)
n Caproic acid	78 55	676_0	(624) (25°)
Caprolphenylacetylene	(130 4)	651	
n-Caprylic acid	101 60	7053	(642) (20°)
Carbanilide	134 05	(6316)	(783) (20°)
Carbazole	117 4	(702)	
Carbon disulfide	42 2	554	699) (22°)
Carbon tetrabromide	93 73	2826 (20°)	(966)
Carbon tetrachloride	66 60	433	691 (20°)
Carbon tetraiodide	(136)	261	1 13) (20°)
Carvacrol	(109 1)	726	(709) (20°)
Carvone	(92 2)	614	(590) (20°)
Cetyl alcohol	(183 5)	757 (17 5°)	(619) (50°)
Cetyl mercaptan	390 4	1 510)	
Chloral	(67 7)	459	(694) (20°)
Chloranil	(112 6)	458	
Chloracetic acid	48 1	(509)	(804) (20°)
Chloroacetone	(50 9)	550	(633) (20°)
Chloroacetylchloride	53 7	(475)	(710) (0°)
p-Chloranisole	89 1	(625)	
Chlorobenzene	69 97	(6216)	(688) (20°)
Chlorobenzene diazocyanide	65 02	(393)	
Chlorodibromomethane	75 1 ± 4	(361)	(883) (15°)
Chlorodifluoromethane	38 6	446	
1-Chloro-2 3-dihydroxypropane	(77 9)	604	
Chlorodiphenylmethane	(131 9	(651)	
Chloroethylene	35 9	574	(528) (liq , 15°)
Chloroform	59 30	497	740 (20°)
Chlorofumaric acid	67 02	(445)	
p-Chloroiodo benzene	90 42	(417)	(786) (57°)
Chloromaleic acid	67 36	(448)	
Chloromethylstilbene	144 8	(633)	
α-Chloronaphthalene	107 60	661	789 (20°)
m Chloronitrobenzene	(74 8)	475	638 (48°)
o-Chlorophenol	77 4	(602)	(747) (18°)
p-Chlorophenol	77 6	(604)	(789) (20°)
1-(o-Chlorophenylazo) 2 napthol	161 0	(570)	
1 (p-Chlorophenylazo) 2 napthol	161 4	(571)	
Chlorotrifluoroethylene	49 1	422	
Chlorotrifluoromethane	45 3 ± 1 5	(434)	
Cholesterol	(284 2)	735	(784) (20°)
Chrysene	166 67	731	
Chrysoidine	(126 3)	595	
Cinnamic acid	78 36	529	(660) (4°)
Cinnamic acid (α trans)	78 2	(528)	
Cinnamic acid (β trans)	79 0	(533)	
Cinnamic acid (cis MP 68°)	77 6	(524)	
Cinnamic acid (cis-MP 58°)	77 9	(526)	
Cinnamic acid (cis-MP 42°)	83 2	(562)	
Cinnamic aldehyde	(74 8)	566	(629) (15°)
Cinnamyl alcohol	(87 2)	650	(679) (20°)
Cinnamylideneaniline	123 2	(595)	
Citral	(98 9)	650	(577) (20°)
Coronene	(243 3)	810	
Coumarin	82 5	(565)	(528) (20°)
o-Cresol	72 90	675	(706) (20°)
m Cresol	72 02	667 (26°)	(690) (20°)
p-Cresol	72 1	667 (26°)	(690) (20°)
o-Cresylmethyl ether	81 94	671 (40°)	(661) (15°)
m Cresylmethyl ether	77 91	638 (40°)	(623) (15°)
p-Cresylmethyl ether	79 13	648 (40°)	(629) (19°)
Cumene	89 53	744_9	(642)
Cyamelide	(56 1)	435	490) (15°)
Cyameluric acid	101 1 (10°)	(457)	
9-Cyanoanthracene	142 1	(699)	
Cyanogen	(21 6)	415	(359) (liq 17°)
Cyanuric acid	61 5	476	(842) (0°)
Cyclobutanecarboxylic acid	58 16	5816 (30°)	(613) (30°)
1 3-Cyclohexadiene	48 6	(607)	(510) (20°)
1,4-Cyclohexadiene	48 7	(608)	(515) (20°)
Cyclohexane	68 13	8100 (27 5°)	(627) (20°)
Cyclohexanecarboxylic acid	83 24	6499 (30°)	(668) (30°)
Cyclohexanol	73 40	732	694 (20°)
Cyclohexanone	62 0$_4$	632_3	(599) (20°)
Cyclohexanone oxime	71 5$_0$	632_1	
Cyclohexanoneoxime O-methyl ether	82 9$_6$	652_3	
Cyclohexene	57 5	(700)	(567) (20°)
Cyclohexenol	64 1	(653)	
Cyclooctane	91 4	(815)	(684) (20°)
Cyclooctene	84 6	(769)	(654) (20°)
Cyclooctatetraene	(53 9)	518	
Cyclopentane	59 18	8439	6290 (20°)
Cyclopentanecarboxylic acid	73 48	6446 (30°)	(677) (30°)
Cyclopentanone	51 63	6141 (30°)	(582) (30°)
Cyclopropane	39 9	(948)	(683) (−79°)
Cyclopropanecarboxylic acid	45 33	5271 (30°)	(569) (30°)
p-Cymene	102 8	766 (20°)	(656) (20°)
Decalin	106 70	7718	6814 (20°)
cis Decalin	(107 0)	774	(686) (35°)
trans-Decalin	(107 7)	779	(670) (35°)
n-Decane	119 74	(8416)	(6143) (20°)
l-Deuterio pyrrole	48 75	716 (20°)	
Deuteromdene	80 88	690	(692) (13°)
Diacetal	(153 8)	668	
Di-iso-amylamine	(133 1)	846	(649) (21°)
Diazoacetic ester	57	(50)	(54) (24°)
Dibenzocoronene	289 4	778	
1 2,5 6 Dibenzofluorene	184	69 ± 03	
3,4 5,6-Dibenzophenanthrene	(203)	73 ± 03	
Dibenzphenanthrone	200 5	716	
Dibenzpyrene	213 6	706	
Dibenzpyrenequinone	183 1	551	
iso-Dibenzpyrenequinone	194 6	586	
Dibenzyl ketone	131 70	626_0	
p-Dibromobenzene	(101 4)	430	786 (100°)
2,3 Dibromo-2-butene-1,4-diol	94 2	(383)	
Dibromodichloromethane	81 1 ± 4	(334)	(808) (25°)
1,2-Dibromodiiodoethylene	(140 1)	320	
1,2-Dibromoethylene	(71 7)	386	(877) (17 5°)
1,2-Dibromo-2-fluoroethane	(78 0)	379	(855) (17°)
Dibromo-4-nitrophenol	(167 5)	564	
1,2-Dibromotetrachloroethane	(126 0)	387	(1 049)
Di-n-butylamine	103 7	(802)	(767) (20°)
Di iso-butylamine	105 7	(817)	(609) (20°)
Di-sec-butylamine	105 9	(819)	(641) (0°)
Di-iso-butyl ketone	104 30	733_5	(591) (20°)
Di-tert-butyl ketone	104 06	732_1	
2 6-Di-tert-butyl-4-methyl phenol	165 3	(750)	
2,4-Di-tert-butyl phenol	155 6	(754)	
Dibutyl phthalate	175 1	(629)	(657) (21°)
Di-iso-butyralacetylene	(125 6)	738	
Dicetyl sulfide	401 7	(832)	
Dichloroacetic acid	58 2	(451)	(705) (20°)
Dichloroacetyl chloride	69 0	(468)	

Compound	$-\chi_M \times 10^6$	$-\chi \times 10^6$	$-K \times 10^6$
o-Dichlorobenzene	84 26	5734	(748) (20°)
m-Dichlorobenzene	83 19	5661	(729) (20°)
p-Dichlorobenzene	82 93	5644	(823) (20 5°)
1,4-Dichloro-2-butyne	74 2	(603)	
1,2-Dichloro-1,2-dibromoethane	(108 6)	423	
1,1-Dichloro-difluoroethylene	60 0	451	
Dichlorodifluoromethane	52 2	432	(642) (−30°)
1,1-Dichloroethylene	49 2	508	(635) (15°)
cis-1,2-Dichloroethylene	51 0	526	(679) (15°)
trans 1,2-Dichloroethylene	48 9	504	(638) (15°)
1,3-Dichloro-2-hydroxypropane	(80 1)	621	
Dicyandiamide	44 55	(530)	(742) (14°)
Dicyclohexanol acetylene	(151 6)	682	
Dicyclohexyl	129 31	7776	6889 (20°)
1,1-Dicyclohexylnonane	231 98	7930	7001 (20°)
Diethanolacetylene	(75 3)	660	
Diethyl acetaldehyde	70 71	705_9	(576) (20°)
Diethylallylacetophenone	146 2	(676)	(663) (16°)
Diethyl allylmalonate	118 8	(593)	(602) (14°)
Diethylamine	56 8	(777)	(552) (18°)
Diethylcyclohexylamine	(124 5)	802	(699) (0°)
Diethyl ethylmalonate	115 2	(612)	(614) (20°)
Diethyl ketone	58 1_4	675_1	(551) (19°)
Diethyl ketoxime	68 3_1	6754	
Diethyl malonate	(92 6)	5782	(611) (20°)
Diethyl-3-(1-methyl butane) ethyl-malonate	175	(677)	
Diethyl oxalate	81 71	5595	(603) (15°)
Diethyl phthalate	127 5	(574)	(645) (25°)
Diethyl sebacate	(177 0)	685	(661) (20°)
Diethylstilbestrol	172 0	(547)	
Diethylstilbestrol dipropionate	265 2	720	
Diethyl succinate	105 07	6035	(628) (20°)
Diethyl sulfate	(86 8)	563	(667) (15°)
Diethyl sulfide	(67 9)	753	(630) (20°)
Diethyl tartrate	(113 4)	550	(662) (20°)
Difluoroacetamide	(41 2)	433	
1-Difluoro-2-dibromoethane	(85 5)	382	(883) (20°)
1,1-Difluoro-2,2 dichloroethyl amyl ether	129 84	(587)	(694) (20°)
1,1-Difluoro-2,2-dichloroethyl butyl ether	119 48	(577)	(703) (20°)
1,1-Difluoro-2 2-dichloroethyl ethyl ether	96 13	(537)	(723) (20°)
1,1-Difluoro-2,2-dichloroethyl methyl ether	80 68	(489)	(696) (20°)
1,1-Difluoro-2,2-dichloroethyl propyl ether	107 19	(555)	(701) (20°)
Difluoroethanol	(41 3)	503	
Di-n-heptylamine	171 5	(805)	
Di-n-hexylamine	148 9	(803)	
Dihydronaphthalene	(85 1)	654	(652) (12°)
o-Dimethoxybenzene	87 39	6329	(686) (25°)
m-Dimethoxybenzene	87 21	6316	(682) (0°)
p-Dimethoxybenzene	86 65	6275	(661) (55°)
o-(2,5-Dimethoxybenzoyl)-benzoic acid	161 0	(.562)	
Dimethoxymethane	(47 3)	621	(532)
Dimethylacetophenone	96 8	(653)	(645) (16°)
Dimethylallylacetophenone	122 4	(650)	(635) (16°)
Dimethylaniline	89 66	(740)	
2,2-Dimethylbutane	76 24	8848	5744 (20°)
2,3-Dimethylbutane	76 22	8845	5853 (20°)
2,3-Dimethyl-2-butene	65 9	(783)	(557)
Dimethylcyclohexanone	(84 8)	672	
1,2 and 1 3 Dimethylcyclopentanes	81 31	8281	6224 (20°)
2,5-Dimethyl-2,5 dibromo-3-hexine	(135 6)	506	
Dimethyl diethylketo tetrahydro-furfurane	(116 2)	753	
2,5-Dimethyl 1-ethylpyrrole	94 61	768 (20°)	
2,5-Dimethyl 3-ethylpyrrole	93 87	762 (20°)	
2,5-Dimethylfuran	66 37	687 (20°)	(620) (18°)
Dimethyl furazan	57 27	584	
2,5-Dimethyl-4-heptene	100 6	(797)	
2,4 Dimethyl-2,4-hexadiene	(78 7)	714	
2 3-Dimethylhexane	98 77	8648	6164 (20°)
2,5-Dimethylhexane	98 15	8593	5969 (20°)
3 4-Dimethylhexane	99 06	8673	6240 (20°)
2,6-Dimethyl-4 hexanol	116 9	812	
2,5-Dimethyl 3 hexine-2,5-diol	(103 0)	724	
Dimethyl isoxazole	59 7	(615)	
Dimethylketo tetrahydrofurfurane	(68 5)	600	
Dimethyl malonate	69 69	5277	(609) (20°)
1,6-Dimethylnaphthalene	113 3	(725)	
2,4-Dimethylnonane	134 68	(862)	(636) (20°)
3,4 Dimethylnonane	134 70	(862)	(647) (20°)
4,5-Dimethylnonane	134 52	(861)	(647) (20°)
2,6-Dimethyl-2,6,8-nonatriene	(108 8)	724	
Dimethyl-2,4-nonatriene	(148 8)	990	
2,6-Dimethyloctane	122 54	(861)	(627) (20°)
3,4-Dimethyloxadiazole	57 17	583	
Dimethyl oxalate	(55 7)	472	(542) (54°)
Dimethyl oxamide	(63 2)	544	
2,2-Dimethylpentane	86 97	8680	5849 (20°)
2,3-Dimethylpentane	87 51	8733	6070 (20°)
2,4-Dimethylpentane	87 48	8732	5876 (20°)
2,2-Dimethylpropane	63 1	(875)	(536) (0°)
2,5-Dimethyl-3-propyl-pyrrole	106 07	773 (20°)	
2,4-Dimethylpyrrole	69 64	732 (20°)	(679) (14°)
2,5-Dimethylpyrrole	71 92	756 (20°)	(707) (20°)
α ω-Dimethyl styrene	(90 7)	686	
Dimethyl succinate	81 50	5581	(625) (18°)
Dimethyl sulfate	(62 2)	493	(657) (20°)
Dimethyl sulfide	(44 9)	723	(612) (21°)
Dimethyltrichloromethylcarbinol	(105)	59	
N,N-Dimethyl urea	55 1	(625)	(784)
N N'-Dimethyl urea	56 3	(639)	(730)
o-Dinitrobenzene	65 98	3921	(614) (17°)
m-Dinitrobenzene	70 53	4197	(659) (0°)
p-Dinitrobenzene	68 30	4064	(660) (30°)
2,4-Dinitrophenol	(73 1)	397	(668) (24°)
Dinitroresorcinol	(62 4)	312	
1,4-Dioxane	52 16	592 (32°)	(606) (32°)
Diphenyl	103 25	6695	(664) (73°)
1,1-Diphenylallyl-3-chloride	146 1	(639)	
1,3-Diphenylallyl-3-chloride	140 7	(615)	
Diphenylamine	(109 7)	648	686 (55 5°)
Diphenyl-bis-diazo cyanide	85 03	(327)	
Diphenylbutadiene	129 6	(629)	
Diphenylchloroarsine	(145 5)	550	(871) (40°)
Diphenyldecapentaene	180 5	(635)	
Diphenyldiacetylene	(134 6)	640	
Diphenyldiazomethane	115	(592)	
Diphenyldihydrotetrazine	129 9	(545)	
1,1 Diphenylethylene	(118 0)	655	(680) (14°)
1,6-Diphenylhexane	171 81	7208	6877 (20°)
Diphenylhexatriene	146 9	(632)	
Diphenylmethane	(115 7)	688	684 (35 5°)
Diphenylmethanol	119 1	647	
1,1-Diphenylnonane	206 32	7357	6935 (20°)
Diphenyloctatetraene	164 3	(636)	
Diphenylphenoxyarsine	(225 2)	567	
N,N-Diphenyl urea	126 3	(595)	(759)
N,N -Diphenyl urea	127 5	(600)	(743) (20°)
Di-n propyl ketone	80 45	705_0	(576) (20°)
Di iso-propyl ketone	81 14	711_0	(573) (20°)
Dipropyl oxalate	105 27	6046	(628) (0°)
Di iso-propyl oxalate	106 02	6089	
Dodecyl alcohol	147 70	7849 (20 7°)	(652) (24°)
Dulcitol	112 40	617	(905) (15°)
Flaidic acid	204 8	(725)	(619) (79°)
Erythritol	73 80	604	(876) (20°)
Ethane	27 3	(910)	(511) (−100°)
4-Ethoxy-3-methoxybenzyl acetate	138 5	619	
4-Ethoxy 3-methoxybenzyl benzoate	177 3	620	
1-Ethoxynaphthalene	119 9	(696)	(738) (20°)
2-Ethoxynaphthalene	119 2	(692)	(734) (25°)
Ethyl acetate	54 10	614	554 (20°)
Ethyl acetoacetate	71 67	550_8	(565) (20°)
Ethylacetophenone	95 5	(644)	(639) (16°)
Ethyl alcohol	33 60	728	575 (20°)
Ethylally acetophenone	122 5	(651)	(634) (16°)
Ethyl amylpropiolate	(112 7)	670	
Ethylaniline	89 30	(737)	(709)
9-Ethyl anthracene	153 0	(741)	(771) (99°)
Ethylbenzene	77 20	7272	6341 (20°)
Ethyl benzoate	93 32	621_1	(648) (25°)
Ethyl benzoylacetate	(115 3)	600	(673) (20°)
Ethyl benzylidenecyanoacetate	(116 3)	578	
Ethyl benzylmalonate	(154 5)	6172	(663) (20°)
Ethyl bromide	54 70	502	719 (20°)
Ethyl bromoacetate	(82 8)	496	(747) (20°)
Ethyl-1-isobutylacetoacetate	(121 4)	652	
Ethyl butylmalonate	139 3	644_0	(629) (20°)
Ethyl n-butyrate	(77 7)	6693	(585) (25°)
Ethyl iso-butyrate	78 32	674_3	(583) (25°)
Ethyl chloroacetate	(72 3)	590	(684) (20°)
Ethyl cinnamate	(107 5)	610	(640) (20°)
Ethyl-iso-cyanate	(45 6)	642	(582) (16°)
Ethyl cyanoacetate	(67 3)	595	(632) (20°)
Ethylcyclohexane	91 09	8118	6324 (20°)
Ethyldiallylacetophenone	147 4	(646)	(636) (16°)
Ethyl dibromocinnamate	174 5	519	
Ethyl dichloroacetate	85 2	(543)	(696) (20°)
Ethyl diethylacetoacetate	(117 9)	6328	(615) (20°)
Ethyl diethylmalonate	(140 4)	6492	(641)(20°)
Ethyl dithioacetate	(71 0)	5904 (27 4°)	
Ethylene	12 0	(428)	(242) (−102°)
Ethylene	15 30	546 (32°)	(309) (−102°)
Ethylene bromide	78 80	419	915 (20°)
Ethylene chloride	59 62	602 (32°)	(757) (20°)
Ethylenediamine	46 26	771 (32°)	(686) (20°)
Ethylene iodide	104 7	371 (32°)	(791) (10°)
Ethylene oxide	30 7	(697)	(618) (7°)
Ethyl ether	55 10	743	534 (20°)
Ethyl etnylacetoacetate	93 9	5937	(582) (20°)
Ethyl ethylbutylmalonate	(163 3)	6683	(650) (20°)
Ethyl ethylpropylmalonate	(152 4)	6619	(648) (20°)
Ethyl formate	43 00	580	531 (20°)
Ethyl hexylpropiolate	129 9	713	
Ethyl hydroxylamine	(43 0)	704	
Ethylidene chloride	(57 4)	580	(681) (20°)
Ethyl iodide	(69 7)	4470 (17 5°)	(864) (20°)
Ethyl iodoacetate	(97 6)	456	(829) (13°)
Ethyl lactate	(72 6)	615	(633) (25°)

DIAMAGNETIC SUSCEPTIBILITIES OF ORGANIC COMPOUNDS (Continued)

Compound	$-\chi_M \times 10^6$	$-\chi \times 10^6$	$-K \times 10^6$
Ethyl methylacetoacetate	(81 9)	5684	(569) (20°)
Ethyl methyl ketoxime	57 3_2	658_0	(530) (20°)
Ethyl-1-methyl-2-oxocyclohexane-carboxylate	112 1	(608)	
Ethyl methylphenylmalonate	(153 2)	6121	(658) (20°)
Ethyl nitrophenylpropiolate	114 6	523	
Ethyl oxamate	62 0	(529)	(427) (19°)
Ethyl perfluor-n-butyrate	103 5	(427)	
Ethyl phenylacetate	104 27	(635)	(656) (20°)
Ethyl phenylmalonate	(142 2)	6017	(659) (20°)
Ethyl phenylpropiolate	(104 2)	598	(636) (13°)
Ethyl phosphate	(98 2)	539	(576) (25°)
Ethyl propionate	(66 5)	6514	(584) (15°)
Ethyl propylacetoacetate	(105 7)	6135	(593) (20°)
Ethyl-n-propyl ketone	69 03	689_1	(560) (22°)
Ethyl succinimide	(72 0)	566	
Ethyl sulfine	(67 0)	631	
Ethyl sulfite	(75 4)	546	(604) (0°)
Ethylsulfone ethyl ether	(81 8)	592	
Ethyl thiocyanate	(55 7)	6392 (27 4°)	(637) (25°)
Ethyl isothiocyanate	(59 0)	6772 (27 4°)	(680) (15°)
Ethyl thiolacetate	(62 7)	6019 (27 4°)	(586) (25°)
Ethyl thionacetate	(63 5)	6098 (27 4°)	
Ethyl tribromoacetate	(119 5)	368	(821) (20°)
Ethyl trichloroacetate	(99 6)	520	(719) (20°)
N-Ethyl urea	55 5	(630)	(764) (18°)
Ethyl iso valerate	(91 1)	700	(607) (20°)
Eucalyptol	(116 3)	754	(699) (20°)
Eugenol and iso-eugenol	(102 1)	622	(663) (20°)
Flavanthrone	241 0	590	
Fluorene	110 5	655	
Fluorenone	99 4	552	(623) (100°)
Fluorobenzene	(58 4)	608	(623) (20°)
Fluorobromoacetic acid	(59 5)	379	
Fluorodichloromethane	48 8	474	(676) (0°)
p-Fluorophenetole	(88 0)	628	
Fluoro trichloroethylene	72 5	485	(742) (25°)
Fluorotrichloromethane	58 7	427	(638) (17°)
Formaldehyde	(18 6)	62	(51) (−20°)
Formamide	(21 9)	486	(551) (20°)
Formic acid	19 90	432	527 (20°)
β-Formylpropionic acid	55 3	(542)	
Fructose	102 60	570	
Fulvene (Benzene χ_M measured to be 49)	42 9	(549)	(452) (20°)
Fulvene $\left(\chi \frac{54\ 8}{49}\right)$	48 0	(614)	(505) (20°)
Fumaric acid	49 11	(423)	(692) (20°)
Furan	43 09	633 (20°)	(598) (15°)
Furfural	47 1	(490)	(568) (20°)
Galactose	103 00	572	
Gallic acid	90 0	(529)	(896) (4°)
Geraniol formate	(119 9)	658	(610) (20°)
Glucose	102 60	570	
D-Glucose	101 5	(563)	(869) (25°)
Glutamic acid	78 5	(533)	
Glycerol	57 06	619	779 (20°)
Glycine	40 3	(537)	(846) (50°)
Glycol	38 80	624	698 (20°)
Guaiacol	(79 2)	638	(720) (21°)
Helianthrone	189 9	497	
1,2-Heptadiene	73 5	(764)	
2,3-Heptadiene	72 1	(749)	
Heptaldehyde	81 02	709_6	(603) (20°)
n-Heptane	85 24	8507	5817 (20°)
4-Heptanol	91 5	789	(647) (20°)
n-Heptanoic acid	88 60	680	626 (20°)
n-Heptyl amine	93 1	(808)	(628) (20°)
n-Heptyl benzene	134 41	7625	6528 (20°)
Heptyl cyclohexane	147 40	8084	6559 (20°)
n-Heptylic acid	89 74	6900	(630) (25°)
1-Heptyne	77 0	(801)	(584) (25°)
2 Heptyne	79 5	(826)	(615) (25°)
Hexabromoethane	(148 0)	294	(1 124) (20°)
Hexachlorobenzene	(147 5)	518	(1 059) (24°)
Hexachloroethane	(112 7)	476	(995) (20°)
Hexachlorohexatriene	(145 0)	433	
n-Hexadecane	187 63	8286	6421 (20°)
1,5-Hexadiene	(55 1)	671	(462) (20°)
2,3-Hexadiene	60 9	(741)	
n Hexaldehyde	69 40	693_0	
2,2,4,7,9,9-Hexamethyldecane	191 52	8458	6596 (20°)
Hexamethyl disiloxane	118 9	7324	
Hexamethylene glycol	84 30	713	
n-Hexane	(74 6)	8654 (27 4°)	(565)
Hexene	65 7	(781)	
Hexestrol	(165)	61 ± 02	
n-Hexyl alcohol	79 20	774	637 (20°)
n-Hexyl benzene	124 23 (20°)	(767)	(658) (20°)
n-Hexyl methyl ketone	91 4_7	713_1	(583)
n-Hexyl methyl ketoxime	102 5_8	716_2	(634) (20°)
Hexylpropiolamide	(103 7)	677	
Hydrindene	(78 5)	664	(639) (16°)
Hydroquinone	64 63	587	(797) (20°)
Hydroxyazobenzene	(99 7)	503	
p-Hydroxybenzaldehyde	66 8	(547)	(618) (130°)
4-Hydroxy-2-butanone	48 5	55	(573) (14°)
Indene (natural)	84 79	(730)	(723) 25°)
Indene (synthetic)	80 89	(696)	(690) (25°)
Indole	85 0	(726)	
Iodobenzene	92 00	451	826 (20°)
Iodoform (in sol'n)	117 1	2974 (20°)	(1 192) (17°)
1 Iodo-2 phenylacetylene	(110 1)	483	
o Iodotoluene	(112 2)	5145 (30°)	(874) (20°)
m-Iodotoluene	(112 3)	5152 (30°)	(875) (20°)
p-Iodotoluene	101 31	(465)	(780) (40°)
Leucine	84 9	(647)	
iso-Leucine	84 9	(647)	
Maleic acid	49 71	(428)	(681) (20°)
Maleic anhydride	(35 8)	365	(341) (20°)
Malonic acid	(46 3)	4453	(726) (15°)
Mannitol	111 20	610	(908) (20°)
Mannose	102 90	571	(879)
Mesitylene	92 32	7632 (20°)	(665) (20°)
Methane	12 2_7	(765)	
Methione	91 0	(610)	
p-Methoxyazobenzene	(118 9)	560	
o-Methoxybenzaldehyde	76 0	(558)	(632) (20°)
p-Methoxybenzaldehyde	78 0	(572)	(642) (20°)
o-Methoxybenzyl alcohol	87 9	637	(664) (25°)
1-Methoxynaphthalene	107 0	(676)	(741) (14°)
2-Methoxynaphthalene	107 6	(680)	
1 (o-Methoxyphenylazo)-2-naphthol	163 6	(588)	
Methoxysaligenin acetate	110 3	613	
Methyl acetate	42 60	575	537 (20°)
Methyl acetoacetate	59 60	513_2	(553) (20°)
Methylacetylacetone	(65 0)	569	
Methyl alcohol	21 40	668	530 (20°)
Methylallylaketone	111 9	(1 330)	
Methylamine	(27 0)	870	(608) (−11°)
N Methylaniline	82 74	(773)	(762) 20°)
9-Methylanthracene	146 5	762)	(812) (99°)
Methyl benzoate	81 59	599_3	(651) (25°)
Methyl-o-benzoylbenzoate	139 4	(580)	(690) (19°)
Methylbenzylaniline	(132 2)	670	
Methyl bromide	42 8	451	(1 044) (0°)
2-Methylbutane	64 40	8925	5531 (20°)
2-Methyl-2-butene	54 14	(772)	(516) (18°)
Methyl butyl ketone	(69 1)	690	(563) (15°)
Methyl iso-butyl ketone	(69 3)	692	(554) (20°)
Methyl tert-butyl ketone	(70 4)	703	(562) (16°)
p-Methyl-o-tert butylphenol	120 3	(732)	
Methyl butyrate	(66 4)	6498	(588) (16°)
o-Methylcarbanilide	154 0	(681)	
Methyl chloride	(32 0)	633	
Methyl chloroacetate	58 1	(535)	(661) (20°)
Methylcholanthrene	(182)	68 ± 04	
3-Methylcholanthrene	194 0	(723)	
Methylcyclohexane	78 91	8038	6181 (20°)
2-Methylcyclohexanone	(74 0)	660	(610) (18°)
3-Methylcyclohexanone	(74 8)	667	(610) (20°)
4-Methylcyclohexanone	(63 5)	566	(516) (24°)
Methylcyclopentane	70 17	8338	6245 (20°)
4-Methyl-2,6-di tert-butylphenol	167 6	(761)	
Methyl dichloroacetate	73 1	(511)	
Methyldiphenoxyphosphine oxide	(152 9)	616	
Methyldiphenyltriazine	(155 1)	627	
Methylene bromide	65 10	375	935 (20°)
Methylene chloride	(46 6)	549	(733) (20°)
Methylene iodide	93 10	348	1 156 (20°)
Methylene succinic acid	57 57	(443)	(723)
Methyl ether	26 3	571	
Methylethylallylacetophenone	133 3	(659)	(643) (16°)
Methyl ethyl ketone	45 5_8	632_0	(509) (20°)
Methyl formate	(32 0)	5327	(519) (20°)
Methylfumaric acid	56 98	(438)	(642)
3-Methylheptane	97 99	8580	6056 (20°)
2-Methyl-4 heptene	88 0	(784)	
5-Methyl-1,2 hexadiene	73 6	(765)	(553) (19°)
2-Methylhexane	86 24	8607	5841 (20°)
Methyl hexyl ketone	(93 3)	728	(596) (20°)
Methyl-m-hydroxybenzoate	88 4	(581)	
Methyl p-hydroxybenzoate	88 7	(583)	
Methyl iodide	(57 2)	403	(918) (20°)
Methylmaleic acid	57 84	(446)	(721)
9-Methyl-10 methoxyanthracene	158 1	(711)	
Methyl-o-methoxybenzoate	95 6	(575)	(665) (19°)
Methyl-p-methoxybenzoate	98 6	(593)	
Methyl-α-methoxy isobutyrate	(81 9)	620	
1-Methylnaphthalene	102 8	(723)	(741) (14°)
2-Methylnaphthalene	102 6	(722)	(743) (20°)
4-Methylnonane	121 39	(853)	(625) (20°)
5-Methyl-5-nonene	111 6	(796)	
4-Methyloctane	109 63	(855)	(618) (20°)
Methylol urea	48 3	(493)	
2 Methylpentane	75 26	8734	5705 (20°)
3-Methylpentane	75 52	8764	5823 (20°)
4-Methyl 2-pentanol	80 4	788	(641) (20°)
Methyl perfluor-n-butyrate	92 5	(406)	
Methyl phenylacetate	92 73	(618)	(645) (16°)
Methyl phenylpropiolate	95 6	597	
2-Methylpropene	44 4	(791)	
Methyl propionate	(55 0)	6240	(571) (20°)

Compound	$-\chi_M \times 10^6$	$-\chi \times 10^6$	$-K \times 10^6$
Methyl n-propyl ketone	57 41	666$_1$	(541) (15°)
Methyl-iso-propyl ketone	58 45	679$_0$	(545) (20°)
1 Methylpyrrole	58 56	722 (20°)	(664) (10°)
2-Methylpyrrole	60 10	741 (20°)	(700)
Methyl salicylate	86 30	567	668 (20°)
Methyl silicone	(172 7)	730	
α-Methyl styrene	(80 1)	678	(620) (20°)
2 Methylthiazole	59 56	601 (20°)	
2-Methylthiophene	66 35	676 (20°)	(689) (20°)
Methyl trichloroacetate	84 2	(475)	(707) (19°)
N-Methyl urea	44 6	(602)	(725)
Morpholine	55 0	(631)	(631)
Myleran	169 7	69	(834) (4°)
Myristic acid	176 0	(771)	(661) (60°)
Naphthalaldehydic acid	117 6	(588)	
Naphthalene	(91 9)	717	(821) (20°)
Naphthalene picrate	185 9	(523)	
2-Naphthalenesulfonylamine	127 6	(616)	
2-Naphthalenesulfonyl chloride	121 91	(538)	
meso-Naphthodianthrene	214 6	612	
meso-Naphthodianthrone	221 8	583	
1-Naphthol	98 2	681	(834) (4°)
	97 0	673	(819) (4°)
2-Naphthol	98 25	(682)	(829) (4°)
α Naphthonitrile	103 3	(674)	(753) (5°)
β-Naphthonitrile	101 0	(659)	(721) (60°)
α-Naphthoquinone	73 5	(465)	(661)
β-Naphthoquinone	67 9	(429)	
N-1-Naphthylacetamide	117 8	(636)	
N-2-Naphthylacetamide	117 8	(636)	
1-Naphthylamine	98 8	690	757 (54°)
2-Naphthylamine	98 00	(684)	(726) (98°)
1-Naphthylamine hydrochloride	(127 6)	710	
Nicotine	113 328	(699)	(705) (20°)
o-Nitroaniline	66 47	(481)	(694) (15°)
m-Nitroaniline	70 09	(507)	(725) (20°)
p-Nitroaniline	66 43	(481)	(691) (14°)
o-Nitrobenzaldehyde	68 23	4517	
m-Nitrobenzaldehyde	68 55	4538	
p-Nitrobenzaldehyde	66 57	4407	(507) (0°)
Nitrobenzene	61 80	502	604 (20°)
Nitrobenzene diazo cyanide	59 22	(336)	
o-Nitrobenzoic acid	76 11	4556	(718) (4°)
m-Nitrobenzoic acid	80 22	4802	(717) (4°)
p-Nitrobenzoic acid	78 81	4718	(731) (32°)
o-Nitrobromobenzene	87 3	(432)	(700) (80°)
m-Nitrobromobenzene	89 5	(443)	(755) (20°)
p-Nitrobromobenzene	89 6	(444)	(859) (22°)
m-Nitro carbanilide	148 1	(576)	
Nitroethane	(35 4)	472	(497) (20°)
Nitromethane	21 1	3457	(391) (25°)
1-Nitronaphthalene	98 47	(569)	(696) (62°)
o-Nitrophenol	73 3	527 (24°)	(873) (20°)
m Nitrophenol	70 8	509 (25°)	(756)
p-Nitrophenol	69 5	500 (22°)	(740)
1-(m-Nitrophenylazo)-2-naphthol	142 0	(484)	
1-(p-Nitrophenylazo)-2-naphthol	141 7	(483)	
Nitrophenylfluoroform	(84 1)	440	
2-Nitropropane	45 73	5135	(509) (20°)
Nitrosobenzene	59 1	(552)	
N-Nitrosodiethylamine	59 3	(580)	(546) (20°)
p-Nitrosodiethylaniline	92 6	(520)	(644) (15°)
p-Nitrosodimethylaniline	73 3	(488)	
N-Nitrosodiphenylamine	110 7	(558)	
1-Nitroso-2-naphthol	83 9	(485)	
2-Nitroso-1-naphthol	82 7	(478)	
4-Nitroso-1-naphthol	91 8	(530)	
m-Nitrosonitrobenzene	66 0	(433)	
p-Nitrosonitrobenzene	65 8	(433)	
p-Nitrosophenol	50 7	(412)	
Nitrosopiperidine	(63 4)	555	(590) (20°)
p-Nitrosotoluene	70 4	(581)	
o-Nitrotoluene	72 28	5272	(613) (20°)
m-Nitrotoluene	72 71	5304	(614) (20°)
p-Nitrotoluene (in sol'n)	72 06	5257	(676) (20°)
n-Nonane	108 13	8431	6057 (20°)
1,2-Octadiene	83 6	(759)	
n-Octane	96 63	8460	5949 (20°)
Octanonoxime	(102 7)	717	
Octyl alcohol	102 65	7766 (20°)	(640) (20°)
Octyl chloride	(114 9)	773	(676) (20°)
Octylcyclohexane	158 09	8051	6578 (20°)
Octylene	(89 5)	798	(576) (17°)
Octylene bromide	(150 4)	553	
n-Octyl mercaptan	(115 1)	7866 (27 4°)	
Oenanthylidene chloride	(116 5)	689	
Oleic acid	208 5	(738)	(661) (18°)
Opianic acid	111 5	(530)	
Ovalene	353 8	888	
Oxalic acid (anh)	33 8	(375)	
Oxalic acid	60 05	(4763)	(787)
Oxamide	(39 0)	443	(738)
Palmitic acid	198 6	(775)	(661) (62°)
Paraldehyde	(86 2)	652	(648) (20°)
Pentabromophenol	(194 0)	397	
Pentacene	(205 4)	738	

Compound	$-\chi_M \times 10^6$	$-\chi \times 10^6$	$-K \times 10^6$
Pentachloroethane	(99 1)	490	(819) (25°)
Pentachlorohexadiene	(129 5)	452	
2 3 Pentadiene	49 1	(721)	(501) (20°)
n-Pentane	63 05	8739	5472 (20°)
2 4 Pentanediol	70 4	677	
Perfluoroacetic acid	43 3	(380)	
Perfluoro n-butyric acid	81 0	(378)	
Perfluorobutyric anhydride	149 4	(387)	
Perfluorocyclooctane oxide	157 6	(379)	
Perfluoropropionic acid	61 0	(372)	
Perhydroanthracene	146 01	7592	7178 (20°)
Perylene	166 8	662	
Phenanthrene	(127 9)	718	(763) (100°)
Phenanthrenequinone	104 5	502	(698)
Phenanthrenonitrile	139 0	(685)	
o-Phenetidine	(101 7)	741 (25°)	
p-Phenetidine	(96 8)	706 (25°)	(749) (15°)
Phenetole	(84 5)	692	(689) (20°)
Phenol	60 21	(640)	(675) (45°)
Phenothiazine	114 8	(576)	
Phenylacetaldehyde	72 01	599$_4$	(614) (20°)
Phenyl acetate	82 04	(603)	(647) (25°)
Phenylacetic acid	82 72	(608)	(657) (80°)
Phenylacetylene	72 01	(705)	(655) (20°)
1-Phenylazo-2 naphthol	137 6	(554)	
2-Phenylbensofuran	130 5	(672)	
1 Phenyl 4-benzoyl 1,3 butadiene	(140 3)	599	
Phenylbutadiene	(85 7)	658	
4 Phenyl 1-butene	93 49	(7077)	(6239) (20°)
Phenylbutyl acetate	134 5	653	
Phenyl n-butyrate	105 46	(643)	
Phenyl iso-cyanate	(72 7)	610	(699) (20°)
o Phenylenediamine	71 98	6662	
m Phenylenediamine	70 53	6529	(723) (58°)
p Phenylenediamine	70 28	6503	
Phenyl ether	(108 1)	635	(681) (20°)
Phenylethyl sulfide	(94 4)	6826 (27 4°)	
Phenylfluoroform	(77 3)	529	
Phenylhydrazine	67 82	(627)	(688) (23°)
Phenylhydroxylamine	(68 2)	625	
Phenyl mercaptan	(70 8)	6425 (27 4°)	(693) (20°)
1-Phenyl 2 Methylbutane	113 53	(766)	(660) (20°)
Phenylmethyl sulfide	(83 2)	6695 (27 4°)	
Phenylpropiolamide	(83 3)	574	
Phenyl propionate	93 79	625)	(654) (25°)
Phenylsulfone	(129 0)	591	(740) (20°)
Phenyl thiocyanate	(81 5)	6027 (27 4°)	(677) (24°)
Phenyl isothiocyanate	(86 0)	6365 (27 4°)	(719) (24°)
1-Phenyl 4,6 6-trimethylheptane	173 90	(796)	(682) (20°)
N Phenyl urea	82 1	(603)	(785)
Phloroglucinol	(73 4)	582	
Phthalamide	(91 3)	556	
Phthalic acid	83 61	5035	(802) (20°)
iso Phthalic acid	84 64	5097	
tere-Phthalic acid	83 51	5029	(759)
Phthalic anhydride	67 31	(454)	(694) (4°)
Phthalimide	(78 4)	533	
Picric acid	84 38	(368)	(649)
Piperazine	56 8	(659)	
Piperidine	64 2	(754)	(650) (20°)
Propane	40 5	(919)	(538) (−45°)
Propene	31 5	(749)	(456) (−47°)
Propionaldehyde	34 32	591$_0$	(477) (20°)
Propionic acid	43 50	586	582 (20°)
Propionitrile	38 5	(699)	(547) (21°)
Propionylphenylacetylene	(95 1)	601	
Propiophenone	83 73	624$_0$	(631) (20°)
n-Propyl acetate	65 91	645$_3$ (25°)	(569) (25°)
iso Propyl acetate	67 04	656$_4$	(566) (25°)
n-Propyl alcohol	45 176 (20°)	(7518)	(6047) (20°)
iso-Propyl alcohol	45 794 (20°)	(7621)	(5985) (20°)
9-Propylanthracene	164 0	(744)	
n-Propylbenzene	89 24	(742)	(640) (20°)
n-Propyl benzoate	105 00	(640)	(646) (2$_0$°)
n-Propyl bromide	(65 6)	533	(721) (20°)
iso-Propyl bromide	(65 1)	529	(693) (20°)
Propyl butyrate	(89 4)	6867	(604) (15°)
prim-Propyl chloride	56 10	715	633 (20°)
iso-Propylcyclohexane	102 65	8131	6528 (20°)
Propylenediamine	(58 1)	784	(688) (15°)
Propylene oxide	42 5	(732)	(629) (0°)
Propyl formate	(55 0)	6248	(563) (20°)
Propyl hexylpropiolate	(136 8)	697	
Propyl iodide	(84 3)	4958 (30°)	(864) (20°)
Propyl propionate (extrap)	(77 95)	6711	(593) (20°)
Propyl sulfide	(92 1)	7787 (27 4°)	(634) (17°)
N-Propyl urea	67 4	(660)	
Pseudocumene	(101 6)	845 (20°)	(740) (20°)
Pyramidone	149 0	(645)	
Pyranthrene	266 9	709	
Pyranthrone	250 3	616	
Pyrazine	37 6	(469)	(484) (61°)
Pyrene	147 9	731	(933) (0°)
Pyridine	49 21	(622)	(611) (20°)
Pyrocatechol	68 76	6248	(857) (15°)
Pyrrole	47 6	(709)	(688) (20°)

DIAMAGNETIC SUSCEPTIBILITIES OF ORGANIC COMPOUNDS (Continued)

Compound	$-\chi_M \times 10^6$	$-\chi \times 10^6$	$-K \times 10^6$	Compound	$-\chi_M \times 10^6$	$-\chi \times 10^6$	$-K \times 10^6$
Pyrrolidine	54 8	(771)	(657) (23°)	Trianilinophosphine oxide	(201 7)	624	
Quinoline	86 0	(666)	(729) (20°)	1,2,3-Tribromopropane	(117 9)	420	(1 023) (23°)
Quinone	38 4	(355)	(468) (20°)	Tri-iso-butylamine	(156 8)	846	(646) (25°)
Quinonoxime	(50 4)	409		Trichloroacetic acid (in sol n)	73 0	(44)	(723) (46°)
Resorcinol	67 26	6112	(785) (15°)	Trichlorobenzene	(106 5)	587	
Rhamnose	99 20	605	(890) (20°)	Trichloro-tert-butyl alcohol (in sol n)	98 01	552	
Safrol and iso-Safro	(97 5)	601	(66) (20°)	Trichloroethylene	65 8	501	(734) (20°)
Salicylaldehyde	64 4	(527)	(615) (20°)	Trichloronitromethane	(75 3)	458	(756) (20°)
Salicylic acid	72 23	523	(755) (20°)	Triethylamine	81 4	(804)	(586) (20°)
Saligenin	76 9	620	(720) (25°)	Triethyl citrate	(161 9)	586	(666) (20°)
Salol	(123 2)	575	678 (45°)	Triethyl phosphate	(125 3)	688	(735) (20°)
Salvarsan dihydrochloride	(246 1)	518		Triethylphosphine	(90 0)	762	(610) (15°)
Selenophene	66 82	510		Triethylphosphine oxide	(91 6)	683	
iso-Selenophene	110–111	84– 85		Triethyl phosphite	(104 8)	631	(611) (20°)
trans-Selenophene	70–77	53 59		Triethyl triazinetricarbonate	(164 1)	552	
Sorbitol	107 80	592		Trifluorocresol	(83 8)	517	
Stearic acid	220 8	(776)	(657) (69°)	Tri-n heptylamine	251 3	(806)	
Stilbene	(120 0)	666	(646) (125°)	Tri n hexylamine	221 7	(823)	
Stilbestrol	(130)	62 63		Trimethylacetophenone	108 2	(667)	(648) (16°)
Styrene	(68 2)	655	(594) (20°)	2,2 3-Trimethylbutane	88 36	8818	6086 (20°)
Succinic acid	(57 9)	4902	(767) (15°)	2,2 3 Trimethylpentane	99 86	8743	6261 (20°)
Succinic anhydride	(47 5)	475	(524)	2,2,4-Trimethylpentane	98 34	8610	5958 (20°)
Succinimide	(47 3)	477	(674) (16°)	2,3 5-Trimethylpyrrole	82 31	754 (20°)	
Sulfamide	44 4	(462)	(832)	1,3 5-Trinitrobenzene	74 55	(350)	(591) (20°)
p-Sulfanilamide	80 15	(465)		Triperfluorobutylamine	253 0	(377)	
Terpineol	111 9	(725)	(678) (room temp)	Triphenoxyarsine	(195 2)	551	
				Triphenylarsine	(177 0)	578	
Tetrabenzylmonosilane	266 2	(678)		Triphenylarsine dihydroxide	(270 5)	795	
1 1,2,2-Tetrabromoethane	(123 4)	357	(1 058) (20°)	Triphenylarsine oxide	(199 1)	618	
Tetrabromoethylene	(114 8)	334		Triphenylbismuthine	(196 8)	447	(708) (20°)
Tetracene	(168 0)	736		Triphenylbismuthine dinitrate	(254 5)	451	
1,1,2,2-Tetrachloroethane	(89 8)	535	(856) (20°)	Triphenylcarbinol	(175 7)	675	(802) (20°)
Tetrachloroethylene	81 6	492	(802) (15°)	Triphenylmethane	(165 6)	678	686 (100°)
Tetrahydroquinoline	(89 0)	668	(715) (4°)	Triphenylphosphine	(166 8)	636	(759)
Tetraiodoethylene	(164 3)	309	(922) (20°)	Triphenyl phosphite	(183 7)	592	(701) (18°)
Tetraiodopyrrole	(188 9)	331		Triphenylstibine	(182 2)	516	
Tetramethylketotetrahydrofurfurane	(104 7)	736		Triphenylstibine dihydroxide	(238 5)	616	
Tetranitromethane	43 02	2195	(360) (20°)	N,N',N Triphenyl urea	176 5	(613)	
Tetraphenylbutadiene	228 0	(636)		Triquinoyl	(133 0)	426	
Tetraphenyldecapentaene	280 8	(643)		Tropolone	61	50	
Tetraphenylhexatriene	246 4	(641)		Tryptophan	132 0	(646)	
Tetraphenyloctatetraene	264 1	(643)		Tyrosine	105 3	(581)	
Tetraphenylrubene	344 0	(646)		Undecane	131 84	(8435)	(6247) (20°)
Tetra-p-tolylmonosilane	276 4	(704)		Urea	33 4	(556)	(742) (20°)
Tetrolic acetal	(97 8)	688		Urethan	(57)	64	(63) (21°)
Tetronic acid	(52 5)	525		iso-Valeraldehyde	(57 5)	668	(536) (17°)
Thiacoumerin	93 6	577		n Valeric acid	66 85	6548	(617) (20°)
Thiazole	50 55	595 (20°)	(714) (17°)	iso-Valeric acid	(67 7)	663	(621) (15°)
Thiobarbituric acid	72 9	(506)		Valerylphenylacetylene	(119 0)	639	
Thiophene	57 38	682 (20°)	(726) (20°)	Valine	74 3	(634)	
Tolane	(118 9)	667	(644) (100°)	Violanthrene	273 5	641	
Toluene	66 11	7176	6179 (20°)	Violanthrone	204 8	449	
o-Toluidine	76 0	710 (24°)	(709) (20°)	iso-Violanthrone	215 9	473	
m-Toluidine	74 6	697 (25°)	(689) (20°)	Water	(13 00)	7218 (20°)	(7205) (20°)
p-Toluidine	72 1	673 (25°)	(704) (20°)	Water (value usually used as standard)	(12 97)	720 (20°)	(719) (20°)
α-Tolunitrile	76 87	(656)	(666) (18°)	Xanthone	(108 1)	551	
1-(o-Tolylazo) 2-naphthol	148 7	(567)		o-Xylene	77 78	7327	6440 (20°)
1-(p-Tolylazo)-2 naphthol	157 6	(601)		m-Xylene	76 56	7212	6235 (20°)
Triallylacetophenone	152 5	(634)		p-Xylene	76 78	7232	6226 (20°)
Tri iso-amylamine	192	845	(647) (25°)	Xylose	84 80	565	(862) (20°)

FOUR-PLACE LOGARITHMS

N	0	1	2	3	4	5	6	7	8	9	Proportional Parts 1	2	3	4	5	6	7	8	9
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	*4	8	12	17	21	25	29	33	37
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	8	11	15	19	23	26	30	34
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	7	10	14	17	21	24	28	31
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	3	6	10	13	16	19	23	26	29
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	6	9	12	15	18	21	24	27
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	*3	6	8	11	14	17	20	22	25
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	5	8	11	13	16	18	21	24
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	2	5	7	10	12	15	17	20	22
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	2	5	7	9	12	14	16	19	21
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	2	4	7	9	11	13	16	18	20
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	4	6	8	11	13	15	17	19
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	4	6	8	10	12	14	16	18
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	4	6	8	10	12	14	15	17
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6	7	9	11	13	15	17
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	4	5	7	9	11	12	14	16
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	3	5	7	9	10	12	14	15
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5	7	8	10	11	13	15
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	3	5	6	8	9	11	13	14
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	3	5	6	8	9	11	12	14
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	3	4	6	7	9	10	12	13
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	3	4	6	7	9	10	11	13
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	3	4	6	7	8	10	11	12
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	3	4	5	7	8	9	11	12
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	3	4	5	6	8	9	10	12
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	3	4	5	6	8	9	10	11
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	2	4	5	6	7	9	10	11
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	1	2	4	5	6	7	8	10	11
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	3	5	6	7	8	9	10
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	2	3	5	6	7	8	9	10
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	2	3	4	5	7	8	9	10
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	2	3	4	5	6	8	9	10
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	2	3	4	5	6	7	8	9
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	2	3	4	5	6	7	8	9
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	2	3	4	5	6	7	8	9
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	1	2	3	4	5	6	7	8	9
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	2	3	4	5	6	7	8	9
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	2	3	4	5	6	7	7	8
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	2	3	4	5	5	6	7	8
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	2	3	4	4	5	6	7	8
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	2	3	4	4	5	6	7	8
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	2	3	3	4	5	6	7	8
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	2	3	3	4	5	6	7	8
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	2	3	4	5	6	7	7
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	2	3	4	5	6	6	7
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	2	3	4	5	6	6	7
N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9

* Interpolation in this section of the table is inaccurate.

FOUR-PLACE LOGARITHMS (Continued)

N	0	1	2	3	4	5	6	7	8	9	Proportional Parts 1	2	3	4	5	6	7	8	9
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	2	3	4	5	5	6	7
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	2	3	4	5	5	6	7
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	2	2	3	4	5	5	6	7
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	1	2	3	4	4	5	6	7
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	1	2	3	4	4	5	6	7
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	4	4	5	6	6
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	1	2	3	4	4	5	6	6
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	1	2	3	3	4	5	6	6
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	1	2	3	3	4	5	5	6
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3	4	5	5	6
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	1	2	3	3	4	5	5	6
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3	4	5	5	6
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3	4	5	5	6
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3	4	4	5	6
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	1	2	2	3	4	4	5	6
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	1	2	2	3	4	4	5	6
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	2	3	4	4	5	5
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	2	3	4	4	5	5
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3	4	4	5	5
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3	4	4	5	5
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3	3	4	5	5
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3	3	4	5	5
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3	3	4	4	5
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3	3	4	4	5
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	1	2	2	3	3	4	4	5
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3	3	4	4	5
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3	3	4	4	5
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3	3	4	4	5
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3	3	4	4	5
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3	3	4	4	5
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3	3	4	4	5
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3	3	4	4	5
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	0	1	1	2	2	3	3	4	4
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2	3	3	4	4
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2	3	3	4	4
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2	3	3	4	4
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2	3	3	4	4
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2	3	3	4	4
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2	3	3	4	4
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2	3	3	4	4
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2	3	3	4	4
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2	3	3	4	4
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2	3	3	4	4
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2	3	3	4	4
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2	3	3	3	4
N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9

1a	2a	3b	4b	5b	6b	7b	8	1b	2b	3a	4a	5a	6a	7a	0	Orbit
1 +1 −1 **H** 1.00797 1					Atomic Number → **50** +2 +4 Symbol → **Sn** Atomic Weight → 118.69 −18−18−4 ← Electron Configuration ← Oxidation States KEY TO CHART										**2** 0 **He** 4.0026 2	K
3 +1 **Li** 6.939 2-1	**4** +2 **Be** 9.0122 2-2									**5** +3 **B** 10.811 2-3	**6** +2 +4 −4 **C** 12.01115 2-4	**7** +1 +2 +3 +4 +5 −1 **N** 14.0067 −2 −3 2-5	**8** −2 **O** 15.9994 2-6	**9** −1 **F** 18.9984 2-7	**10** 0 **Ne** 20.183 2-8	K-L
11 +1 **Na** 22.9898 2-8-1	**12** +2 **Mg** 24.312 2-8-2	Transition Elements						Transition Elements		**13** +3 **Al** 26.9815 2-8-3	**14** +2 +4 −4 **Si** 28.086 2-8-4	**15** +3 +5 −3 **P** 30.9738 2-8-5	**16** +4 +6 −2 **S** 32.064 2-8-6	**17** +1 +5 +7 −1 **Cl** 35.453 2-8-7	**18** 0 **Ar** 39.948 2-8-8	K-L-M
19 +1 **K** 39.102 -8-8-1	**20** +2 **Ca** 40.08 -8-8-2	**21** +3 **Sc** 44.956 -8-9-2	**22** +2 +3 +4 **Ti** 47.90 -8-10-2	**23** +2 +3 +4 +5 **V** 50.942 -8-11-2	**24** +2 +3 +6 **Cr** 51.996 -8-13-1	**25** +2 +3 +4 +7 **Mn** 54.9380 -8-13-2	**26** +2 +3 **Fe** 55.847 -8-14-2	**27** +2 +3 **Co** 58.9332 -8-15-2	**28** +2 +3 **Ni** 58.71 -8-16-2	**29** +1 +2 **Cu** 63.54 -8-18-1	**30** +2 **Zn** 65.37 -8-18-2	**31** +3 **Ga** 69.72 -8-18-3	**32** +2 +4 **Ge** 72.59 -8-18-4	**33** +3 +5 −3 **As** 74.9216 -8-18-5	**34** +4 +6 −2 **Se** 78.96 -8-18-6	**35** +1 +5 −1 **Br** 79.909 -8-18-7	**36** 0 **Kr** 83.80 -8-18-8	-L-M-N
37 +1 **Rb** 85.47 -18-8-1	**38** +2 **Sr** 87.62 -18-8-2	**39** +3 **Y** 88.905 -18-9-2	**40** +4 **Zr** 91.22 -18-10-2	**41** +3 +5 **Nb** 92.906 -18-12-1	**42** +6 **Mo** 95.94 -18-13-1	**43** +4 +6 +7 **Tc** (99) -18-13-2	**44** +3 **Ru** 101.07 -18-15-1	**45** +3 **Rh** 102.905 -18-16-1	**46** +2 +4 **Pd** 106.4 -18-18-0	**47** +1 **Ag** 107.870 -18-18-1	**48** +2 **Cd** 112.40 -18-18-2	**49** +3 **In** 114.82 -18-18-3	**50** +2 +4 **Sn** 118.69 -18-18-4	**51** +3 +5 −3 **Sb** 121.75 -18-18-5	**52** +4 +6 −2 **Te** 127.60 -18-18-6	**53** +1 +5 +7 −1 **I** 126.9044 -18-18-7	**54** 0 **Xe** 131.30 -18-18-8	-M-N-O
55 +1 **Cs** 132.905 -18-8-1	**56** +2 **Ba** 137.34 -18-8-2	**57*** +3 **La** 138.91 -18-9-2	**72** +4 **Hf** 178.49 -32-10-2	**73** +5 **Ta** 180.948 -32-11-2	**74** +6 **W** 183.85 -32-12-2	**75** +4 +6 +7 **Re** 186.2 -32-13-2	**76** +3 +4 **Os** 190.2 -32-14-2	**77** +3 +4 **Ir** 192.2 -32-15-2	**78** +2 +4 **Pt** 195.09 -32-16-2	**79** +1 +3 **Au** 196.967 -32-18-1	**80** +1 +2 **Hg** 200.59 -32-18-2	**81** +1 +3 **Tl** 204.37 -32-18-3	**82** +2 +4 **Pb** 207.19 -32-18-4	**83** +3 +5 **Bi** 208.980 -32-18-5	**84** +2 +4 **Po** (210) -32-18-6	**85** **At** (210) -32-18-7	**86** 0 **Rn** (222) -32-18-8	-N-O-P
87 +1 **Fr** (223) -18-8-1	**88** +2 **Ra** (226) -18-8-2	**89**** +3 **Ac** (227) -18-9-2														-O-P-Q

*Lanthanides	**58** +3 +4 **Ce** 140.12 -19-9-2	**59** +3 **Pr** 140.907 -20-9-2	**60** +3 **Nd** 144.24 -22-8-2	**61** +3 **Pm** (145) -23-8-2	**62** +2 +3 **Sm** 150.35 -24-8-2	**63** +2 +3 **Eu** 151.96 -25-8-2	**64** +3 **Gd** 157.25 -25-9-2	**65** +3 **Tb** 158.924 -26-9-2	**66** +3 **Dy** 162.50 -28-8-2	**67** +3 **Ho** 164.930 -29-8-2	**68** +3 **Er** 167.26 -30-8-2	**69** +3 **Tm** 168.934 -31-8-2	**70** +2 +3 **Yb** 173.04 -32-8-2	**71** +3 **Lu** 174.97 -32-9-2	-N-O-P
**Actinides	**90** +4 **Th** 232.038 -19-9-2	**91** +5 +4 **Pa** (231) -20-9-2	**92** +3 +4 +5 +6 **U** 238.03 -21-9-2	**93** +3 +4 +5 +6 **Np** (237) -22-9-2	**94** +3 +4 +5 +6 **Pu** (242) -23-9-2	**95** +3 +4 +5 +6 **Am** (243) -24-9-2	**96** +3 **Cm** (247) -25-9-2	**97** +3 +4 **Bk** (249) -26-9-2	**98** +3 **Cf** (251) -28-8-2	**99** **Es** (254) -29-8-2	**100** **Fm** (252) -30-8-2	**101** **Md** (256) -31-8-2	**102** (254) -32-8-2	**103** **Lw**	-O-P-Q

Numbers in parentheses are mass numbers of most stable isotope of that element.

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PERIODIC TABLE OF THE ELEMENTS

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ATOMIC WEIGHTS

For the sake of completeness all known elements are included in the list. Several of those more recently discovered are represented only by the unstable isotopes. The value in parenthesis in the atomic weight column is, in each case, the mass number of the most stable isotope.**

Name	Symbol	At. No.	International atomic weight		Valence
			1961	1959	
Actinium	Ac	89	.....	(227)	.....
Aluminum	Al	13	26.9815	26.98	3
Americium	Am	95	.....	(243)	3, 4, 5, 6
Antimony, stibium	Sb	51	121.75	121.76	3, 5
Argon	Ar	18	39.948	39.944	0
Arsenic	As	33	74.9216	74.92	3, 5
Astatine	At	85	.....	(210)	1, 3, 5, 7
Barium	Ba	56	137.34	137.36	2
Berkelium	Bk	97	.....	(217)	3, 4
Beryllium	Be	4	9.0122	9.013	2
Bismuth	Bi	83	208.980	208.99	3, 5
Boron	B	5	10.811	10.82	3
Bromine	Br	35	79.909	79.916	1, 3, 5, 7
Cadmium	Cd	48	112.40	112.41	2
Calcium	Ca	20	40.08	40.08	2
Californium	Cf	98	.....	(251)	.....
Carbon	C	6	12.01115	12.011	2, 4
Cerium	Ce	58	140.12	140.13	3, 4
Cesium	Cs	55	132.905	132.91	1
Chlorine	Cl	17	35.453	35.457	1, 3, 5, 7
Chromium	Cr	24	51.996	52.01	2, 3, 6
Cobalt	Co	27	58.9332	58.94	2, 3
Columbium, see *Niobium*					
Copper	Cu	29	63.54	63.54	1, 2
Curium	Cm	96	.....	(247)	3
Dysprosium	Dy	66	162.50	162.51	3
Einsteinium	Es	99	.....	(254)	.....
Erbium	Er	68	167.26	167.27	3
Europium	Eu	63	151.96	152.0	2, 3
Fermium	Fm	100	.....	(257)	.....
Fluorine	F	9	18.9984	19.00	1
Francium	Fr	87	.....	(223)	1
Gadolinium	Gd	64	157.25	157.26	3
Gallium	Ga	31	69.72	69.72	2, 3
Germanium	Ge	32	72.59	72.60	4
Gold, aurum	Au	79	196.967	197.0	1, 3
Hafnium	Hf	72	178.49	178.50	4
Helium	He	2	4.0026	4.003	0
Holmium	Ho	67	164.930	164.94	3
Hydrogen	H	1	1.00797	1.0080	1
Indium	In	49	114.82	114.82	3
Iodine	I	53	126.9044	126.91	1, 3, 5, 7
Iridium	Ir	77	192.2	192.2	3, 4
Iron, ferrum	Fe	26	55.847	55.85	2, 3
Krypton	Kr	36	83.80	83.80	0
Lanthanum	La	57	138.91	138.92	3
Lead, plumbum	Pb	82	207.19	207.21	2, 4
Lithium	Li	3	6.939	6.940	1
Lutetium	Lu	71	174.97	174.99	3
Magnesium	Mg	12	24.312	24.32	2
Manganese	Mn	25	54.9380	54.94	2, 3, 4, 6, 7
Mendelevium	Md	101	.....	(256)	.....
Mercury, hydrargyrum	Hg	80	200.59	200.61	1, 2
Molybdenum	Mo	42	95.94	95.95	3, 4, 6
Neodymium	Nd	60	144.24	144.27	3
Neon	Ne	10	20.183	20.183	0
Neptunium	Np	93	.....	(237)	4, 5, 6
Nickel	Ni	28	58.71	58.71	2, 3
Niobium (columbium)	Nb	41	92.906	92.91	3, 5
Nitrogen	N	7	14.0067	14.008	3, 5
Nobelium	No	102	.....	(254)	.....
Osmium	Os	76	190.2	190.2	2, 3, 4, 8
Oxygen	O	8	15.9994	16.000	2
Palladium	Pd	46	106.4	106.4	2, 4, 6
Phosphorus	P	15	30.9738	30.975	3, 5
Platinum	Pt	78	195.09	195.09	2, 4
Plutonium	Pu	94	.....	(244)	3, 4, 5, 6
Polonium	Po	84	.....	(209)	.....
Potassium, kalium	K	19	39.102	39.100	1
Praseodymium	Pr	59	140.907	140.92	3
Promethium	Pm	61	.....	(145)	3
Protactinium	Pa	91	.....	(231)	.....
Radium	Ra	88	.....	(226)	2
Radon	Rn	86	.....	(222)	0
Rhenium	Re	75	186.2	186.22	.....
Rhodium	Rh	45	102.905	102.91	3
Rubidium	Rb	37	85.47	85.48	1
Ruthenium	Ru	44	101.07	101.1	3, 4, 6, 8
Samarium	Sm	62	150.35	150.35	2, 3
Scandium	Sc	21	44.956	44.96	3
Selenium	Se	34	78.96	78.96	2, 4, 6
Silicon	Si	14	28.086	28.09	4
Silver, argentum	Ag	47	107.870	107.873	1
Sodium, natrium	Na	11	22.9898	22.991	1
Strontium	Sr	38	87.62	87.63	2
Sulfur	S	16	32.064	32.066*	2, 4, 6
Tantalum	Ta	73	180.948	180.95	5
Technetium	Tc	43	.....	(97)	6, 7
Tellurium	Te	52	127.60	127.61	2, 4, 6
Terbium	Tb	65	158.924	158.93	3
Thallium	Tl	81	204.37	204.39	1, 3
Thorium	Th	90	232.038	(232)	4
Thulium	Tm	69	168.934	168.94	3
Tin, stannum	Sn	50	118.69	118.70	2, 4
Titanium	Ti	22	47.90	47.90	3, 4
Tungsten (wolfram)	W	74	183.85	183.86	6
Uranium	U	92	238.03	238.07	4, 6
Vanadium	V	23	50.942	50.95	3, 5
Xenon	Xe	54	131.30	131.30	0
Ytterbium	Yb	70	173.04	173.04	2, 3
Yttrium	Y	39	88.905	88.91	3
Zinc	Zn	30	65.37	65.38	2
Zirconium	Zr	40	91.22	91.22	4

* Because of natural variations in the relative abundances of the isotopes of sulfur the atomic weight of this element has a range of ± 0.003.

** The 1959 atomic weights are based on O = 16.000 whereas those of 1961 are based on the isotope C^{12}.

ORGANIC COMPOUND INDEX

A	Compound No.	Page No.
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Acenaphthene-5-carbonitrile	155	364
Acenaphthene-5-carboxylic acid	347	207
5,6-Acenaphthenediol	497	122
Acenaphthenequinone	44	183
Acenaphthene-3-sulfonamide	309	404
Acenaphthene-5-sulfonamide	369	406
Acenaphthene-5-sulfonanilide	224	400
Acenaphthene-3-sulfonic acid	144	376
Acenaphthene-3-sulfonyl chloride	175	386
Acenaphthene-5-sulfonyl chloride	172	386
1-Acenaphthenol	353	114
7-Acenaphthenone	151	177
1-Acenaphthoic acid	387	209
cis-Acenaphthylene glycol	527	124
Acepleiadene	123	48
Acetaldehyde	3	144
Acetaldehyde cyanohydrin	54	349
Acetaldehyde trimer	34	145
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4-Acetamidobenzene sulfonamide	359	406
4-Acetamidobenzene sulfonanilide	345	405
4-Acetamidobenzene-1-sulfonic acid	164	377
4-Acetamidobenzenesulfonyl chloride	237	388
4-Acetamidobenzonitrile	180	365
4-Acetamidonaphthalene-1-sulfonamide	417	408
4-Acetamidonaphthalene-1-sulfonanilide	197	399
4-Acetamidonaphthalene-1-sulfonic acid	192	378
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3-Acetylanisole	200	167
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Acetylanthranilic acid	293	205
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3-Acetylbiphenyl	94	170
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0-Acetyl lactonitrile	46	348
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1-Acetylnaphthalene	215	168
2-Acetylnaphthalene	57	174
Acetylnaphthionic acid	192	378
1-Acetyl-2-naphthol	73	100
2-Acetyl-1-naphthol	196	106
δ-Acetylpentanoic acid	23	193
2-Acetylphenanthrene	172	178
3-Acetylphenanthrene	95	175
9-Acetylphenanthrene	99	175
N-Acetyl-*o*-phenetidine	51	232
2-Acetylphenol	10	96

	Compound No.	Page No.
3-Acetylphenol	180	105
" "	64	434
4-Acetylphenol	223	107
" "	141	176
" "	36	434
Acetyl phenyl carbinol	74	170
Acetyl β-phenylhydrazine	203	236
Acetylphloroglucinol	545	125
N-Acetylpiperidine	7	230
β-Acetylpropionic Acid	16	172
" " "	18	193
2-Acetylpyridine	144	165
3-Acetylpyridine	84	436
2-Acetylquinoline	42	173
4-Acetylresorcinol	362	115
5-Acetylresorcinol	368	115
Acetylsalicylaldehyde diacetate	141	280
Acetyl salicylanilide	246	237
0-Acetylsalicylic acid	186	200
" " "	400	432
6-Acetyltetralin	99	170
3-Acetylthianaphthene	102	171
2-Acetylthiophene	169	166
N-Acetyl-*m*-toluidine	31	231
N-Acetyl-*p*-toluidine	290	239
Acetylurea	461	244
5-Acetyl-*n*-valeric acid	23	193
cis-Aconitanilide	344	240
trans-Aconitic acid	314	206
Aconitic acid dianilide	400	242
cis-Aconitic acid dianilide	427	243
trans-Aconityl trichloride	37	215
Acraldehyde	6	144
Acridine	69	324
"	420	439
2,3-Acridinediol	564	126
2,8-Acridinediol	588	127
3,7-Acridinediol	590	127
Acrolein	6	144
Acrylamide	62	232
Acrylanilide	139	234
Acrylic acid	5	190
" "	334	431
Acrylonitrile	3	345
Acrylyl chloride	4	212
Adamantane	80	9
Adipic acid	232	202
" "	377	432
Adipic acid dianilide	490	245
Adipic acid monoamide	204	236
Adipic acid monoanilide	286	238
Adipic aldehyde	26	151
Adiponitrile	104	354
Adipyl dichloride	34	215
β-Alanine	32	285
DL-Alanine	103	289
" "	80	429
L-Alanine	105	289
3-Aldehydobenzoic acid	271	204
Aldol	23	150
Aletheine	29	417
Aleuritic acid	121	197
Alizarin	54	184
Allene	4	12
L-(+)-Alloisoleucine	128	290
Allomucic acid	274	204
β-D-Allose	19	330
β-L-Allose	20	330
DL-Allothreonine	65	287
Alloxanic acid	249	203
Allyl acetate	32	251
Allylacetic acid	22	190
Allylacetone	28	162
Allylacetyl chloride	23	212
Allylacetylene	10	28
Allyl alcohol	5	80
Allylamine	12	295
N-Allylaniline	134	437
Allyl benzoate	238	263
Allyl bromide	6	58
Allyl *n*-butyrate	74	253
Allyl chloride	6	55
Allyl cyanide	16	346
Allylcyclohexane	281	21
4-Allyl-1,2-dimethoxybenzene	99	136
Allyl ethyl ether	17	131
Allyl ethyl sulfide	15	420
Allyl formate	15	250
Allyl iodide	6	60
Allyl isobutyrate	66	252
Allylmalonic acid	126	198
Allyl malononitrile	72	350
Allyl mercaptan	8	413
2-Allyl-6-methoxyphenol	22	95
4-Allyl-2-methoxyphenol	23	95
" "	97	434
4-Allyl-1,2-methylenedioxybenzene	96	135
Allyl methyl ether	8	131
Allyl methyl sulfide	5	420
1-Allylnaphthalene	157	41
2-Allylphenol	10	94
4-Allylphenol	15	94
Allyl phenyl sulfide	51	421
1-Allylpiperidine	342	438
Allyl propionate	51	252
Allylsulfide	23	420
2-Allylthiophene	35	424
Allylurea	63	232
D-Altrose	11	329
L-Altrose	10	329
2-Aminoacenaphthene	305	312
3-Aminoacenaphthene	135	307
4-Aminoacenaphthene	152	307
5-Aminoacenaphthene	220	309
Aminoacetamide	95	305
3-Aminoacetanilide	153	307
4-Aminoacetanilide	321	240
"	364	314
Aminoacetonitrile	22	356
"	212	437
2-Aminoacetophenone	1	172
"	166	300
"	42	436
3-Aminoacetophenone	125	176
"	193	308
"	102	436
4-Aminoacetophenone	137	176
"	213	309
"	41	436
3-Aminoalizarin	56	184
1-Aminoanthracene	132	437
1-Amino-9,10-anthraquinone	41	183
" "	459	318
2-Amino-9,10-anthraquinone	59	185
" "	472	318
2-Amino-9,10-anthraquinone-1-carboxylic acid	381	209
4-Aminoantipyrine	222	309
2-Aminoazobenzene	71	305
4-Aminoazobenzene	277	311
4-Aminobenzalacetophenone	337	313
2-Aminobenzaldehyde	16	153
4-Aminobenzaldehyde	62	156

	Compound No.	Page No.
2-Aminobenzamide	224	309
3-Aminobenzamide	167	235
4-Aminobenzamide	173	235
"	395	315
3-Aminobenzanilide	254	237
4-Aminobenzene-1,3-disulfonamide	398	407
4-Aminobenzene-1,3-disulfonic acid	181	377
2-Aminobenzene sulfonamide	136	397
3-Aminobenzene sulfonamide	102	395
4-Aminobenzene sulfonamide	178	398
4-Aminobenzene sulfonanilide	311	404
2-Aminobenzene sulfonic acid	54	372
3-Aminobenzene sulfonic acid	37	372
4-Aminobenzene sulfonic acid	70	373
4-Aminobenzhydrol	260	311
2-Aminobenzoic acid	9	284
3-Aminobenzoic acid	15	284
" "	149	430
4-Aminobenzoic acid	26	285
" "	94	429
2-Aminobenzonitrile	58	359
3-Aminobenzonitrile	61	359
4-Aminobenzonitrile	150	307
"	111	362
2-Aminobenzophenone	135	176
"	209	309
4-Aminobenzophenone	155	177
"	272	311
"	40	436
3-Aminobenzopyrazole	345	314
6-Aminobenzopyrazole	433	317
2-Aminobenzothiazole	297	312
2-Aminobenzyl alcohol	136	307
3-Aminobenzyl alcohol	186	308
4-Aminobenzyl alcohol	92	305
DL-α-Aminobenzyl cyanide	63	304
α-Aminobenzl cyanide	65	360
2-Aminobenzyl cyanide	91	361
4-Aminobenzyl cyanide	36	304
" " "	42	358
2-Aminobiphenyl	46	304
" "	113	436
3-Aminobiphenyl	142	437
4-Aminobiphenyl	60	304
" "	140	437
1-Amino-3-bromoanthraquinone	455	317
2-Amino-3-bromoanthraquinone	473	318
2-Amino-4-bromobenzaldehyde	146	307
2-Amino-5-bromobiphenyl	66	304
4-Amino-4'-bromobiphenyl	326	313
3-Amino-5-bromo-*p*-cresol	165	308
2-Amino-1-bromo-3-methylanthraquinone	422	316
1-Amino-3-bromonaphthalene	107	306
" "	63	436
1-Amino-4-bromonaphthalene	197	309
" "	87	436
2-Amino-1-bromonaphthalene	83	305
2-Amino-4-bromonaphthalene	94	436
2-Amino-5-bromonaphthalene	23	303
2-Amino-6-bromonaphthalene	282	311
2-Amino-3-bromophenol	333	113
2-Amino-4-bromophenol	283	311
2-Amino-5-bromophenol	380	115
4-Amino-2-bromophenol	432	118
5-Amino-2-bromophenol	379	115
3-Amino-5-bromopyridine	100	306
2-Aminobutane	13	295
α-Amino-*n*-butylbenzene	131	299
γ-Amino-*n*-butylbenzene	133	299
4-Aminobutyl methyl sulfide	42	421

	Compound No.	Page No.
DL-α-Aminobutyric acid	115	290
" " "	72	429
L-(+)-α-Aminobutyric acid	100	289
DL-β-Aminobutyric acid	29	285
γ-Aminobutyric acid	35	285
" "	289	431
4-Aminobutyrophenone	143	307
3-Aminocamphor	228	310
γ-Amino-*n*-caproic acid	37	285
ω-Amino-*n*-caproic acid	34	285
3-Aminocarbazole	460	318
4-Aminochalcone	337	313
1-Amino-4-chloroanthraquinone	392	315
1-Amino-5-chloroanthraquinone	443	317
4-Amino-2-chlorobenzaldehyde	329	313
2-Amino-5-chloro-*p*-cresol	213	107
2-Amino-6-chloro-*p*-cresol	157	104
4-Amino-6-chloro-*m*-cresol	551	125
6-Amino-4-chloro-*o*-cresol	218	107
2-Amino-4-chloro-N,N-dimethylaniline	178	300
2-Amino-5-chloro-4-methylphenol	213	107
2-Amino-6-chloro-4-methylphenol	157	104
4-Amino-6-chloro-3-methylphenol	551	125
6-Amino-4-chloro-2-methylphenol	218	107
1-Amino-2-chloronaphthalene	72	305
1-Amino-3-chloronaphthalene	80	305
" "	65	436
1-Amino-4-chloronaphthalene	190	308
1-Amino-5-chloronaphthalene	91	436
1-Amino-6-chloronaphthalene	97	436
1-Amino-7-chloronaphthalene	96	436
2-Amino-1-chloronaphthalene	70	305
2-Amino-4-chloronaphthalene	92	436
2-Amino-7-chloronaphthalene	110	436
2-Amino-4-chloro-5-nitrophenol	554	126
2-Amino-4-chloro-6-nitrophenol	382	115
4-Amino-2-chloro-3-nitrophenol	434	118
4-Amino-2-chloro-5-nitrophenol	445	119
2-Amino-3-chlorophenol	278	110
2-Amino-4-chlorophenol	334	113
2-Amino-5-chlorophenol	387	116
4-Amino-2-chlorophenol	385	116
4-Amino-3-chlorophenol	402	117
2-Amino-4-chloropyridine	294	312
8-Amino-6-chloroquinoline	113	306
trans-2-Aminocinnamic acid	12	284
trans-3-Aminocinnamic acid	20	285
trans-4-Aminocinnamic acid	16	284
3-Aminocoumarin	292	312
6-Aminocoumarin	379	315
2-Amino-*p*-cresol	323	113
3-Amino-*o*-cresol	309	112
" "	156	307
3-Amino-*p*-cresol	350	114
4-Amino-*m*-cresol	466	120
4-Amino-*o*-cresol	458	120
5-Amino-*o*-cresol	410	117
6-Amino-*m*-cresol	416	117
6-Amino-*o*-cresol	154	104
1-Amino-3-cyanonaphthalene	44	436
2-Amino-4-cyanonaphthalene	62	436
1-Aminocyclohexanecarboxylic acid	125	290
" " "	111	430
2-Aminocyclohexanecarboxylic acid	217	430
cis-3-Aminocyclohexanecarboxylic acid	239	431
trans-3-Aminocyclohexanecarboxylic acid	257	431
cis-4-Aminocyclohexanecarboxylic acid	445	432
trans-4-Aminocyclohexanecarboxylic acid	366	432
4-Aminocyclohexanecarboxylic acid	114	289
2-Aminocyclohexanol	96	305
3-Aminocyclohexene	391	439

	Compound No.	Page No.
2-Amino-*p*-cymene	158	300
cis-9-Aminodecalin	140	299
trans-9-Aminodecalin	132	299
2-Amino-2-desoxy-D-glucose	12	329
3-Amino-3-desoxy-D-glucose	14	328
2-Aminodibenzfuran	172	308
2-Aminodibenzyl	12	303
4-Aminodibenzyl	42	304
3-Amino-4,6-dichlorophenol	324	113
4-Amino-N, N-diethylaniline	173	300
2-Aminodiethylether	35	296
4-Amino-2,6-diethyl-5-methylpyrimidine	404	316
2-Amino-1,4-dihydroxy-9,10-anthraquinone	474	318
3-Amino-1,2-dihydroxy-9,10-anthraquinone	56	184
5-Amino-1,4-dihydroxy-9,10-anthraquinone	437	317
1-Amino-2,4-dihydroxynaphthalene	417	117
2-Amino-3,4-dihydroxynaphthalene	424	118
3-Amino-4-(dimethylamino)toluene	148	299
2-Amino-N,N-dimethylaniline	120	299
4-Amino-N,N-dimethylaniline	29	303
2-Amino-5,4′-dimethylazobenzene	251	310
4-Amino-3,2′-dimethylazobenzene	195	309
2-Amino-4,4′-dimethylbiphenyl	81	305
3-Amino-4,4′-dimethylbiphenyl	204	309
6-Amino-3,4′-dimethylbiphenyl	6	302
1-Amino-2,6-dimethylnaphthalene	161	307
2-Amino-1,4-dimethylnaphthalene	119	306
2-Amino-3,6-dimethylnaphthalene	313	312
2-Amino-3,7-dimethylnaphthalene	286	311
2-Amino-3,5-dimethylphenol	420	118
2-Amino-3,6-dimethylphenol	376	115
2-Amino-4,6-dimethylphenol	318	112
3-Amino-4,5-dimethylphenol	429	118
4-Amino-2,5-dimethylphenol	569	126
4-Amino-2,6-dimethylphenol	332	113
4-Amino-3,5-dimethylphenol	472	121
4-Amino-2,3-dimethyl-1-phenylpyrazolone-5	222	309
4-Amino-2,6-dimethylpiperidine	89	298
4-Amino-2,6-dimethylpyridine	400	316
2-Amino-4,5-dimethylpyrimidine	438	317
2-Amino-4,6-dimethylpyrimidine	413	316
4-Amino-2,6-dimethylpyrimidine	394	315
6-Amino-5,7-dimethylquinoline	385	315
7-Amino-2,4-dimethylquinoline	174	308
1-Amino-4,5-dimethyl-1,2,3-triazole	178	308
4-Amino-2,6-dinitro-*m*-cresol	436	119
6-Amino-2,4-dinitro-*m*-cresol	403	117
4-Amino-2,6-dinitro-3-methylphenol	436	119
6-Amino-2,4-dinitro-3-methylphenol	403	117
1-Amino-2,4-dinitronaphthalene	453	317
2-Amino-1,5-dinitronaphthalene	409	316
2-Amino-1,8-dinitronaphthalene	450	317
2-Amino-3,5-dinitrophenol	542	125
2-Amino-4,6-dinitrophenol	444	119
4-Amino-2,5-dinitrophenol	435	119
4-Amino-2,6-dinitrophenol	448	119
2-Aminodiphenylamine	129	306
4-Aminodiphenylamine	115	306
2-Aminodiphenyl ether	28	138
3-Aminodiphenyl ether	20	137
4-Aminodephenyl ether	49	139
α-Aminodiphenylmethane	185	301
2-Aminodiphenylmethane	58	304
2-Aminodiphenyl sulfide	10	425
4-Aminodiphenyl sulfide	54	426
1-Aminodocosane	409	439
2-Aminoethanethiol	32	417
2-Aminoethyl alcohol	62	83
" " "	71	297
α-Aminoethylbenzene	83	297
α-Aminoethylbenzene	309	438
β-Aminoethylbenzene	93	298
"	349	438
1-(2-Aminoethyl)-4-hydroxybenzene	368	314
2-(*w*-Aminoethyl)-indole	256	310
4-(2-Aminoethyl)-phenol	368	314
1-Aminoethyl phenyl ketone	233	310
1-Aminofluorene	117	436
2-Aminofluorene	168	437
3-Aminofluorene	179	437
4-Aminofluorene	93	436
9-Aminofluorene	90	305
2-Aminofluorenone	367	314
1-Amino-4-fluoronaphthalene	41	304
D-1-Aminofructose	18	330
4-Aminoguaiacol	275	311
1-Aminohendecane	155	300
2-Aminohendecane	151	299
1-Aminoheptadecane	408	439
2-Amino-*n*-heptane	55	296
"	425	439
4-Amino-*n*-heptane	53	296
DL-α-Aminoheptanoic acid	86	288
1-Aminohexadecane	413	439
3-Amino-*n*-hexane	47	296
4-Aminohexanoic acid	37	285
6-Aminohexanoic acid	34	285
D-α-Aminohydratropic acid	104	289
DL-α-Aminohydratropic acid	76	287
1-Aminohydrocinnamic acid	1	284
4-Aminohydrocinnamic acid	7	284
D-β-Aminohydrocinnamic acid	62	287
DL-β-Aminohydrocinnamic acid	60	287
L-β-Aminohydrocinnamic acid	63	287
3-Amino-6-hydroxyacetophenone	261	311
4-Amino-2-hydroxyacetophenone	265	311
1-Amino-2-hydroxyanthraquinone	458	317
4-Amino-4′-hydroxyazobenzene	401	316
3-Amino-4-hydroxybenzenesulfonamide	323	404
4-Amino-2-hydroxybenzenesulfonamide	143	397
5-Amino-2-hydroxybenzenesulfonamide	317	404
5-Amino-2-hydroxybenzenesulfonamide	163	398
5-Amino-2-hydroxybenzene sulfonic acid	148	376
4-Amino-2-hydroxybenzenesulfonyl chloride	261	389
4-Amino-2-hydroxybenzoic acid	40	429
5-Amino-2-hydroxybenzoic acid	114	430
trans-1-Amino-2-hydroxycyclohexane	338	438
cis-1-Amino-2-hydroxycyclohexane	346	438
cis-1-Amino-2-hydroxycyclopentane	344	438
trans-1-Amino-2-hydroxycyclopentane	317	438
2-Amino-4-hydroxy-3-methoxybenzaldehyde	285	311
1-Amino-3-hydroxynaphthalene	397	316
"	90	436
1-Amino-5-hydroxynaphthalene	122	437
1-Amino-6-hydroxynaphthalene	406	316
"	124	437
1-Amino-7-hydroxynaphthalene	430	317
" "	138	437
1-Amino-8-hydroxynaphthalene	179	308
2-Amino-3-hydroxynaphthalene	452	317
2-Amino-5-hydroxynaphthalene	129	437
2-Amino-6-hydroxynaphthalene	436	317
2-Amino-7-hydroxynaphthalene	421	316
" "	143	437
1-Amino-4-hydroxy-3-nitronaphthalene	359	314
2-Amino-3-hydroxypentane	74	297
3-Amino-2-hydroxypentane	72	297
2-Amino-10-hydroxyphenanthrene	446	317
5-Amino-8-hydroxyquinoline	321	313
7-Amino-8-hydroxyquinoline	273	311
5-Amino-2-hydroxy-*m*-xylene	310	312

	Compound No.	Page No.
1-Aminoindane	125	299
"	316	438
2-Aminoindane	143	299
"	333	438
4-Aminoindane	150	299
5-Aminoindane	21	303
"	210	437
4-Amino-4′-iodobiphenyl	372	315
1-Amino-3-iodonaphthalene	142	307
" "	72	436
2-Amino-4-iodonaphthalene	95	436
2-Amino-5-iodophenol	341	113
α-Aminoisobutyric acid	85	288
" "	88	429
4-Amino-6-isopropyl-*m*-cresol	464	120
4-Amino-5-isopropyl-2-methyl-6-nitrophenol	319	112
4-Amino-6-isopropyl-3-methylphenol	464	120
(2-Aminoisopropyl) methyl sulfide	33	421
4-Amino-5-isopropyl-6-nitro-*o*-cresol	319	112
1-Aminoisoquinoline	266	311
5-Aminoisoquinoline	284	311
β-Aminoisovaleric acid	48	286
Aminomalonic acid	3	284
1-Amino-4-mercaptonaphthalene	162	307
1-Amino-3-methoxynaphthalene	89	436
1-Amino-6-methoxynaphthalene	118	436
1-Amino-7-methoxynaphthalene	130	437
2-Amino-4-methoxynaphthalene	128	437
2-Amino-6-methoxynaphthalene	169	437
2-Amino-7-methoxynaphthalene	137	437
4-Amino-N-methylaniline	17	303
1-Amino-2-methylanthraquinone	428	317
2-Amino-5-methylbenzene-1,3-disulfonalimide	285	403
2-Amino-5-methylbenzene-1,3-disulfonamide	440	409
2-Amino-5-methylbenzene-1,4-disulfonamide	441	409
2-Amino-5-methylbenzene-1,4-disulfonic acid	202	378
2-Amino-5-methylbenzene-1,3-disulfonyl chloride	242	389
3-Amino-4-methylbenzenesulfonamide	216	400
5-Amino-2-methylbenzenesulfonamide	175	398
3-Amino-4-methylbenzene sulfonic acid	92	374
3-Amino-6-methylbenzene sulfonic acid	68	373
2-Amino-5-methylbenzophenone	97	305
3-Amino-4-methylbenzophenone	223	309
3′-Amino-4-methylbenzophenone	230	310
4-Amino-3-methylbenzophenone	231	310
4-Amino-4′-methylbenzophenone	402	316
4-Amino-3-methylbiphenyl	32	303
4-Amino-4′-methylbiphenyl	192	308
2-Amino-2-methylbutane	18	295
(Aminomethyl) cyclohexane	399	439
cis-1-Amino-2-methylcyclohexane	400	439
trans-1-Amino-2-methylcyclohexane	402	439
cis-1-Amino-3-methylcyclohexane	403	439
trans-1-Amino-3-methylcyclohexane	414	439
trans-1-Amino-4-methylcyclohexane	398	439
2-Amino-4-methyldiphenylamine	317	313
4-Amino-2-methyldiphenylamine	47	304
α-Amino-α-methylmalonic acid	72	287
1-Amino-2-methylnaphthalene	9	303
1-Amino-3-methylnaphthalene	54	304
" "	123	437
1-Amino-4-methylnaphthalene	55	304
1-Amino-5-methylnaphthalene	124	306
1-Amino-7-methylnaphthalene	68	304
1-Amino-8-methylnaphthalene	101	306
2-Amino-1-methylnaphthalene	53	304
2-Amino-3-methylnaphthalene	304	312
2-Amino-4-methylnaphthalene	105	306
2-Amino-5-methylnaphthalene	86	305
2-Amino-4-methyl-5-nitrophenol	501	122
2-Amino-4-methyl-6-nitrophenol	263	109
4-Amino-2-methyl-6-nitrophenol	258	109
4-Amino-3-methyl-2-nitrophenol	509	123
DL-α-Amino-α-methylpentanoic acid	102	289
2-Amino-4-methylphenol	323	113
2-Amino-5-methylphenol	416	117
2-Amino-6-methylphenol	154	104
3-Amino-2-methylphenol	309	112
3-Amino-4-methylphenol	350	114
4-Amino-2-methylphenol	458	120
4-Amino-3-methylphenol	466	120
5-Amino-2-methylphenol	410	117
4-Amino-3-methyl-1-phenylpyrazole	155	307
5-Amino-3-methyl-1-phenylpyrazole	241	310
2-Amino-3-methylpyridine	4	303
2-Amino-4-methylpyridine	188	308
2-Amino-6-methylpyridine	28	303
3-Amino-4-methylpyridine	211	309
5-Amino-2-methylpyridine	180	308
2-Amino-4-methylquinoline	298	312
3-Amino-2-methylquinoline	358	314
4-Amino-2-methylquinoline	378	315
5-Amino-2-methylquinoline	246	310
6-Amino-2-methylquinoline	403	316
7-Amino-2-methylquinoline	333	313
8-Amino-6-methylquinoline	82	305
α-Amino-α-methyl-succinic acid	61	287
5-Amino-2-methylthiophenol	15	416
1-Amino-5-methyl-1,2,3-triazole	108	306
5-Amino-3-methyl-1,2,4-triazole	331	313
DL-α-Amino-α-methylvaleric acid	102	289
1-Aminonaphthalene	51	304
"	119	436
2-Aminonaphthalene	232	310
"	133	437
2-Aminonaphthalene-8-sulfonamide	232	400
4-Aminonaphthalene-1-sulfonamide	340	405
4-Aminonaphthalene-2-sulfonamide	77	394
5-Aminonaphthalene-1-sulfonamide	442	409
5-Aminonaphthalene-2-sulfonamide	358	406
6-Aminonaphthalene-1-sulfonamide	180	398
1-Aminonaphthalene-7-sulfonanilide	121	396
4-Aminonaphthalene-1-sulfonanilide	274	402
5-Aminonaphthalene-1-sulfonanilide	203	399
5-Aminonaphthalene-2-sulfonanilide	71	394
8-Aminonaphthalene-1-sulfonanilide	96	395
4-Aminonaphthalene-1-sulfonic acid	154	376
5-Aminonaphthalene-1-sulfonic acid	203	378
5-Aminonaphthalene-2-sulfonic acid	165	377
6-Aminonaphthalene-1-sulfonic acid	72	373
8-Aminonaphthalene-1-sulfonic acid	4	380
8-Aminonaphthalene-2-sulfonic acid	102	374
4-Amino-1-naphthalenethiol	28	417
1-Amino-2-naphthoic acid	39	285
2-Amino-1-naphthoic acid	5	284
3-Amino-1-naphthoic acid	21	285
4-Amino-1-naphthoic acid	19	285
5-Amino-1-naphthoic acid	42	286
6-Amino-1-naphthoic acid	38	285
7-Amino-1-naphthoic acid	52	286
1-Amino-2-naphthol	580	127
3-Amino-2-naphthol	562	126
4-Amino-2-naphthol	479	121
5-Amino-1-naphthol	491	122
5-Amino-2-naphthol	489	122
6-Amino-1-naphthol	502	122
6-Amino-2-naphthol	529	124
7-Amino-2-naphthol	508	123
8-Amino-1-naphthol	179	308
8-Amino-2-naphthol	520	123
2-Amino-1,4-naphthoquinone	427	317
5-Amino-4-nitroacenaphthene	447	317

	Compound No.	Page No.
1-Amino-4-nitroanthraquinone	470	318
1-Amino-5-nitroanthraquinone	469	318
4-Amino-4′-nitroazobenzene	440	317
2-Amino-4-nitrobenzaldehyde	271	311
2-Amino-5-nitrobenzaldehyde	420	316
4-Amino-3-nitrobenzaldehyde	408	316
4-Amino-3-nitrobenzenesulfonamide	330	404
4-Amino-2-nitrobenzenesulfonic acid	155	376
4-Amino-3-nitrobenzenesulfonyl chloride	57	382
4-Amino-3-nitrobenzophenone	316	312
2-Amino-4′-nitrobiphenyl	357	314
2-Amino-5-nitrobiphenyl	274	311
4-Amino-3-nitrobiphenyl	373	315
4-Amino-4′-nitrobiphenyl	419	316
4-Amino-6-nitrocatechol	557	126
2-Amino-5-nitro-*p*-cresol	501	122
2-Amino-6-nitro-*p*-cresol	263	109
4-Amino-2-nitro-*m*-cresol	509	123
4-Amino-6-nitro-*o*-cresol	258	109
3-Amino-4-nitrodiphenyl sulfide	57	426
2-Amino-3-nitrofluorenone	464	318
2-Amino-5-nitrohydroquinone	346	314
2-Amino-4-nitromesitylene	120	306
1-Amino-2-nitronaphthalene	322	313
"	7	436
1-Amino-3-nitronaphthalene	38	436
1-Amino-4-nitronaphthalene	412	316
" "	15	436
1-Amino-5-nitronaphthalene	252	310
" "	68	436
1-Amino-6-nitronaphthalene	75	436
1-Amino-7-nitronaphthalene	55	436
1-Amino-8-nitronaphthalene	185	308
" "	71	436
2-Amino-1-nitronaphthalene	276	311
2-Amino-3-nitronaphthalene	30	436
2-Amino-4-nitronaphthalene	50	436
2-Amino-5-nitronaphthalene	323	313
" "	79	436
2-Amino-6-nitronaphthalene	59	436
2-Amino-7-nitronaphthalene	81	436
2-Amino-8-nitronaphthalene	201	309
" "	69	436
2-Amino-3-nitrophenol	538	124
2-Amino-4-nitrophenol	344	114
2-Amino-5-nitrophenol	522	123
2-Amino-6-nitrophenol	233	108
3-Amino-4-nitrophenol	481	121
4-Amino-2-nitrophenol	312	112
4-Amino-3-nitrophenol	390	116
5-Amino-2-nitrophenol	414	117
5-Amino-3-nitrophenol	427	118
3-Amino-4′-nitrophenyl sulfide	57	426
4-Amino-3-nitropyridine	418	316
2-Amino-8-nitroquinoline	355	314
6-Amino-5-nitroquinoline	388	315
8-Amino-6-nitroquinoline	411	316
2-Amino-4-nitroresorcinol	473	121
4-Amino-6-nitroresorcinol	405	117
2-Amino-4-nitrostilbene	320	313
4-Amino-2-nitrostilbene	227	310
DL-α-Aminononanoic acid	82	288
1-Aminooctadecane	410	439
2-Aminooctane	401	439
DL-α-Aminooctanoic acid	80	288
1-Aminooxindole	50	304
DL-2-Amino-*n*-pentane	27	295
1-Aminopentadecane	411	439
3-Aminopentane	390	439
2-Amino-*n*-pentanoic acid	74	429
DL-3-Aminopentanoic acid	13	284
" "	288	431
DL-4-Aminopentanoic acid	46	286
5-Aminopentanoic acid	11	284
" "	338	431
5-Amino-1-pentene	26	295
2-Aminophenacyl alcohol	189	308
4-Aminophenacyl alcohol	369	315
2-Amino-9,10-phenanthraquinone	55	184
3-Amino-9,10-phenanthraquinone	42	183
1-Aminophenanthrene	327	313
2-Aminophenanthrene	149	307
3-Aminophenanthrene	154	307
4-Aminophenanthrene	208	309
9-Aminophenanthrene	308	312
2-Aminophenol	456	120
"	84	434
3-Aminophenol	277	110
"	263	311
"	88	434
4-Aminophenol	476	121
"	396	316
4-Aminophenol-2-sulfonic acid	148	376
(2-Aminophenyl)acetic acid	4	284
DL-α-Aminophenylacetic acid	74	287
L-α-Aminophenylacetic acid	118	290
(3-Aminophenyl) acetic acid	10	284
(4-Aminophenyl)acetic acid	31	285
(2-Aminophenyl)acetonitrile	91	361
(4-Aminophenyl)acetonitrile	42	358
3-Amino-5-phenylacridine	426	317
2-Aminophenyl-4-aminophenyl sulfide	32	425
2-(2-Aminophenyl)ethyl alcohol	5	302
2-(4-Aminophenyl)ethyl alcohol	219	309
β-Amino-β-phenylisobutyric acid	68	287
3-Aminophenyl-4-nitrophenyl sulfide	57	426
2-Aminophenyl phenyl sulfide	10	425
4-Aminophenyl phenyl sulfide	54	426
3-Amino-6-phenylpyridine	210	309
2-(4-Aminophenyl)-quinoline	312	312
3-Amino-2-phenylquinoline	240	310
4-Amino-2-phenylquinoline	376	315
3-Amino-1-phenyl-1,2,4-triazole	336	313
5-Amino-1-phenyl-1,2,4-triazole	351	314
4-Aminophenylurethane	114	306
2-Amino-β-picoline	4	303
2-Amino-γ-picoline	188	308
3-Amino-γ-picoline	211	309
5-Amino-α-picoline	180	308
6-Amino-α-picoline	28	303
1-Amino-2-propanethiol	20	416
3-Amino-1-propanethiol	36	417
2-(3-Aminopropionamido)ethanethiol	29	417
3-Aminopropionic acid	212	430
2-Aminopropiophenone	46	173
"	37	304
3-Aminopropiophenone	34	173
4-Aminopropiophenone	170	178
"	315	312
β-Aminopropiophenone	233	310
2-Aminopropyl alcohol	73	297
3-Aminopropyl alcohol	87	297
DL-3-Aminopropyleneglycol	179	300
3-Aminopropyl methyl sulfide	36	421
4-Aminopyrazole	131	306
2-Aminopyridine	74	305
"	270	438
3-Aminopyridine	89	305
"	248	438
4-Aminopyridine	353	314
"	311	438

	Compound No.	Page No.
γ-Aminopyridine	353	314
2-Aminopyrimidine	281	311
4-Aminopyrimidine	338	313
5-Aminoquinaldine	246	310
2-Aminoquinizarin	474	318
5-Aminoquinizarin	437	317
γ-Aminoquinoline	344	314
2-Aminoquinoline	289	312
"	276	438
3-Aminoquinoline	173	308
"	185	437
4-Aminoquinoline	344	314
"	312	438
5-Aminoquinoline	226	310
"	217	437
6-Aminoquinoline	238	310
"	223	437
7-Aminoquinoline	171	308
"	267	438
8-Aminoquinoline	109	306
"	121	437
5-Aminoresorcinol	361	114
"	328	313
3-Aminosalicylic acid	64	287
4-Aminosalicylic acid	40	429
5-Aminosalicylic acid	88	288
" "	114	430
2-Aminostyrene	9	302
3-Aminostyrene	1	302
4-Aminostyrene	2	303
1-Aminotetradecane	415	439
1-Amino-1,2,3,4-tetrahydronaphthalene	339	438
2-Amino-1,2,3,4-tetrahydronaphthalene	354	438
1-Amino-5,6,7,8-tetrahydronaphthalene	175	300
" " "	157	437
2-Amino-5,6,7,8-tetrahydronaphthalene	22	303
" " "	202	437
3-Amino-1,2,4,5-tetramethylbenzene	117	306
4-Amino-1,2,3,5-tetramethylbenzene	170	300
4-Amino-2-thiocresol	39	304
4-Amino-1-thionaphthol	162	307
2-Aminothiophene	10	302
2-Aminothiophenol	5	303
"	5	416
3-Aminothiophenol	3	302
4-Aminothiophenol	35	303
"	13	416
3-Aminothioxanthone	445	317
6-Aminothymol	389	315
2-Amino-4-toluic acid	14	284
3-Amino-4-toluic acid	18	284
1-Amino-1,2,3-triazole	52	304
1-Amino-1,3,4-triazole	137	307
3-Amino-1,2,4-triazole	356	314
3-Amino-2,4,6-tribromophenol	264	109
3-Amino-2,4,6-trichlorophenol	179	105
4-Amino-2,3,6-trichlorophenol	401	117
w-Aminotridecylic acid	17	284
2-Amino-4,4,4-trifluoro-n-butyric acid	24	429
1-Amino-2,4,5-trimethylbenzene	103	306
1-Amino-3,4,5-trimethylbenzene	118	306
4-Amino-2,3,6-trinitrophenol	354	114
2-Aminotriphenyl carbinol	262	311
3-Aminotriphenyl carbinol	348	314
4-Aminotriphenyl carbinol	242	310
2-Aminotriphenylmethane	288	311
4-Aminotriphenylmethane	141	307
1-Aminoundecane	155	300
2-Aminoundecane	151	299
DL-β-Amino-n-valeric acid	13	284
DL-γ-Amino-n-valeric acid	46	286
w-Amino-n-valeric acid	11	284
2-Aminovanillin	285	311
4-Aminoveratrol	148	307
4-Amino-o-xylene	43	304
n-Amyl acetate	94	254
sec.-Amyl(2) acetate	65	252
sec.-Amyl(3) acetate	64	252
tert.-Amyl acetate	50	252
active-Amylacetic acid	42	191
active-Amyl alcohol	23	81
n-Amyl alcohol	32	81
sec-Amyl alcohol	15	80
sym-sec-Amyl alcohol	13	80
tert-Amyl alcohol	8	80
active-Amylamine	29	296
n-Amylamine	32	296
sec-n-Amylamine	27	295
n-Amyl bromide	17	58
tert-Amyl bromide	12	58
n-Amyl-n-butyrate	146	257
n-Amyl-n-caproate	226	262
n-Amyl-n-caprylate	302	267
tert-Amyl carbinol	31	81
n-Amyl chloride	22	55
tert-Amyl chloride	15	55
2-n-Amylcinnamaldehyde	9	150
n-Amyl n-enanthate	277	265
n-Amyl ether	72	134
n-Amyl ethyl ether	43	133
tert-Amyl ethyl ether	35	132
tert-Amyl ethyl ketone	68	163
n-Amyl formate	63	252
n-Amyl iodide	15	60
tert-Amyl iodide	10	60
n-Amyl levulinate	292	266
sec-n-Amylmalonic acid	50	194
n-Amyl mercaptan	18	413
sec-Amyl mercaptan	10	413
n-Amyl methyl carbinol	50	82
n-Amyl methyl ether	34	132
tert-Amyl methyl ether	28	132
n-Amyl methyl ketone	69	163
tert-Amyl methyl ketone	26	162
Amyl methyl sulfide	28	420
n-Amyl 2-naphthyl ether	5	137
4-n-Amylphenol	4	96
4-tert-Amylphenol	166	104
n-Amyl phenyl ketone	3	172
n-Amylpropiolic acid	16	190
n-Amylpropionate	120	255
n-Amyl stearate	25	274
n-Amyl n-valerate	183	259
Anethole	3	137
Angelamide	212	236
Angelanilide	207	236
Angelic acid	34	194
" "	342	432
Anhalamine	58	140
Anhydrocamphoronic acid	201	201
Aniline	80	297
"	165	437
Aniline-2,4-disulfonamide	398	407
Aniline-2,4,-disulfonic acid	181	377
N-Anilinoacetonitrile	46	359
2-Anilinobutyric acid	209	201
2-(N-Anilino)-butyronitrile	31	358
2-Anilinoisobutanoic acid	290	204
2-Anilinoisobutyric acid	290	204
2-(N-Anilino)-isobutyronitrile	124	362
Anilinoisovaleric acid	188	200
Anilinomalonic acid	155	199

	Compound No.	Page No.
2-Anilinopentanoic acid	221	202
2-Anilinopropionic acid	247	203
2-(N-Anilino)-propionitrile	118	362
2-Anilinovaleric acid	221	202
2-(N-Anilino)-valeronitrile	57	359
Anisalacetone	96	175
Anisalacetophenone	104	175
α-Anisal-α-cinnamalacetone	169	178
o-Anisaldehyde	15	153
3-Anisaldehyde	85	149
4-Anisaldehyde	89	149
4-Anisamide	330	240
4-Anisanilide	341	240
2-Anisic acid	114	197
4-Anisic acid	291	204
Anisic anhydride	43	226
2-Anisidine	94	135
3-Anisidine	102	136
4-Anisidine	35	138
m-Anisidine	168	300
o-Anisidine	134	299
p-Anisidine	67	304
Anisil	56	140
"	161	177
Anisoin	54	139
"	146	177
Anisole	56	133
Anisoyl chloride	58	213
4-Anisyl alcohol	5	88
" "	4	137
4-Anisyl methyl carbinol	133	87
2-Anisyl phenyl ketone	29	173
4-Anisyl phenyl ketone	80	174
2-Anisyl sulfide	43	426
Anthracene	189	51
9-Anthracenecarbonitrile	214	367
Anthracene-1-carboxylic acid	380	209
" "	234	431
Anthracene-2-carboxylic acid	397	209
" "	315	431
Anthracene-9-carboxylic acid	331	207
" "	230	431
1,2-Anthracenediol	408	117
1,5-Anthracenediol	578	127
1,8-Anthracenediol	556	126
2,3-Anthracenediol	582	127
2,6-Anthracenediol	586	127
2,7-Anthracenediol	581	127
9,10-Anthracenediol	468	120
Anthracene-1,5-disulfonamide	474	410
Anthracene-1,8-disulfonamide	475	410
Anthracene-1,5-disulfonanilide	463	409
Anthracene-1,8-disulfonanilide	373	406
Anthracene-1,5-disulfonic acid	225	379
Anthracene-1,8-disulfonic acid	226	379
Anthracene-1,5-disulfonyl chloride	281	390
Anthracene-1,8-disulfonyl chloride	278	390
Anthracene-1-sulfonamide	321	404
Anthracene-2-sulfonamide	444	409
Anthracene-2-sulfonanilide	314	404
Anthracene-1-sulfonic acid	150	376
Anthracene-2-sulfonic acid	205	378
Anthracene-1-sulfonyl chloride	117	384
Anthracene-2-sulfonyl chloride	192	387
1,8,9-Anthracentriol	465	120
9,10-Anthradiol	468	120
Anthragallol	61	185
9-Anthraldehyde	91	158
Anthralin	465	120
Anthranilamide	155	235
Anthranilanilide	223	237
Anthranilic acid	9	284
Anthranilic acid	43	429
Anthranilonitrile	58	359
9-Anthraphenone	179	178
Anthrapurpurin	63	185
1,2-Anthraquinone	28	182
1,4-Anthraquinone	35	183
9,10-Anthraquinone	52	184
9,10-Anthraquinone-1-carboxylic acid	402	210
" " "	194	430
9,10-Anthraquinone-2-carboxylic acid	401	210
" " "	197	430
9,10-Anthraquinone-2-carboxylic acid chloride	32	217
9,10-Anthraquinone-2,3-dicarboxylic acid	407	210
9,10-Anthraquinone-1,4-dicarboxylic acid dichloride	35	217
9,10-Anthraquinone-1,5-dicarboxylic acid dichloride	36	217
9,10-Anthraquinone-2,6-dicarboxylic acid dichloride	34	217
9,10-Anthraquinone-1,3-disulfonamide	478	410
9,10-Anthraquinone-1,5-disulfonamide	426	408
9,10-Anthraquinone-1,8-disulfonamide	477	410
9,10-Anthraquinone-2,7-disulfonamide	283	403
9,10-Anthraquinone-1,5-disulfonanilide	450	409
9,10-Anthraquinone-1,6-disulfonanilide	381	406
9,10-Anthraquinone-1,7-disulfonanilide	408	407
9,10-Anthraquinone-1,8-disulfonanilide	409	407
9,10-Anthraquinone-2,6-disulfonanilide	449	409
9,10-Anthraquinone-2,6-disulfonanilide	473	410
9,10-Anthraquinone-2,7-disulfonanilide	279	402
9,10-Anthraquinone-1,5-disulfonic acid	228	379
9,10-Anthraquinone-1,6-disulfonic acid	18	380
9,10-Anthraquinone-1,7-disulfonic acid	21	380
9,10-Anthraquinone-1,8-disulfonic acid	227	379
9,10-Anthraquinone-2,6-disulfonic acid	22	380
9,10-Anthraquinone-2,7-disulfonic acid	10	380
9,10-Anthraquinone-1,3-disulfonyl chloride	283	390
9,10-Anthraquinone-1,6-disulfonyl chloride	271	390
9,10-Anthraquinone-1,7-disulfonyl chloride	285	390
9,10-Anthraquinone-1,8-disulfonyl chloride	277	390
9,10-Anthraquinone-2,6-disulfonyl chloride	282	390
9,10-Anthraquinone-2,7-disulfonyl chloride	267	389
9,10-Anthraquinone-2-sulfonamide	445	409
9,10-Anthraquinone-1-sulfonanilide	343	405
9,10-Anthraquinone-2-sulfonanilide	289	403
9,10-Anthraquinone-1-sulfonic acid	17	380
9,10-Anthraquinone-2-sulfonic acid	206	378
9,10-Anthraquinone-2-sulfonyl chloride	274	390
9,10-Anthraquinone-2-sulfonyl chloride	270	390
1-Anthraquinonethiol	47	417
2-Anthraquinonethiol	48	417
Anthrarufin	50	184
α-Anthroic acid	380	209
β-Anthroic acid	397	209
meso-Anthroic acid	331	207
1-Anthrol	381	115
Anthrone	183	178
Anthroxanic acid	307	205
Antiarol	57	140
Antipyrine	72	324
Apiolic acid	273	204
Apiolonitrile	182	365
Apionol	413	117
Apiose	2	328
cis-Apocamphoric acid	327	206
β-D-Arabinose	40	331
DL-Arabinose	49	332
β-L-Arabinose	41	331
l-Arabonic acid	152	199
Arachidamide	154	234
Arachidanilide	79	233
Arachidic acid	78	196

	Compound No.	Page No.
Arachidic anhydride	32	225
DL-Arginine	66	287
"	50	429
L-Arginine	40	286
Asaronic acid	216	202
l-Ascorbic acid	309	205
L-Ascorbic acid	59	333
DL-Asparagine	42	429
α-L-Asparagine	45	286
β-L-Asparagine	54	286
DL-Aspartic acid	79	288
L-Aspartic acid	81	288
Aspirin	186	200
Atropic acid	130	198
" "	400	432
Azelaic acid	132	198
" "	396	432
Azelaic acid diamide	351	241
Azelaic acid monoamide	91	233
Azelaic acid monoanilide	153	234
Azelayl chloride	26	214
Azelonitrile	12	355
Azepine	456	439
Azetidine	15	295
"	467	439
Azidoacetyl chloride	2	214
d,l-Azidobutyric acid	3	193
α-Azidoisobutyric acid	9	193
2-Azidoisovaleric acid	6	192
d,l-2-Azidopropionic acid	8	192
Aziridine	292	438
Azobenzene-3-carboxylic acid	264	204
Azobenzene-4-carboxylic acid	374	208
Azobenzene-2,2′-dicarboxylic acid	379	209
Azobenzene-4,4′-dicarboxylic acid dichloride	31	217
Azobenzene-3,3′-disulfonamide	469	410
Azobenzene-3,4′-disulfonamide	460	409
Azobenzene-4,4′-disulfonamide	436	408
Azobenzene-3,3′-disulfonic acid	222	379
Azobenzene-3,4′-disulfonic acid	215	378
Azobenzene-4,4′-disulfonic acid	199	378
Azobenzene-3,3′-disulfonyl chloride	256	389
Azobenzene-3,4′-disulfonyl chloride	195	387
Azobenzene-4,4′-disulfonyl chloride	276	390
2-Azophenol	453	120
3-Azophenol	521	123
4-Azophenol	537	124
Azoxybenzene-3,3′-disulfonamide	454	409
Azoxybenzene-3,3′-disulfonic acid	208	378
Azoxybenzene-3,3′-disulfonyl chloride	220	388
2-Azoxyphenol	391	116
3-Azoxyphenol	474	121
4-Azoxyphenol	552	125
Azulene	102	47

B

	Compound No.	Page No.
Bayer acid	13	380
Behenic acid	83	196
Benz[bc]aceanthrylene	127	48
3,4-Benzacenaphthenequinone	48	184
Benzalacenaphthenone	138	176
Benzalacetone	31	173
Benzalacetophenone	66	174
Benzal chloride	22	63
Benzaldehyde	66	147
Benzaldehyde-2-carboxylic acid	86	157
Benzaldehyde-3-carboxylic acid	122	159
Benzaldehyde-4-carboxylic acid	130	160
Benzaldehyde cyanohydrin	7	357
Benzaldehyde-4-sulfonic acid	17	371
Benzalfluorene	67	45
Benzalmalononitrile	112	362
Benzamide	220	236
2-Benzamidobenzoic acid	282	204
4-Benzamidobenzonitrile	201	366
2-Benzamidophenol	437	119
3-Benzamidophenol	457	120
4-Benzamidophenol	539	124
Benzanilide	323	240
1,2-Benzanthracene	158	49
Benzanthrone	186	178
Benzene	1	35
Benzeneazocatechol	433	118
2-Benzeneazophenol	134	103
4-Benzeneazophenol	383	116
Benzeneazoresorcinol	449	119
Benzene-1,2-dicarboxylic acid	321	206
Benzene-1,3-dicarboxylic acid	408	210
Benzene-1,4-dicarboxylic acid	404	210
Benzene-1,2-disulfonamide	439	409
Benzene-1,3-disulfonamide	388	407
Benzene-1,4-disulfonamide	461	409
Benzene-1,2-disulfonanilide	418	408
Benzene-1,3-disulfonanilide	126	396
Benzene-1,4-disulfonanilide	432	408
Benzene-1,2-disulfonic acid	201	378
Benzene-1,3-disulfonic acid	175	377
Benzene-1,4-disulfonic acid	214	378
Benzene-1,2-disulfonyl chloride	233	388
Benzene-1,3-disulfonyl chloride	62	382
Benzene-1,4-disulfonyl chloride	212	388
Benzenehexacarboxylic acid	14	429
α-Benzene hexachloride	4	64
β-Benzene hexachloride	6	64
γ-Benzene hexachloride	3	64
Benzenepentacarboxylic acid	28	429
Benzene sulfonamide	145	397
Benzene sulfonanilide	48	393
Benzene sulfonic acid	53	372
Benzenesulfonyl chloride	5	381
1,2,3,4-Benzenetetracarboxylic acid	46	429
1,2,3,5-Benzenetetracarboxylic acid	93	429
1,2,4,5-Benzenetetracarboxylic acid	34	429
1,2,3-Benzenetricarboxylic acid	118	430
1,2,4-Benzenetricarboxylic acid	100	429
Benzenetricarboxylic-1,3,5-acid	410	210
" "	51	429
Benzene-1,3,5-trisulfonamide	472	410
Benzene-1,3,5-trisulfonanilide	406	407
Benzene-1,3,5-trisulfonic acid	224	379
Benzene-1,3,5-trisulfonyl chloride	268	390
1,3,5-Benzenetrithiol	18	416
10,11-Benzfluoranthene	166	50
11,12-Benzfluoranthene	190	51
1,2-Benzfluorene	179	50
2,3-Benzfluorene	187	51
3,4-Benzfluorene	132	48
Benzhydrol	39	89
Benzhydrylamine	185	301
Benzidine	280	311
Benzidine-2,2′-disulfonamide	456	409
Benzidine-2,2′-disulfonic acid	211	378
Benzidine-2,2′-disulfonyl chloride	273	390
Benzil	119	176
Benzilamide	295	239
Benzilic acid	227	202
" "	144	430
Benzilic acid chloride	23	214
Benzimidazole	219	437
2-Benzimidazolthiol	49	417
4,5-Benzindane	171	42
5,6-Benzindane	97	47
Benzindole	34	231

	Compound No.	Page No.
Benzo-4-bromoanilide	438	243
Benzo-4-chloroanilide	410	243
Benzo-2-ethylanilide	275	238
Benzo-4-fluoroanilide	388	242
2-Benzofurylacetic acid	111	197
2-Benzofurylacetic acid	251	203
2-Benzofuryl methyl ketone	102	175
Benzoic acid	164	199
" "	323	431
Benzoic anhydride	13	225
d,l-Benzoin	56	90
" "	162	177
Benzoin acetate	122	279
Benzo-2-iodovanilide	251	237
Benzonitrile	58	349
2-Benzophenetidide	132	234
3-Benzophenetidide	129	234
4-Benzophenetidide	354	241
Benzophenone	47	173
Benzophenone-2-carboxylic acid	171	200
Benzophenone-2,4-dicarboxylic acid	365	208
Benzophenone-4,4′-dicarboxylic acid	409	210
Benzophenone-3,3′-disulfonamide	152	397
Benzophenone-3,3′-disulfonanilide	222	400
Benzophenone-3,3′-disulfonic acid	62	373
Benzophenone-3,3′-disulfonyl chloride	217	388
Benzophenone-2-sulfonanilide	109	396
Benzophenone-2-sulfonic acid	6	380
Benzophenone-2-sulfonyl chloride	136	385
Benzopyrazine	5	323
1,4-Benzoquinone	12	181
Benzotetronic acid	516	123
2-Benzothiazolthiol	45	417
2-Benzotoluidide	266	238
3-Benzotoluidide	201	236
4-Benzotoluidide	315	239
Benzotrichloride	23	63
Benzo-2,4,6-trichloroanilide	350	241
Benzoylacetone	75	174
Benzoylacetonitrile	103	362
w-Benzoylacetophenone	111	175
2-Benzoylacrylic acid	126	176
4-Benzoylanisine	40	436
9-Benzoylanthracene	179	178
N-Benzoylanthranilic acid	282	204
N-Benzoylanthranilonitrile	201	366
2-Benzoylbenzamide	327	240
2-Benzoylbenzanilide	416	243
2-Benzoylbenzenesulfonyl chloride	136	385
2-Benzoylbenzoic acid	171	200
Benzoyl bromide	14	218
N-Benzoyl-*p*-bromoaniline	438	243
α-Benzoylbutanoic acid	90	196
α-Benzoylbutyric acid	90	196
Benzoyl carbinol	47	89
" "	150	177
Benzoylcarbinyl acetate	60	276
4-Benzoylcatechol	355	114
Benzoyl chloride	41	213
N-Benzoyl-*p*-chloroaniline	410	243
N-Benzoyl-*o*-ethylaniline	275	238
Benzoylformic acid	85	174
" "	61	195
Benzoylformyl chloride	7	214
2-Benzoylfuran	40	173
Benzoyl-2-furoylmethane	90	175
Benzoyl iodide	3	222
O-Benzoyllactic acid	138	198
O-Benzoyllactonitrile	98	353
Benzoylmethanethiol	4	416
Benzoylnitromethane	136	176
N-Benzoyl-*m*-phenetidine	129	234
N-Benzoyl-*o*-phenetidine	132	234
N-Benzoyl-*p*-phenetidine	354	241
2-Benzoylphenol	26	97
3-Benzoylphenol	251	109
4-Benzoylphenol	322	112
" "	165	177
Benzoyl phenyl carbinol	56	90
α-Benzoyl-β-phenylhydrazine	334	240
2-Benzoylphloroglucinol	426	118
N-Benzoylpiperidine	3	231
β-Benzoylpropionanilide	283	238
α-Benzoylpropionic acid	114	175
" "	85	196
β-Benzoylpropionic acid	147	199
2-Benzoylpyridine	217	168
Benzoylpyruvic acid	241	202
4-Benzoylresorcinol	352	114
Benzoyl sulfide	20	425
Benzoyl-2-thenoylmethane	107	175
2-Benzoylthiophene	60	174
N-Benzoyl-*m*-toluidine	201	236
N-Benzoyl-*o*-toluidine	266	238
N-Benzoyl-*p*-toluidine	315	239
N-Benzoyl-2,4,6-trichloroaniline	350	241
1,2-Benzphenanthrene	195	51
3,4-Benzphenanthrene	56	45
N-Benzpiperidide	3	231
1,2-Benzpyrene	172	50
4,5-Benzpyrene	174	50
3,4-Benzpyrene-5-carboxaldehyde	127	160
N-Benzylacetamide	26	231
N-Benzylacetanilide	20	231
Benzyl acetate	209	261
Benzylacetic acid	123	198
Benzylacetophenone	97	175
N-Benzylacrylamide	487	245
Benzyl alcohol	104	85
Benzylamine	81	297
"	321	438
Benzylanilide	355	241
N-Benzylaniline	19	303
N-Benzylbenzamide	143	234
N-Benzylbenzanilide	148	234
Benzyl benzoate	8	273
Benzyl bromide	23	58
Benzyl 4-bromophenyl sulfide	37	425
Benzyl *n*-butyl ether	91	135
Benzyl *n*-butyrate	258	264
N-Benzyl-*n*-caproamide	9	231
Benzyl chloride	38	56
Benzyl chloroacetate	89	254
Benzyl 3-chlorophenyl ketone	79	174
Benzyl 4-chlorophenyl ketone	139	176
α-Benzylcinnamic anhydride	47	226
Benzyl cinnamate	44	275
N-Benzylcrotonamide	175	235
Benzyl cyanide	80	351
Benzylcyanoacetic acid	119	197
2-Benzyl-2-cyanopropionic acid	73	429
Benzyl dimethyl amine	44	320
Benzyl dimethyl carbinol	4	88
Benzyl ether	109	136
Benzyl ethyl amine	93	298
Benzyl ethyl ether	71	134
Benzyl ethyl ketone	182	167
Benzyl ethyl sulfide	55	421
N-Benzylformamide	25	231
Benzyl formate	176	259
Benzylglycolaldehyde	26	154
Benzyl 4-hydroxybenzoate	43	434
N-Benzylidene-2-aminophenol	155	104
N-Benzylidene-4-aminophenol	475	121

	Compound No.	Page No.
Benzylidenemalonic acid	315	206
Benzylidene malonyldichloride	17	216
Benzyl iodide	2	61
Benzyl isobutyl ether	85	135
N-Benzylisovaleramide	14	231
Benzylmalonic acid	148	199
Benzylmalonic acid diamide	475	245
Benzylmalonic acid dianilide	459	244
Benzylmalonyl dichloride	35	215
Benzyl mercaptan	32	414
Benzyl-4-methoxyphenyl ketone	103	164
Benzyl methyl amine	79	297
N-Benzyl-N-methylaniline	113	321
Benzyl methyl ether	61	134
Benzyl methyl ketone	5	172
Benzyl methyl sulfide	46	421
1-Benzylnaphthalene	40	44
2-Benzylnaphthalene	39	44
4-Benzyl-1-naphthol	296	111
Benzyl-1-naphthyl ether	47	139
Benzyl-2-naphthyl ether	53	139
Benzyl 4-nitrophenyl sulfide	66	426
Benzyl oxalate	120	279
3-Benzyloxybenzaldehyde	35	154
2-Benzyloxyethanol	128	86
N-Benzylpalmitamide	90	233
2-Benzylphenol	1	96
4-Benzylphenol	137	103
d,l-Benzylphenyl carbinol	37	89
Benzyl phenyl ketone	73	174
Benzyl phenyl sulfide	13	425
2-Benzyl-2-phenylsuccinic acid	235	431
N-Benzylphthalamide	371	241
α-Benzylpropionic acid	20	193
2-Benzylpyridine	200	437
2-Benzylpyrrolidine	383	439
2-Benzyl-2-pyrroline	275	438
Benzylpyruvic acid	40	194
Benzyl salicylate	354	271
N-Benzylstearamide	101	233
Benzyl succinate	47	275
Benzylsuccinic acid	302	431
DL-Benzylsuccinic anhydride	44	226
Benzyl sulfide	21	425
Benzyl sulfonamide	37	393
Benzyl sulfonanilide	34	393
Benzyl sulfonic acid	9	371
Benzyl sulfonyl chloride	120	384
N-Benzyltoluene-4-sulfonamide	53	394
Benzylurea	281	238
Betaine	28	285
Betol	178	105
Biacetyl	5	161
Biallyl	38	13
Bibenzyl	27	44
Bicetyl	55	9
Bicyclo[2,2,1]heptane	77	9
Bicyclohexyl	262	7
Bicyclo[12,2,2]octadeca-14,16,18-triene	1	25
cis-Bicyclo[3,3,0]octane	103	4
Bicyclo[4,2,0]octane	102	4
Bicyclo[2,2,2]oct-2-ene	24	26
Bicyclo[4,2,0]oct-2-ene	241	19
Bicyclo[4,2,0]oct-3-ene	2	25
Bicyclo[4,2,0]oct-7-ene	230	19
Bicyclo[4,7]pentadiene	3	26
Bifluorenylidene	182	50
2,2′-Bifuroyl	185	178
Bi-α-naphthol	587	127
1,1′-Binaphthyl	160	49
1,2′-Binaphthyl	71	46
2,2′-Binaphthyl	178	50
2,2′-Biphenol	227	108
2,4′-Biphenol	418	118
3,3′-Biphenol	290	111
4,4′-Biphenol	579	127
Biphenyl	60	45
Biphenyl-2-carboxylic acid	202	430
Biphenyl-2,2′-dicarboxylic acid	354	208
Biphenyl-4,4′-disulfonamide	467	410
Biphenyl-4,4′-disulfonic acid	220	379
Biphenyl-4,4′-disulfonyl chloride	272	390
Biphenyleneethylene	28	44
Biphenylene oxide	50	139
2-Biphenyl ethyl ether	14	137
3-Biphenyl ethyl ether	16	137
4-Biphenyl ethyl ether	46	139
2-Biphenyl methyl ether	10	137
4-Biphenyl methyl ether	51	139
Biphenyl-4-sulfonamide	390	407
Biphenyl-4-sulfonanilide	66	394
Biphenyl-4-sulfonic acid	176	377
Biphenyl-4-sulfonyl chloride	178	386
4-Biphenylthiol	35	417
α,α′-Bipyridyl	38	323
β,β′-Bipyridyl	36	323
2,2′-Bipyridyl	38	323
2,3′-Bipyridyl	110	321
3,3′-Bipyridyl	36	323
3,4′-Bipyridyl	34	323
4,4′-Bipyridyl	73	324
2,2′-Bipyrroyl	94	325
α,α′-Biquinolyl	92	325
2,2′-Biquinolyl	92	325
2,3′-Biquinolyl	89	325
2,7′-Biquinolyl	83	324
3,4′-Biquinolyl	48	324
5,5′-Biquinolyl	88	325
6,6′-Biquinolyl	90	325
6,8′-Biquinolyl	79	324
7,7′-Biquinolyl	86	325
2,2′-Biquinolyl ketone	84	325
2,2′-Biquinolylmethane	67	324
Bis(benzylthio)methane	28	425
Bis(2-cyanoethyl)amine	207	437
Bis(2-cyanoethyl)ethylamine	163	437
Bis(cyanomethyl)amine	94	361
"	13	436
Bis(2-chloroethyl)ethylamine	263	438
Bis(2-chloroethyl)methylamine	259	438
1,2-Bis(chloromethyl)-benzene	6	57
1,3-Bis(chloromethyl)-benzene	1	57
1,4-Bis-(chloromethyl)-benzene	8	57
1,1-Bis-(4-chlorophenyl)-2,2,2-trichloroethane	3	57
2,2-Bis-(4-chlorophenyl)-1,1-trichloroethane	2	64
1,2-Bis(diethylamino)ethane	332	438
4,4′-Bis-(dimethylamino)-benzhydrol	64	324
4,4′-Bis-(dimethylamino)-benzophenone	87	325
" " "	190	178
2,2′-Bis-(dimethylamino)-biphenyl	41	323
1,4-Bis(dimethylamino)butane	35	319
4,4′-Bis(dimethylamino)diphenylmethane	54	324
1,2-Bis(dimethylamino)ethane	308	438
4,4′-Bis(dimethylamino)etriphenylmethane	66	324
1,2-Bis(ethylamino)ethane	394	439
1,2-Bis(furfurylamino)ethane	300	438
Bis(2-hydroxyethyl)amine	305	438
Bis(2-hydroxyethyl)-methyl amine	299	438
2,2-Bis(hydroxymethyl)-1,3-propanediol	69	90
1,2-Bis(isopropylamino)ethane	388	439
Bis(2-mercaptoethyl)ether	41	415
Bis(4-mercaptophenyl)ether	30	417
1,2-Bis(methylamino)ethane	370	439
1,4-Bis(methylamino)ethane	61	304

	Compound No.	Page No.
1,3-Bis(2-nitrophenylthio)propane	68	426
1,2-Bis(phenylthio)ethane	38	426
Bis(phenylthio)methane	24	425
1,2-Bis(propylamino)ethane	380	439
Bis(4-thiophenyl)sulfide	39	417
1,2-Bis(tolylthio)ethane	48	426
Biuret	411	243
Bornane	79	9
"Borneo camphor"	66	90
d-Borneol	66	90
d-Bornyl acetate	21	274
trans-Bornylamine	373	439
trans-Brassidic acid	51	195
Brometone	63	90
Bromoacetamide	76	233
Bromoacetanilide	224	237
2-Bromoacetanilide	111	233
3-Bromoacetanilide	69	232
4-Bromoacetanilide	331	240
Bromoacetic acid	41	194
"	129	430
Bromoactic anhydride	11	225
Bromoacetone	33	162
2-Bromoacetophenone	52	169
3-Bromoacetophenone	97	170
4-Bromoacetophenone	52	173
w-Bromoacetophenone	51	173
Bromoacetyl bromide	8	218
Bromoacetyl chloride	24	212
cis-2-Bromoallocinnamic acid	158	199
2-Bromoaniline	10	303
"	54	436
3-Bromoaniline	167	300
"	105	436
4-Bromoaniline	98	305
"	116	436
3-Bromo-*o*-anisidine	93	305
4-Bromo-*o*-anisidine	187	308
2-Bromo-*p*-anisidine	87	305
2-Bromoanisole	84	135
4-Bromoanisole	86	135
3-Bromobenzaldehyde	86	149
4-Bromobenzaldehyde	43	155
2-Bromobenzamide	298	239
3-Bromobenzamide	301	239
4-Bromobenzamide	402	242
2-Bromobenzanilide	258	238
3-Bromobenzanilide	247	237
Bromobenzene	1	73
2-Bromobenzene-1,4-dicarboxylic acid	403	210
2-Bromobenzenesulfonamide	252	401
4-Bromobenzenesulfonamide	182	398
4-Bromobenzenesulfonanilide	56	394
2-Bromobenzenesulfonic acid	114	375
4-Bromobenzenesulfonic acid	73	373
2-Bromobenzenesulfonyl chloride	38	382
4-Bromobenzenesulfonyl chloride	88	383
2-Bromobenzoic acid	226	202
" "	122	430
3-Bromobenzoic acid	235	202
" "	253	431
4-Bromobenzoic acid	382	209
" "	277	431
2-Bromobenzoic anhydride	31	225
3-Bromobenzoic anhydride	66	226
4-Bromobenzoic anhydride	80	227
2-Bromobenzonitrile	59	359
3-Bromobenzonitrile	30	358
4-Bromobenzonitrile	156	364
2-Bromobenzophenone	35	173
4-Bromobenzophenone	113	175
2-Bromo-1,4-benzoquinone	4	181

	Compound No.	Page No.
2-Bromobenzoyl bromide	6	219
4-Bromobenzoyl bromide	11	219
2-Bromobenzoyl chloride	56	213
3-Bromobenzoyl chloride	55	213
4-Bromobenzoyl chloride	5	216
2-Bromobenzoylformic acid	99	197
2-Bromobenzyl bromide	2	59
3-Bromobenzyl bromide	3	59
4-Bromobenzyl bromide	7	59
4-Bromobenzyl chloride	2	57
2-Bromobenzyl cyanide	15	357
4-Bromobenzyl cyanide	45	359
2-Bromobiphenyl	17	73
4-Bromobiphenyl	6	74
α-Bromobutanoic acid	39	191
β-Bromobutanoic acid	1	193
1-Bromo-2-butanone	75	163
α-Bromobutyric acid	39	191
β-Bromobutyric acid	1	193
DL-α-Bromobutyric anhydride	1	224
DL-α-Bromobutyryl bromide	11	218
DL-α-Bromobutyryl chloride	31	212
3-Bromocamphor-8-sulfonamide	117	396
D-3-Bromocamphor-10-sulfonamide	147	397
10-Bromocamphor-3-sulfonamide	31	393
3-Bromocamphor-8-sulfonic acid	43	372
3-Bromocamphor-10-sulfonic acid	59	373
10-Bromocamphor-3-sulfonic acid	8	371
3-Bromocamphor-8-sulfonyl chloride	215	388
3-Bromocamphor-10-sulfonyl chloride	68	383
10-Bromocamphor-3-sulfonyl chloride	138	385
4-Bromocatechol	151	104
Bromochloroacetic acid	14	193
1-Bromo-4-chlorobenzene	19	71
1-Bromo-2-chloroethane	12	63
2-Bromo-4-chlorophenol	16	96
1-Bromo-3-chloropropane	18	63
erythro-2-Bromo-3-chlorosuccinic acid	17	429
threo-2-Bromo-3-chlorosuccinic acid	19	429
trans-α-Bromocinnamic acid	178	200
trans-2-Bromocinnamic acid	371	432
4-Bromocinnamic acid	384	209
4-Bromo-*m*-cresol	71	100
5-Bromo-*m*-cresol	55	99
4-Bromo-*o*-cresol	72	100
5-Bromo-*o*-cresol	124	103
2-Bromo-*p*-cresol	54	99
3-Bromo-*p*-cresol	50	99
γ-Bromocrotonic acid	72	196
1-Bromo-4-cyanonaphthalene	141	363
1-Bromo-5-cyanonaphthalene	194	365
2-Bromocymene	13	73
2-Bromo-1,4-diaminobenzene	122	306
2-Bromo-4,6-dichlorophenol	89	101
3-Bromo-2,6-dichlorophenol	113	102
Bromodicyanomethane	169	364
2-Bromo-1,4-dihydroxy-9,10-anthraquinone	46	184
6-Bromo-1,4-dihydroxy-9,10-anthraquinone	27	182
4-Bromo-1,2-dihydroxybenzene	151	104
3-Bromo-1,2-dihydroxynaphthalene	253	109
4-Bromo-1,5-dihydroxynaphthalene	250	109
2-Bromo-4,6-dimethylaniline	48	304
4-Bromo-2,6-dimethylaniline	100	436
2-Bromo-N,N-dimethylaniline	145	437
3-Bromo-N,N-dimethylaniline	93	321
4-Bromo-N,N-dimethylaniline	141	437
1-Bromo-2,3-dimethylbenzene	9	73
4-Bromo-2,5-dimethylbenzoic acid	267	204
5-Bromo-2,4-dimethylbenzoic acid	280	204
4-Bromo-2,5-dimethylbenzonitrile	142	363
5-Bromo-2,4-dimethylbenzonitrile	113	362
2-Bromo-4,5-dimethylphenol	123	102

	Compound No.	Page No.
1-Bromo-2,4-dinitrobenzene	40	338
4-Bromo-1,3-dinitrobenzene	40	338
2-Bromo-3,5-dinitrobenzoic acid	339	207
4-Bromo-3,5-dinitrobenzoic acid	305	205
4-Bromo-1,5-dinitronaphthalene	97	341
4-Bromo-1,8-dinitronaphthalene	111	341
2-Bromo-4,6-dinitrophenol	261	109
4-Bromo-2,6-dinitrophenol	118	102
2-Bromoethanol	43	82
2-Bromo-4-ethoxyaniline	2	302
3-Bromo-4-ethoxyaniline	38	304
5-Bromo-2-ethoxyaniline	65	304
β-Bromoethyl acetate	112	255
2-Bromoethylamine	298	438
1-Bromo-2-ethylbenzene	4	73
1-Bromo-4-ethylbenzene	5	73
2-Bromo-4-ethylphenol	8	94
β-Bromoethyl phenyl ether	11	137
Bromoethyl sulfide	8	425
Bromoform	7	65
4-Bromofuran-2-carboxylic acid	174	200
5-Bromofuran-2-carboxylic acid	295	205
2-Bromohexane	19	58
6-Bromo-2-hexanone	171	166
6-Bromo-*n*-hexylamine	407	439
Bromohydroquinone	228	108
3-Bromo-4-hydroxyaniline	370	315
4-Bromo-3-hydroxyaniline	335	313
5-Bromo-2-hydroxyaniline	283	311
3-Bromo-2-hydroxybenzoic acid	289	204
5-Bromo-2-hydroxybenzoic acid	255	203
3-Bromo-2-hydroxybenzonitrile	50	359
5-Bromo-2-hydroxybenzonitrile	202	366
3-Bromo-4-hydroxybiphenyl	174	105
3-Bromo-2-hydroxy-5-methylaniline	165	308
5-Bromo-2-hydroxy-3-methylaniline	236	310
5-Bromo-2-hydroxy-4-methylaniline	243	310
5-Bromo-4-hydroxy-2-methylaniline	439	317
5-Bromo-2-hydroxy-3-methylbenzoic acid	366	208
4-Bromo-3-hydroxy-2-naphthoic acid	362	208
5-Bromo-2-hydroxy-3-toluic acid	366	208
α-Bromoisobutanoic acid	36	194
2-Bromoisobutyraldehyde	28	145
α-Bromoisobutyramide	277	238
α-Bromoisobutyranilide	59	232
α-Bromoisobutyric acid	36	194
α-Bromoisobutyric anhydride	23	225
2-Bromoisobutyronitrile	27	347
α-Bromoisobutyryl bromide	10	218
α-Bromoisobutyryl chloride	21	214
1-Bromo-2-isopropylbenzene	7	73
1-Bromo-4-isopropylbenzene	11	73
4-Bromo-5-isopropyl-2-methylphenol	37	98
4-Bromoisoquinoline	14	323
8-Bromoisoquinoline	47	323
α-Bromoisovaleramide	237	237
α-Bromoisovaleranilide	181	235
d,l-α-Bromoisovaleric acid	30	194
DL-α-Bromoisovaleryl bromide	13	218
DL-α-Bromoisovaleryl chloride	19	214
Bromol	171	105
Bromomalonic acid	142	198
Bromomalononitrile	77	360
3-Bromomandelic acid	183	430
2-Bromo-6-methoxyaniline	93	305
3-Bromo-4-methoxyaniline	87	305
" "	131	437
5-Bromo-2-methoxyaniline	187	308
2-Bromo-4-methylaniline	154	300
3-Bromo-2-methylaniline	169	300
3-Bromo-4-methylaniline	3	303
3-Bromo-5-methylaniline	16	303
4-Bromo-2-methylaniline	69	304
" "	104	436
4-Bromo-3-methylaniline	132	307
5-Bromo-2-methylaniline	8	303
3-Bromo-4-methylbenzenesulfonamide	131	396
4-Bromo-2-methylbenzenesulfonamide	193	399
4-Bromo-3-methylbenzenesulfonamide	119	396
5-Bromo-2-methylbenzenesulfonamide	183	398
3-Bromo-4-methylbenzenesulfonic acid	52	372
4-Bromo-2-methylbenzenesulfonic acid	81	373
4-Bromo-3-methylbenzenesulfonic acid	45	372
5-Bromo-2-methylbenzenesulfonic acid	74	373
3-Bromo-4-methylbenzenesulfonyl chloride	59	382
4-Bromo-2-methylbenzenesulfonyl chloride	36	382
4-Bromo-3-methylbenzenesulfonyl chloride	34	382
5-Bromo-2-methylbenzenesulfonyl chloride	14	381
2-Bromo-4-methylbenzoic acid	205	201
4-Bromo-2-methylbenzoic acid	298	205
(2-Bromomethyl)butyric acid	272	431
Bromomethyl ethyl ketone	75	163
2-Bromo-4-methyl-5-nitrobenzoic acid	324	206
4-Bromo-2-methyl-6-nitrobenzoic acid	352	208
6-Bromo-4-methyl-2-nitrobenzoic acid	330	207
2-Bromo-4-methyl-3-nitrophenol	115	102
2-Bromo-4-methyl-5-nitrophenol	203	106
2-Bromo-4-methyl-6-nitrophenol	90	101
6-Bromo-2-methyl-4-nitrophenol	270	110
3-Bromo-2-methylolbenzoic acid	190	430
6-Bromo-2-methylolbenzoic acid	69	429
2-Bromo-4-methylphenol	54	99
3-Bromo-4-methylphenol	50	99
4-Bromo-2-methylphenol	72	100
4-Bromo-3-methylphenol	71	100
5-Bromo-2-methylphenol	124	103
5-Bromo-3-methylphenol	55	99
6-Bromo-2-methylquinoline	62	324
1-Bromo-2-naphthaldehyde	105	159
1-Bromonaphthalene	16	73
2-Bromonaphthalene	2	74
3-Bromo-1,2-naphthalenediol	253	109
4-Bromo-1,5-naphthalenediol	250	109
1-Bromonaphthalene-2-sulfonamide	451	409
2-Bromonaphthalene-1-sulfonamide	98	395
4-Bromonaphthalene-1-sulfonamide	295	403
5-Bromonaphthalene-1-sulfonamide	393	407
5-Bromonaphthalene-2-sulfonamide	360	406
6-Bromonaphthalene-1-sulfonamide	353	405
6-Bromonaphthalene-2-sulfonamide	334	405
7-Bromonaphthalene-1-sulfonamide	335	405
7-Bromonaphthalene-2-sulfonamide	355	405
8-Bromonaphthalene-2-sulfonamide	262	402
2-Bromonaphthalene-1-sulfonic acid	35	372
4-Bromonaphthalene-1-sulfonic acid	140	376
1-Bromonaphthalene-2-sulfonyl chloride	124	384
2-Bromonaphthalene-1-sulfonyl chloride	140	385
4-Bromonaphthalene-1-sulfonyl chloride	111	384
5-Bromonaphthalene-1-sulfonyl chloride	131	385
5-Bromonaphthalene-2-sulfonyl chloride	135	385
6-Bromonaphthalene-1-sulfonyl chloride	90	383
6-Bromonaphthalene-2-sulfonyl chloride	198	387
7-Bromonaphthalene-1-sulfonyl chloride	236	388
7-Bromonaphthalene-2-sulfonyl chloride	151	385
8-Bromonaphthalene-2-sulfonyl chloride	186	387
5-Bromo-1-naphthoic acid	390	209
7-Bromo-1-naphthoic acid	369	208
8-Bromo-1-naphthoic acid	275	204
1-Bromo-2-naphthol	141	103
3-Bromo-2-naphthol	142	103
4-Bromo-1-naphthol	305	112
4-Bromo-2-naphthol	279	110

	Compound No.	Page No.
6-Bromo-2-naphthol	310	112
4-Bromo-1-naphthonitrile	141	363
5-Bromo-1-naphthonitrile	194	365
1-Bromo-2-naphthylamine	83	305
3-Bromo-1-naphthylamine	107	306
4-Bromo-1-naphthylamine	197	309
5-Bromo-2-naphthylamine	23	303
6-Bromo-2-naphthylamine	282	311
2-Bromo-4-nitroacetanilide	219	236
2-Bromo-4-nitroaniline	206	309
4-Bromo-2-nitroaniline	229	310
4-Bromo-3-nitroaniline	296	312
5-Bromo-2-nitroaniline	341	313
2-Bromo-1-nitrobenzene	15	337
3-Bromo-1-nitrobenzene	26	337
4-Bromo-1-nitrobenzene	90	340
4-Bromo-3-nitrobenzenesulfonamide	217	400
4-Bromo-3-nitrobenzenesulfonic acid	94	374
4-Bromo-3-nitrobenzenesulfonyl chloride	49	382
2-Bromo-6-nitrobenzoic acid	13	429
4-Bromo-3-nitrobenzoic acid	325	206
6-Bromo-3-nitrobenzoic acid	279	204
4-Bromo-3-nitrobenzonitrile	165	364
6-Bromo-3-nitrobenzonitrile	162	364
2-Bromo-3-nitro-*p*-cresol	115	102
2-Bromo-5-nitro-*p*-cresol	203	106
2-Bromo-6-nitro-*p*-cresol	90	101
6-Bromo-4-nitro-*o*-cresol	270	110
4-Bromo-1-nitronaphthalene	57	339
5-Bromo-1-nitronaphthalene	86	340
8-Bromo-1-nitronaphthalene	71	339
2-Bromo-4-nitrophenol	241	108
2-Bromo-5-nitrophenol	262	109
2-Bromo-6-nitrophenol	83	100
3-Bromo-2-nitrophenol	77	100
3-Bromo-5-nitrophenol	356	114
4-Bromo-2-nitrophenol	165	104
5-Bromo-2-nitrophenol	32	98
4-Bromo-2-nitrothiophenol	34	417
4-Bromo-3-nitrotoluene	7	337
5-Bromo-2-nitro-4-toluic acid	324	206
5-Bromo-3-nitro-2-toluic acid	352	208
5-Bromo-3-nitro-4-toluic acid	330	207
5-Bromo-2-nitro-4-tolunitrile	177	365
5-Bromo-3-nitro-2-tolunitrile	147	363
5-Bromo-3-nitro-4-tolunitrile	174	365
5-Bromo-*n*-pentylamine	337	438
3-Bromophenacyl bromide	53	173
4-Bromophenacyl bromide	140	176
1-Bromo-9,10-phenanthraquinone	38	183
2-Bromo-9,10-phenanthraquinone	37	183
3-Bromo-9,10-phenanthraquinone	47	184
4-Bromo-*o*-phenetidine	65	304
2-Bromo-*p*-phenetidine	38	304
3-Bromo-*p*-phenetidine	2	302
2-Bromophenetole	90	135
4-Bromophenetole	97	135
2-Bromophenol	2	94
"	44	434
3-Bromophenol	14	96
"	62	434
4-Bromophenol	74	100
"	69	434
(2-Bromophenoxy)acetic acid	214	201
" " "	157	430
(3-Bromophenoxy)acetic acid	155	430
(4-Bromophenoxy)acetic acid	233	202
" " "	159	430
d,l-α-Bromophenylacetic acid	91	196
(2-Bromophenyl)acetic acid	122	198
" " "	294	431
(4-Bromophenyl)acetic acid	143	198
(4-Bromophenyl)acetic acid	320	431
d,l-(2-Bromophenyl)acetonitrile	15	357
(4-Bromophenyl)acetonitrile	45	359
2-Bromo-*p*-phenylenediamine	122	306
2-Bromophenyl ethyl ketone	57	170
4-Bromophenylhydrazine	212	309
4-Bromophenyl methyl sulfide	11	425
4-Bromophenyl sulfide	63	426
3-Bromophthalic acid	304	205
3-Bromophthalic anhydride	57	226
4-Bromophthalic anhydride	49	226
1-Bromopropane	4	58
3-Bromo-1-propanol	73	84
1-Bromo-2-propanone	33	162
α-Bromopropionamide	196	236
β-Bromopropionamide	166	235
α-Bromopropionanilide	114	233
d,l-α-Bromopropionic acid	6	193
" "	138	430
β-Bromopropionic acid	57	195
" "	282	431
DL-α-Bromopropionic anhydride	2	224
3-Bromopropionitrile	7	355
DL-α-Bromopropionyl bromide	9	218
2-Bromopropiophenone	57	170
3-Bromopropiophenone	30	173
4-Bromopropiophenone	44	173
α-Bromopropiophenone	203	168
3-Bromopropylamine	307	438
2-Bromopyridine	21	436
"	53	320
3-Bromopyridine	39	319
"	73	436
4-Bromopyridine	10	322
"	111	436
γ-Bromopyridine	10	322
4-Bromopyromucic acid	174	200
5-Bromopyromucic acid	295	205
6-Bromoquinaldine	62	324
2-Bromoquinizarin	46	184
6-Bromoquinizarin	27	182
2-Bromoquinoline	25	323
"	27	436
3-Bromoquinoline	103	321
"	64	436
4-Bromoquinoline	4	323
5-Bromoquinoline	24	323
"	108	436
6-Bromoquinoline	105	321
7-Bromoquinoline	27	323
8-Bromoquinoline	111	321
α-Bromoquinoline	25	323
β-Bromoquinoline	103	321
γ-Bromoquinoline	4	323
3-Bromosalicylic acid	289	204
5-Bromosalicylic acid	255	203
β-Bromostyrene	28	58
o-Bromostyrene	6	73
p-Bromostyrene	8	73
Bromosuccinic acid	112	430
Bromoterephthalic acid	403	210
4-Bromothiophenol	21	416
2-Bromotoluene	2	73
3-Bromotoluene	3	73
4-Bromotoluene	1	74
3-Bromo-4-toluic acid	205	201
5-Bromo-2-toluic acid	298	205
5-Bromo-*m*-toluidine	16	303
6-Bromo-*m*-toluidine	132	307
4-Bromo-*o*-toluidine	8	303
5-Bromo-*o*-toluidine	69	304
6-Bromo-*o*-toluidine	169	300

	Compound No.	Page No.
2-Bromo-*p*-toluidine	3	303
3-Bromo-*p*-toluidine	154	300
α-Bromo-2-tolunitrile	89	361
α-Bromo-3-tolunitrile	122	362
α-Bromo-4-tolunitrile	160	364
2-Bromo-4-tolunitrile	38	358
3-Bromo-4-tolunitrile	44	359
5-Bromo-2-tolunitrile	88	361
1-Bromo-2-vinylbenzene	6	73
1-Bromo-4-vinylbenzene	8	73
5-Bromo-*m*-4-xylidine	48	304
1,2-Butadiene	11	12
1,3-Butadiene	7	12
1,3-Butadiyne	4	28
Butanal	11	144
n-Butane	6	3
Butanedial	59	147
Butane-1,4-dicarboxylic acid	232	202
Butanedioic acid	294	205
d,l-1,3-Butanediol	105	85
1,4-Butanediol	119	86
2,3-Butanediol	83	84
2,3-Butanedione	5	161
1,4-Butanedithiol	34	414
Butane-1-sulfonamide	5	392
Butane-1,2,3,4-tetracarboxylic acid (low melting form)	306	205
Butane-1,2,3,4-tetracarboxylic acid (high melting form)	368	208
1-Butanethiol	9	413
2-Butanethiol	6	413
Butane-1,1,4-tricarboxylic acid	202	201
n-Butanoic acid	10	190
" "	441	432
1-Butanol	14	80
2-Butanol	7	80
2-Butanone	3	161
2-Butenal	22	145
1-Butene	6	12
cis-2-Butene	10	12
trans-2-Butene	8	8
cis-Butenedioic acid	175	200
trans-Butenedioic acid	399	209
cis-2-Butenoic acid	13	190
trans-2-Butenoic acid	71	195
3-Butenoic acid	12	190
3-Buten-1-ol	11	80
d,l-3-Buten-2-ol	4	80
3-Buten-2-one	2	161
n-Butoxybenzene	82	135
2-Butoxybenzoic acid	332	431
2-*n*-Butoxyethanol	61	83
2-*sec*-Butoxyethanol	52	82
2-(2-*n*-Butoxyethoxy)ethanol	118	86
β-*n*-Butoxyethyl benzoate	4	272
2-Butoxytoluene	93	135
tert-Butylacetaldehyde	21	145
4-*n*-Butylacetanilide	138	234
n-Butyl acetate	54	252
sec-Butyl acetate	40	251
tert-Butyl acetate	22	250
tert-Butylacetic acid	17	190
tert-Butylacetonitrile	21	358
4-*n*-Butylacetophenone	62	170
n-Butyl acetylene	17	28
sec-Butyl acetylene	16	28
tert-Butyl acetylene	8	28
n-Butyl alcohol	14	80
d,l-sec-Butyl alcohol	7	80
tert-Butyl alcohol	7	88
n-Butylallene	135	16
tert-Butylallene	77	14
n-Butylamine	17	295
" "	412	439
Di-*n*-butylamine	65	297
DL-*sec*-*n*-Butylamine	13	295
tert-Butylamine	6	295
" "	427	439
(*tert*-Butylamino)cyclohexane	463	439
2-(Butylamino)ethylamine	381	439
N-*n*-Butylaniline	159	300
	198	437
2-*n*-Butylaniline	4	302
4-*n*-Butylaniline	174	300
N-*tert*-Butylaniline	273	438
2-*tert*-Butylaniline	147	299
" "	192	437
3-*tert*-Butylaniline	171	437
4-*tert*-Butylaniline	139	299
" "	187	437
N-*n*-Butylaziridine	287	438
n-Butylbenzene	26	36
sec-Butylbenzene	16	35
tert-Butylbenzene	13	35
n-Butyl benzoate	288	266
2-*tert*-Butylbenzoic acid	211	430
4-*tert*-Butylbenzoic acid	368	432
n-Butyl bromide	11	58
sec-Butyl bromide	10	58
tert-Butyl bromide	8	58
n-Butyl *tert*-butyl ketone	100	164
n-Butyl *n*-butyrate	115	255
tert-Butyl *n*-butyrate	84	253
n-Butyl *n*-caproate	185	259
n-Butyl *n*-caprylate	275	265
n-Butyl carbamate	13	231
d-sec-Butyl carbinol	23	81
tert-Butyl carbinol	28	89
n-Butyl carbonate	184	259
n-Butyl cellosolve	60	134
Butyl cellosolve benzoate	4	272
n-Butylchloral	58	147
n-Butyl chloride	13	55
sec-Butyl chloride	10	55
tert-Butyl chloride	8	55
n-Butyl chloroacetate	129	256
n-Butyl chloroformate	80	253
4-Butyl-*o*-cresol	289	111
6-*tert*-Butyl-*m*-cresol	38	98
tert-Butylcyanide	10	345
Butyl cyanoacetate	6	355
n-Butylcyclohexane	243	7
n-Butyl cyclooctatetraene	3	25
n-Butylcyclopentane	164	5
n-Butyl dimethyl amine	375	439
tert-Butyl dimethyl amine	428	439
4-*tert*-Butyl-1,3-dimethylbenzene	94	38
n-Butyl *n*-enanthate	227	262
d,l-1,3-Butylene glycol	105	85
2,3-Butylene glycol	83	84
α-Butylene oxide	13	131
n-Butyl ether	54	133
Butyl ethyl acetylene	44	29
1-*tert*-Butyl-4-ethylbenzene	97	39
n-Butyl ethyl ether	31	132
sec-Butyl ethyl ether	24	132
tert-Butyl ethyl ether	20	132
n-Butyl ethyl ketone	64	163
sec-Butyl ethyl ketone	35	162
tert-Butyl ethyl ketone	23	161
n-Butyl ethyl sulfide	27	420
sec-Butyl ethyl sulfide	21	420
n-Butyl formate	35	251
sec-Butyl formate	21	250

	Compound No.	Page No.
tert-Butyl formate	14	250
N-*n*-Butylglycine	86	429
n-Butyl *n*-heptanoate	227	262
n-Butyl *n*-hexanoate	185	259
n-Butyl 2-hydroxybenzoate	27	95
n-Butyl 4-hydroxybenzoate	47	434
n-Butyl iodide	11	60
sec-Butyl iodide	8	60
tert-Butyl iodide	7	60
n-Butyl isobutyl ketone	102	164
sec-Butyl isobutyl ketone	103	175
tert-Butyl isobutyl ketone	85	163
tert-Butyl isobutyrate	56	252
3-*tert*-Butyl-1-isopropylbenzene	118	39
4-*tert*-Butyl-1-isopropylbenzene	120	39
n-Butyl isopropyl ether	40	133
sec-Butyl isopropyl ketone	53	162
tert-Butyl isopropyl ketone	30	162
n-Butyl lactate	151	257
n-Butyl levulinate	257	264
sec-Butyl levulinate	222	262
n-Butylmalonic acid	118	197
sec-Butylmalonic acid	76	196
n-Butyl mercaptan	9	413
sec-Butyl mercaptan	6	413
tert-Butyl mercaptan	4	413
n-Butyl methoxymethyl ketone	106	164
sec-Butyl methoxymethyl ketone	95	164
tert-Butyl methoxymethyl ketone	87	163
n-Butyl methylacetic acid	37	191
n-Butyl methyl acetylene	39	29
tert-Butyl methyl acetylene	23	29
n-Butyl methyl amine	25	295
DL-*sec*-Butyl methyl amine	19	295
2-Butyl-1-methylbenzene	67	38
3-Butyl-1-methylbenzene	79	38
4-Butyl-1-methylbenzene	86	38
2-*sec*-Butyl-1-methylbenzene	54	37
3-*sec*-Butyl-1-methylbenzene	48	37
4-*sec*-Butyl-1-methylbenzene	64	37
2-*tert*-Butyl-1-methylbenzene	65	38
3-*tert*-Butyl-1-methylbenzene	38	36
4-*tert*-Butyl-1-methylbenzene	44	37
n-Butyl methyl carbinol	33	81
sec-Butyl methyl carbinol	28	81
tert-Butyl methyl carbinol	16	80
n-Butyl methyl ether	19	132
tert-Butyl methyl ether	10	131
n-Butylmethylglycol aldehyde	11	150
n-Butyl-methylglucolic acid	16	193
n-Butyl methyl ketone	24	161
sec-Butyl methyl ketone	16	161
tert-Butyl methyl ketone	12	161
4-Butyl-2-methylphenol	289	111
2-*tert*-Butyl-5-methylphenol	38	98
n-Butyl methyl sulfide	18	420
tert-Butyl methyl sulfide	10	420
1-Butylnaphthalene	167	41
2-Butylnaphthalene	170	41
1-*tert*-Butylnaphthalene	169	41
2-*tert*-Butylnaphthalene	168	41
n-Butyl-2-naphthyl ether	18	137
sec-Butyl-2-naphthyl ether	15	137
n-Butyl nitrate	69	253
Butyl nitrite	8	250
1-*tert*-Butyl-4-nitrobenzene	33	336
n-Butyl *n*-octanoate	275	265
n-Butyl oxalate	266	264
n-Butyl oxamate	71	232
n-Butyl *n*-pentanoate	147	257
sec-Butyl *n*-pentanoate	127	256
2-*n*-Butylphenol	17	94
4-*n*-Butylphenol	3	96
2-*sec*-Butylphenol	14	94
4-*tert*-Butylphenol	192	106
n-Butyl phenylacetate	293	266
(4-*tert*-Butylphenyl) acetic acid	374	432
n-Butyl phenyl ether	82	135
n-Butyl phenyl ketone	207	168
tert-Butyl phenyl ketone	181	167
n-Butyl phthalate	355	271
1-*n*-Butylpiperidine	392	439
tert-Butylpropiolic acid	37	194
n-Butyl propionate	88	254
n-Butyl propyl acetylene	46	29
n-Butyl *n*-propyl ketone	107	164
tert-Butyl *n*-propyl ketone	57	163
2-*tert*-Butylpyridine	233	437
3-*tert*-Butylpyridine	236	437
4-*tert*-Butylpyridine	244	438
n-Butyl salicylate	27	95
" "	318	268
n-Butyl stearate	19	274
n-Butyl styryl ketone	25	172
n-Butyl sulfide	41	421
tert-Butyl sulfide	29	420
2-*n*-Butylthiophene	46	424
3-*n*-Butylthiophene	48	424
2-*tert*-Butylthiophene	39	424
3-*tert*-Butylthiophene	40	424
2-Butyltoluene	67	38
3-Butyltoluene	79	38
4-Butyltoluene	86	38
2-*sec*-Butyltoluene	54	37
3-*sec*-Butyltoluene	48	37
4-*sec*-Butyltoluene	64	37
2-*tert*-Butyltoluene	65	38
3-*tert*-Butyltoluene	38	36
4-*tert*-Butyltoluene	44	37
n-Butyl 2-tolyl ether	93	135
n-Butyl urethane	13	231
n-Butyl *n*-valerate	147	257
sec-Butyl *n*-valerate	127	256
2-Butynal	26	145
1-Butyne	3	28
2-Butyne	6	28
2-Butynoic acid	110	430
3-Butyn-2-one	4	161
n-Butyraldehyde	11	144
n-Butyramide	179	235
N-Butyranilide	89	233
n-Butyric acid	10	190
" "	441	432
n-Butyric anhydride	9	223
Butyroin	132	165
Butyronitrile	14	345
n-Butyrophenone	191	167
n-Butyrylacetone	121	165
n-Butyryl bromide	5	218
n-Butyryl chloride	9	212
n-Butyryl fluoride	5	211
n-Butyryl iodide	3	221

C

	Compound No.	Page No.
Cadaverine	76	297
Camphane	79	9
d,l-Camphene	10	26
l-Camphene	11	26
d,l-cis-Camphenecamphoric acid	190	200
d,l-trans-Camphenecamphoric acid	163	199
d,l-cis-Camphenic acid	190	200
d,l-trans-Camphenic acid	163	199
Campholene	237	19

	Compound No.	Page No.
β-Campholenic acid	45	194
d-Campholic acid	129	198
l-Campholic acid	131	198
Campholic nitrile	93	361
d,l-α-Campholytic acid	24	193
β-Campholytic acid	187	200
Δ^5-Campholytic acid	97	196
β-Campholytonitrile	65	350
d,l-Camphor	192	178
d-Camphoric acid	303	205
D-Camphoric acid diamide	413	243
D-Camphoric acid dianilide	479	245
D-Camphoric acid monoamide	367	241
D-Camphoric acid monoanilide	437	243
D-Camphoric anhydride	81	227
Camphorquinone	31	183
D-Camphor-3-sulfonamide	104	395
D-Camphor-8-sulfonamide	92	395
DL-Camphor-8-sulfonamide	83	395
D-Camphor-10-sulfonamide	80	395
D-Camphor-3-sulfonanilide	65	394
D-Camphor-10-sulfonanilide	59	394
D-Camphor-2-sulfonic acid	38	372
D-Camphor-8-sulfonic acid	30	372
DL-Camphor-8-sulfonic acid	25	371
D-Camphor-10-sulfonic acid	23	371
D-Camphor-3-sulfonyl chloride	112	384
D-Camphor-8-sulfonyl chloride	221	388
DL-Camphor-8-sulfonyl chloride	162	386
D-Camphor-10-sulfonyl chloride	72	383
DL-Canaline	27	285
L-Canaline	47	286
L-Canavanine	23	285
Capramide	110	233
Capranilide	36	231
Capric acid	13	193
Capric anhydride	2	225
Caproaldehyde	38	146
n-Caproamide	115	233
n-Caproanilide	88	233
n-Caproic acid	33	191
" "	454	432
Caproic anhydride	15	223
n-Capronitrile	42	348
n-Caprophenone	3	172
Caproylacetic acid	73	196
n-Caproyl bromide	12	218
n-Caproyl chloride	32	212
4-*n*-Caproylresorcinol	53	99
" "	62	174
Caprylaldehyde	60	147
n-Caprylamide	161	235
Caprylanilide	18	231
n-Caprylic acid	47	191
" "	456	432
Caprylic anhydride	18	223
Caprylonitrile	66	350
n-Capryloyl chloride	40	213
Carballylic acid triamide	441	244
Carballylic acid trianilide	495	246
Carbamide	233	237
Carbanilide	488	245
Carbazole	457	317
4-Carbenzyloxyphenol	43	434
N-Carbethoxy-1,4-diaminobenzene	114	306
5-Carbethoxy-2-nitrophenol	16	434
4-Carbethoxyphenol	50	434
4-Carbobutoxyphenol	47	434
5-Carbomethoxy-2-nitrophenol	17	434
4-Carbomethoxyphenol	48	434
Carbon tetrabromide	2	66
Carbon tetrachloride	8	63

	Compound No.	Page No.
4-Carboxamidobenzen sulfonamide	403	407
1-Carboxamido-3-nitro-benzenesulfonanilide	376	406
2-Carboxamidophenol	41	434
4-Carboxanilidobenzenesulfonanilide	437	408
3-Carboxybenzenesulfonamide	199	399
2-Carboxybenzenesulfonanilide	291	403
2-Carboxybenzenesulfonic acid	139	376
3-Carboxybenzenesulfonic acid	84	373
4-Carboxybenzenesulfonic acid	184	377
2-Carboxybenzenesulfonyl chloride	92	383
3-Carboxybenzenesulfonyl chloride	8	381
4-Carboxybenzenesulfonyl chloride	53	382
2-Carboxy-2′-cyanobiphenyl	212	366
2-Carboxy-5-methylbenzenesulfonamide	250	401
2-Carboxy-5-methylbenzenesulfonic acid	111	375
5-Carboxy-2-methylbenzenesulfonyl chloride	56	382
4-Carboxy-3-nitrobenzenesulfonamide	280	402
4-Carboxy-3-nitrobenzenesulfonic acid	169	377
4-Carboxy-3-nitrobenzenesulfonyl chloride	250	389
(2-Carboxyphenyl)acetic acid	292	205
(2-Carboxyphenyl)acetic anhydride	64	226
d-3-Carboxy-2,2,3-trimethylcyclopentylacetonitrile	207	366
l-3-Carene	297	22
l-4-Carene	294	22
cis-Caronic acid	81	429
trans-Caronic acid	255	431
Carvacrol	19	94
Carvacryl acetate	273	265
d-Carvone	192	167
Catechol	207	107
"	75	434
Catechol dibenzoate	124	279
Catechol dibenzyl ether	39	138
Catechol diethyl ether	24	138
Catechol monomethyl ether	9	137
Cedrene	333	24
β-Cellobiose	65	333
6-(β-Cellobiosido)-α-D-glucose	66	333
Cellosolve	51	133
Cellosolve benzoate	300	267
Cetane	2	8
Cetyl acetate	13	273
Cetyl alcohol	25	88
Cetyl bromide	1	59
Cetyl chloride	54	56
Cetyl iodide	1	61
Cetylmalonic acid	161	199
Cetyl mercaptan	2	416
Cetyl palmitate	66	276
Cetyl stearate	79	277
Cetyl sulfonic acid	7	371
Chalcone	66	174
D-Chaulmoogramide	144	234
D-Chaulmoogranilide	73	232
d-Chaulmoogric acid	69	195
Chelidonic acid	391	209
Chloral	19	145
Chloranil	53	184
Chloranilic acid	51	184
Chloroacetaldehyde	13	144
Chloroacetamide	191	236
Chloroacetanilide	243	237
2-Chloroacetanilide	72	232
4-Chloroacetanilide	372	241
Chloroacetic acid	56	195
" "	124	430
Chloroacetic anhydride	16	225
Chloroacetone	17	161
Chloroacetone cyanohydrin	13	355
Chloroacetonitrile	21	346
2-Chloroacetophenone	188	167

	Compound No.	Page No.
3-Chloroacetophenone	184	167
4-Chloroacetophenone	194	167
w-Chloroacetophenone	68	174
Chloroacetyl bromide	4	218
Chloroacetyl chloride	12	212
Chloroacetyl fluoride	6	211
Chloroacetyl iodide	2	222
2-Chloroacrolein	1	152
cis-3-Chloroacrylic acid	191	430
trans-3-Chloroacrylic acid	229	431
cis-2-Chloroallocinnamic acid	170	200
cis-α-Chloroallocinnamic acid	135	198
cis-β-Chloroallocinnamic acid	180	200
2-Chloroaniline	102	298
" "	61	436
3-Chloroaniline	144	299
" "	99	436
4-Chloroaniline	112	306
" "	125	437
3-Chloroanisic acid	342	207
2-Chloro-*p*-anisidine	79	305
3-Chloro-*o*-anisidine	162	300
3-Chloro-*p*-anisidine	8	302
4-Chloro-*o*-anisidine	140	307
5-Chloro-*o*-anisidine	56	304
2-Chloroanisole	79	135
3-Chloroanisole	78	135
4-Chloroanisole	81	135
1-Chloroanthraquinone-2-carboxylic acid	396	209
2-Chlorobenzal chloride	24	63
3-Chlorobenzal chloride	25	63
4-Chlorobenzal chloride	26	63
2-Chlorobenzaldehyde	78	148
3-Chlorobenzaldehyde	1	153
4-Chlorobenzaldehyde	24	154
2-Chlorobenzamide	260	238
3-Chlorobenzamide	241	237
2-Chlorobenzanilide	177	235
3-Chlorobenzanilide	195	236
4-Chlorobenzanilide	414	243
Chlorobenzene	1	70
2-Chlorobenzene-1,4-dicarboxylic acid	405	210
5-Chlorobenzene-1,3-disulfonamide	372	406
5-Chlorobenzene-1,3-disulfonic acid	167	377
5-Chlorobenzene-1,3-disulfonyl chloride	163	386
2-Chlorobenzenesulfonamide	263	402
3-Chlorobenzenesulfonamide	123	396
4-Chlorobenzenesulfonamide	113	396
4-Chlorobenzenesulfonanilide	36	393
2-Chlorobenzenesulfonic acid	127	375
3-Chlorobenzenesulfonic acid	47	372
4-Chlorobenzenesulfonic acid	41	372
2-Chlorobenzenesulfonyl chloride	12	381
4-Chlorobenzenesulfonyl chloride	42	382
2-Chlorobenzoic acid	213	201
" "	130	430
3-Chlorobenzoic acid	243	203
" "	254	431
4-Chlorobenzoic acid	375	208
" "	280	431
2-Chlorobenzoic anhydride	33	225
3-Chlorobenzoic anhydride	39	225
4-Chlorobenzoic anhydride	74	226
2-Chlorobenzonitrile	35	358
3-Chlorobenzonitrile	34	358
4-Chlorobenzonitrile	128	363
4-Chlorobenzophenone	108	175
2-Chloro-1,4-benzoquinone	5	181
4-Chloro-1,2-benzoquinone	8	181
2-Chlorobenzotrichloride	1	71
2-Chlorobenzoyl bromide	4	219
3-Chlorobenzoyl bromide	3	219
4-Chlorobenzoyl bromide	10	219
2-Chlorobenzoyl chloride	53	213
3-Chlorobenzoyl chloride	49	213
4-Chlorobenzoyl chloride	47	213
4-Chlorobenzyl bromide	5	59
2-Chlorobenzyl chloride	47	56
3-Chlorobenzyl chloride	49	56
4-Chlorobenzyl chloride	48	56
2-Chlorobenzyl cyanide	10	357
4-Chlorobenzyl cyanide	16	357
2-Chlorobenzylidene chloride	24	63
3-Chlorobenzylidene chloride	25	63
4-Chlorobenzylidene chloride	26	63
2-Chlorobenzyl phenyl ketone	93	175
3-Chlorobenzyl phenyl ketone	38	173
4-Chlorobenzyl phenyl ketone	168	177
4-Chlorobenzyl sulfide	14	425
2-Chlorobiphenyl	3	71
3-Chlorobiphenyl	29	70
4-Chlorobiphenyl	22	71
1-Chloro-2-butanone	40	162
2-Chloro-2-butenal	49	146
3-Chloro-*n*-butyraldehyde (trimer)	83	157
4-Chloro-*n*-butyraldehyde	2	152
2-Chlorobutyronitrile	32	347
3-Chlorobutyronitrile	48	348
4-Chlorobutyronitrile	61	349
3-Chlorocatechol	39	98
4-Chlorocatechol	160	104
3-Chlorocinchonic acid	377	208
trans-α-Chlorocinnamic acid	195	201
trans-β-Chlorocinnamic acid	212	201
trans-2-Chlorocinnamic acid	337	207
" "	327	431
trans-3-Chlorocinnamic acid	343	432
trans-4-Chlorocinnamic acid	376	432
trans-*o*-Chlorocinnamonitrile	32	358
1-Chlorocyclohexanecarboxylic acid	21	192
2-Chloro-*m*-cresol	47	99
2-Chloro-*p*-cresol	3	94
4-Chloro-*m*-cresol	78	100
6-Chloro-*m*-cresol	36	98
4-Chloro-*o*-cresol	42	98
5-Chloro-*o*-cresol	103	102
2-Chlorocrotonaldehyde	49	146
α-Chlorocrotonic acid	178	430
β-Chlorocrotonic acid	100	197
γ-Chlorocrotonic acid	87	196
2-Chlorocrotononitrile	24	347
trans-4-Chlorocrotononitrile	10	355
p-Chlorocumene	17	70
1-Chloro-4-cyanonaphthalene	154	364
5-Chloro-1-cyanonaphthalene	191	365
5-Chloro-2-cyanonaphthalene	190	365
4-Chloro-2-cyanophenol	208	366
2-Chloro-*p*-cymene	26	70
3-Chloro-*p*-cymene	27	70
4-Chloro-1,3-diaminobenzene	160	307
2-Chloro-4,6-dibromoaniline	176	308
4-Chloro-2,6-dibromoaniline	166	308
4-Chloro-2,6-dibromophenol	164	104
4-Chloro-3,5-dibromophenol	275	110
N-Chlorodiethylamine	25	436
3-Chloro-1,2-dihydroxybenzene	39	98
4-Chloro-1,2-dihydroxybenzene	160	104
4-Chloro-1,3-dihydroxybenzene	214	107
2-Chloro-N,N-dimethylaniline	61	320
2-Chloro-4,6-dimethylaniline	27	303
1-Chloro-2,3-dimethylbenzene	12	70
1-Chloro-2,4-dimethylbenzene	14	70
1-Chloro-3,4-dimethylbenzene	16	70
2-Chloro-1,4-dimethylbenzene	10	70

	Compound No.	Page No.
4-Chloro-2,5-dimethylbenzenesulfonamide	249	401
4-Chloro-2,5-dimethylbenzenesulfonanilide	142	397
4-Chloro-2,5-dimethylbenzenesulfonic acid	110	374
4-Chloro-2,5-dimethylbenzenesulfonyl chloride	37	382
2-Chloro-2,3-dimethylbutane	29	55
3-Chloro-2,2-dimethylbutane	25	55
4-Chloro-2,2-dimethylbutane	27	55
5-Chloro-2,3-dimethylpentane	36	56
2-Chloro-3,4-dimethylphenol	6	96
2-Chloro-4,5-dimethylphenol	101	101
2-Chloro-4,6-dimethylphenol	11	94
3-Chloro-4,5-dimethylphenol	190	106
3-Chloro-4,6-dimethylphenol	161	104
4-Chloro-2,3-dimethylphenol	138	103
4-Chloro-3,5-dimethylphenol	248	109
5-Chloro-2,3-dimethylphenol	130	103
1-Chloro-2,4-dinitrobenzene	22	337
4-Chloro-1,3-dinitrobenzene	22	337
5-Chloro-2,4-dinitrobenzonitrile	200	366
4-Chloro-1,3-dinitronaphthalene	101	341
4-Chloro-1,5-dinitronaphthalene	95	341
4-Chloro-1,8-dinitronaphthalene	117	342
2-Chloro-4,6-dinitrophenol	239	108
4-Chloro-2,6-dinitrophenol	128	103
" "	4	434
5-Chloro-2,4-dinitrophenol	163	104
α-Chlorodiphenylacetic acid	153	199
2-Chloroethanethiol	16	413
2-Chloroethanol	24	81
1-Chloro-4-ethoxybenzene	1	137
β-Chloroethyl acetate	81	253
1-Chloro-2-ethylbenzene	6	70
1-Chloro-3-ethylbenzene	8	70
1-Chloro-4-ethylbenzene	9	70
1-Chloro-2-ethylbutane	32	56
2-Chloroethyl chloromethyl sulfide	45	421
(2-Chloroethyl)diethylamine	304	438
α-Chloroethyl ethyl ether	33	132
β-Chloroethyl ethyl ether	39	133
2-Chloroethyl ethyl sulfide	32	420
1-Chloro-2-ethyl-3-hexane	18	169
2-Chloroethyl methyl sulfide	25	420
2-Chloroethyl 4-nitrophenyl sulfide	34	425
2-Chloroethyl phenyl sulfide	57	421
2-Chloroethyl sulfide	52	421
2-Chloroethyl 4-tolyl sulfide	58	421
Chloroform	5	63
Chlorofumaranilide	393	242
Chlorofumaric acid	310	206
Chlorofumaronitrile	45	348
2-Chlorohexane	31	56
3-Chlorohexane	30	55
o-Chlorohydrocinnamic acid	104	197
Chlorohydroquinone	210	107
3-Chloro-4-hydroxyaniline	342	313
4-Chloro-2-hydroxyaniline	343	314
2-Chloro-3-hydroxybenzaldehyde	112	159
2-Chloro-4-hydroxybenzaldehyde	366	115
" " " "	116	159
2-Chloro-5-hydroxybenzaldehyde	95	158
3-Chloro-2-hydroxybenzaldehyde	36	155
3-Chloro-4-hydroxybenzaldehyde	111	159
4-Chloro-2-hydroxybenzaldehyde	28	154
4-Chloro-3-hydroxybenzaldehyde	106	159
5-Chloro-2-hydroxybenzaldehyde	88	158
2-Chloro-6-hydroxybenzoic acid	109	430
3-Chloro-4-hydroxybenzoic acid	262	203
5-Chloro-2-hydroxybenzoic acid	268	204
3-Chloro-4-hydroxybenzonitrile	199	366
5-Chloro-2-hydroxybenzonitrile	208	366
3-Chloro-4-hydroxybiphenyl	112	102
5-Chloro-2-hydroxybiphenyl	35	98
2-Chloro-2-hydroxybutyric acid	105	430
5-Chloro-4-hydroxy-2-methylaniline	448	317
6-Chloro-3-hydroxy-4-methylbenzoic acid	519	123
3-Chloro-2-hydroxy-2-methylpropionitrile	13	355
4-Chloro-1-hydroxy-2-naphthoic acid	363	208
4-Chloro-3-hydroxy-2-naphthoic acid	359	208
5-Chloro-2-hydroxy-3-nitrobenzoic acid	250	203
2-Chloro-3-hydroxy-3-phenylpropionic acid	108	430
2-Chloro-3-hydroxysuccinic acid	76	429
4-Chloro-2-iodophenol	119	102
α-Chloroisobutanoic acid	8	193
α-Chloroisobutyric acid	8	193
" "	135	430
α-Chloroisobutyronitrile	13	345
β-Chloroisocrotonic acid	54	195
1-Chloro-2-isopropylbenzene	13	70
1-Chloro-4-isopropylbenzene	17	70
2-Chloro-4-isopropyl-1-methylbenzene	26	70
3-Chloro-4-isopropyl-1-methylbenzene	27	70
α-Chloroisopropyl methyl ketone	59	163
α-Chloroisovaleric acid	38	191
3-Chlorolactic acid	158	430
Chloromalonic acid	182	200
3-Chloromandelic acid	184	430
4-Chloromandelic acid	156	199
4-Chloromandelonitrile	36	358
2-Chloro-4-methoxyaniline	8	302
2-Chloro-6-methoxyaniline	162	300
3-Chloro-4-methoxyaniline	79	305
4-Chloro-2-methoxyaniline	56	304
5-Chloro-2-methoxyaniline	140	307
3-Chloro-4-methoxybenzenesulfonamide	76	394
3-Chloro-4-methoxybenzenesulfonic acid	21	371
3-Chloro-4-methoxybenzenesulfonyl chloride	101	384
3-Chloro-4-methoxybenzoic acid	342	207
8-Chloro-7-methoxynaphthalene-1-sulfonamide	135	397
8-Chloro-7-methoxynaphthalene-1-sulfonanilide	302	403
8-Chloro-7-methoxynaphthalene-1-sulfonyl chloride	216	388
5-Chloro-2-methoxy-1-nitrobenzene	69	339
Chloromethyl acetate	38	251
2-Chloro-N-methylaniline	118	298
4-Chloro-N-methylaniline	156	300
2-Chloro-4-methylaniline	130	299
4-Chloro-2 methylaniline	157	300
4-Chloro-3-methylaniline	138	307
2-Chloro-4-methylbenzenesulfonamide	255	401
2-Chloro-5-methylbenzenesulfonamide	146	397
3-Chloro-2-methylbenzenesulfonamide	231	400
3-Chloro-4-methylbenzenesulfonamide	85	395
3-Chloro-6-methylbenzenesulfonamide	115	396
4-Chloro-2-methylbenzenesulfonamide	248	401
4-Chloro-3-methylbenzenesulfonamide	73	394
5-Chloro-2-methylbenzenesulfonamide	105	395
3-Chloro-4-methylbenzenesulfonanilide	27	393
4-Chloro-3-methylbenzenesulfonanilide	25	392
2-Chloro-4-methylbenzenesulfonic acid	117	375
2-Chloro-5-methylbenzenesulfonic acid	57	372
3-Chloro-2-methylbenzenesulfonic acid	99	374
3-Chloro-4-methylbenzenesulfonic acid	27	371
4-Chloro-2-methylbenzenesulfonic acid	109	374
4-Chloro-3-methylbenzenesulfonic acid	20	371
5-Chloro-2-methylbenzenesulfonic acid	44	372
2-Chloro-4-methylbenzenesulfonyl chloride	30	381
2-Chloro-5-methylbenzenesulfonyl chloride	51	382
3-Chloro-2-methylbenzenesulfonyl chloride	83	383
3-Chloro-4-methylbenzenesulfonyl chloride	21	381
4-Chloro-2-methylbenzenesulfonyl chloride	45	382
4-Chloro-3-methylbenzenesulfonyl chloride	63	382
5-Chloro-2-methylbenzenesulfonyl chloride	10	381
2-Chloro-4-methylbenzoic acid	237	202
2-Chloro-6-methylbenzoic acid	120	197

	Compound No.	Page No.
(3-Chloromethyl)benzoic acid	199	201
(4-Chloromethyl)benzoic acid	323	206
3-Chloro-2-methylbenzoic acid	188	430
4-Chloro-2-methylbenzoic acid	269	204
6-Chloro-2-methylbenzoic acid	70	429
4-Chloro-3-methyl-2-butanone	59	163
DL-3-Chloro-2-methyl-1-butene	17	55
3-Chloro-2-methyl-2-butene	18	55
2-Chloro-3-methylbutyronitrile	37	348
Chloromethyl dichloromethyl sulfide	39	421
Chloromethyl ethyl ether	22	132
Chloromethyl ethyl ketone	40	162
Chloromethyl ethyl sulfide	19	420
Chloromethyl methyl ether	12	131
Chloromethyl methyl sulfide	11	420
2-Chloro-5-methyl-6-nitrobenzenesulfonamide	221	400
4-Chloro-3-methyl-5-nitrobenzenesulfonamide	313	404
5-Chloro-2-methyl-3-nitrobenzenesulfonamide	187	399
5-Chloro-4-methyl-2-nitrobenzenesulfonamide	235	401
4-Chloro-3-methyl-5-nitrobenzenesulfonic acid	147	376
5-Chloro-2-methyl-3-nitrobenzenesulfonic acid	76	373
5-Chloro-4-methyl-2-nitrobenzenesulfonic acid	103	374
2-Chloro-5-methyl-6-nitrobenzenesulfonyl chloride	191	387
4-Chloro-3-methyl-5-nitrobenzenesulfonyl chloride	41	382
5-Chloro-2-methyl-3-nitrobenzenesulfonyl chloride	58	382
5-Chloro-4-methyl-2-nitrobenzenesulfonyl chloride	147	385
2-Chloro-2-methylpentane	24	55
3-Chloro-3-methylpentane	28	55
1-Chloro-2-methyl-3-pentanone	1	169
2-Chloro-3-methylphenol	47	99
2-Chloro-5-methylphenol	36	98
3-Chloro-4-methylphenol	3	94
4-Chloro-2-methylphenol	42	98
4-Chloro-3-methylphenol	78	100
5-Chloro-2-methylphenol	103	102
(4-Chloro-2-methylphenoxy)acetic acid	189	430
Chloromethyl 2-phenylethyl ketone	58	174
3-Chloro-2-methyl-1-propene	12	55
4-Chloro-2-methylquinoline	19	323
Chloromethyl sulfide	31	420
1-Chloronaphthalene	28	70
2-Chloronaphthalene	14	71
1-Chloronaphthalene-2-sulfonamide	435	408
2-Chloronaphthalene-1-sulfonamide	134	396
4-Chloronaphthalene-1-sulfonamide	258	401
4-Chloronaphthalene-2-sulfonamide	191	399
5-Chloronaphthalene-1-sulfonamide	377	406
5-Chloronaphthalene-2-sulfonamide	350	405
6-Chloronaphthalene-1-sulfonamide	346	405
6-Chloronaphthalene-2-sulfonamide	245	401
7-Chloronaphthalene-1-sulfonamide	399	407
7-Chloronaphthalene-2-sulfonamide	215	400
8-Chloronaphthalene-1-sulfonamide	305	403
8-Chloronaphthalene-2-sulfonamide	247	401
4-Chloronaphthalene-1-sulfonanilide	118	396
1-Chloronaphthalene-2-sulfonic acid	198	378
4-Chloronaphthalene-1-sulfonic acid	122	375
4-Chloronaphthalene-2-sulfonic acid	80	373
5-Chloronaphthalene-1-sulfonic acid	170	377
6-Chloronaphthalene-1-sulfonic acid	159	376
6-Chloronaphthalene-2-sulfonic acid	107	374
7-Chloronaphthalene-2-sulfonic acid	93	374
8-Chloronaphthalene-1-sulfonic acid	146	376
8-Chloronaphthalene-2-sulfonic acid	112	375
1-Chloronaphthalene-2-sulfonyl chloride	104	384
2-Chloronaphthalene-1-sulfonyl chloride	85	383
4-Chloronaphthalene-1-sulfonyl chloride	129	385
4-Chloronaphthalene-2-sulfonyl chloride	160	386
5-Chloronaphthalene-1-sulfonyl chloride	132	385
5-Chloronaphthalene-2-sulfonyl chloride	177	386
6-Chloronaphthalene-1-sulfonyl chloride	79	383
6-Chloronaphthalene-2-sulfonyl chloride	170	386
7-Chloronaphthalene-1-sulfonyl chloride	207	387
7-Chloronaphthalene-2-sulfonyl chloride	110	384
8-Chloronaphthalene-1-sulfonyl chloride	153	386
8-Chloronaphthalene-2-sulfonyl chloride	127	385
4-Chloro-1-naphthalenethiol	12	416
3-Chloro-2-naphthoic acid	345	207
4-Chloro-1-naphthoic acid	378	209
5-Chloro-2-naphthoic acid	393	209
7-Chloro-1-naphthoic acid	376	208
8-Chloro-1-naphthoic acid	266	204
1-Chloro-2-naphthol	94	101
3-Chloro-1-naphthol	346	114
4-Chloro-1-naphthol	273	110
4-Chloro-2-naphthol	201	106
5-Chloro-1-naphthol	315	112
6-Chloro-1-naphthol	173	105
7-Chloro-2-naphthol	299	111
4-Chloro-1-naphthonitrile	154	364
5-Chloro-1-naphthonitrile	191	365
5-Chloro-2-naphthonitrile	190	365
2-Chloro-1,4-naphthoquinone	13	181
3-Chloro-1,2-naphthoquinone	22	182
4-Chloro-1,2-naphthoquinone	29	182
1-Chloro-2-naphthylamine	70	305
2-Chloro-1-naphthylamine	72	305
3-Chloro-1-naphthylamine	80	305
4-Chloro-1-naphthylamine	190	308
4-Chloro-2-nitroaniline	244	310
" "	8	436
5-Chloro-2-nitroaniline	279	311
4-Chloro-2-nitroanisole	69	339
2-Chloro-1-nitrobenzene	5	337
3-Chloro-1-nitrobenzene	18	337
4-Chloro-1-nitrobenzene	52	339
2-Chloro-5-nitrobenzenesulfonamide	251	401
4-Chloro-2-nitrobenzenesulfonamide	176	398
4-Chloro-3-nitrobenzenesulfonamide	214	400
4-Chloro-2-nitrobenzenesulfonanilide	93	395
5-Chloro-2-nitrobenzenesulfonanilide	164	398
2-Chloro-5-nitrobenzenesulfonic acid	113	375
4-Chloro-2-nitrobenzenesulfonic acid	69	373
4-Chloro-3-nitrobenzenesulfonic acid	91	374
6-Chloro-3-nitrobenzenesulfonic acid	119	375
2-Chloro-5-nitrobenzenesulfonyl chloride	118	384
4-Chloro-2-nitrobenzenesulfonyl chloride	86	383
4-Chloro-3-nitrobenzenesulfonyl chloride	25	381
5-Chloro-2-nitrobenzenesulfonyl chloride	123	384
2-Chloro-3-nitrobenzoic acid	41	429
2-Chloro-4-nitrobenzoic acid	206	201
" " "	39	429
2-Chloro-5-nitrobenzoic acid	61	429
2-Chloro-6-nitrobenzoic acid	12	429
3-Chloro-2-nitrobenzoic acid	364	208
4-Chloro-2-nitrobenzoic acid	211	201
4-Chloro-3-nitrobenzoic acid	283	204
5-Chloro-2-nitrobenzoic acid	200	201
6-Chloro-3-nitrobenzoic acid	256	203
2-Chloro-3-nitrobenzonitrile	131	363
4-Chloro-2-nitrobenzonitrile	133	363
4-Chloro-3-nitrobenzonitrile	135	363
6-Chloro-3-nitrobenzonitrile	146	363
4-Chloro-1-nitronaphthalene	59	339
5-Chloro-1-nitronaphthalene	76	340
8-Chloro-1-nitronaphthalene	66	339
4-Chloro-3-nitro-1,2-naphthequinone	120	342
2-Chloro-3-nitrophenol	274	110
2-Chloro-4-nitrophenol	232	108
2-Chloro-5-nitrophenol	267	110

	Compound No.	Page No.
3-Chloro-5-nitrophenol	363	115
4-Chloro-2-nitrophenol	149	104
4-Chloro-3-nitrophenol	300	111
4-Chloro-4-nitrophenol	42	417
5-Chloro-2-nitrophenol	15	434
5-Choro-3-nitrosalicylic acid	250	203
4-Chloro-2-nitrotoluene	13	337
6-Chloro-2-nitrotoluene	10	337
5-Chloro-2-nitro-4-tolunitrile	121	362
DL-2-Chloropentane	19	55
3-Chloropentane	20	55
2-Chloropentanoic acid	43	191
1-Chloro-2-pentene	23	55
3-Chloro-1-pentene	16	55
4-Chlorophenacyl bromide	122	176
2-Chlorophenetole	83	135
4-Chlorophenetole	1	137
2-Chlorophenol	1	94
"	49	434
3-Chlorophenol	15	96
'	61	434
4-Chlorophenol	20	97
"	72	434
2-Chlorophenoxyacetamide	285	238
4-Chlorophenoxyacetamide	238	237
2-Chlorophenoxyacetanilide	192	236
4-Chlorophenoxyacetanilide	200	236
(2-Chlorophenoxy)acetic acid	217	202
' " '	147	430
(3-Chlorophenoxy)acetic acid	150	430
(4-Chlorophenoxy)acetic acid	238	202
" " "	154	430
(2-Chlorophenyl)acetic acid	102	197
' " "	295	431
(3-Chlorophenyl)acetic acid	305	431
(4-Chlorophenyl)acetic acid	127	198
" " '	321	431
(2-Chlorophenyl)acetonitrile	10	357
(4-Chlorophenyl)acetonitrile	16	357
α-Chloro-α-phenylacetonitrile	5	355
3-(2-Chlorophenyl)alanine	68	429
3-(3-Chlorophenyl)alanine	60	429
3-(4-Chlorophenyl)alanine	48	429
2-Chlorophenyl ethyl ketone	49	169
3-Chlorophenylglycine	6	429
4-Chlorophenyl methyl sulfide	35	421
4-Chlorophenyl phenyl sulfide	63	422
3-(2-Chlorophenyl)propionic acid	401	432
3-(3-Chlorophenyl)propionic acid	402	432
3-(2-Chlorophenyl)propionitrile	96	353
4-Chlorophenyl sulfide	56	426
3-Chlorophthalic anhydride	54	226
4-Chlorophthalic anhydride	42	226
4-Chloropicolinic acid	286	204
Chloroprene	9	55
2-Chloropropanethiol	15	413
1-Chloro-2-propanol	22	81
d,l-2-Chloro-1-propanol	27	81
3-Chloro-1-propanol	54	83
1-Chloro-2-propanone	17	161
1-Chloropropene	5	55
2-Chloropropionaldehyde	14	144
3-Chloropropionaldehyde	37	146
d,l-α-Chloropropionamide	54	232
d,l-α-Chloropropionanilide	80	233
d,l-2-Chloropropionic acid	18	190
" "	127	430
3-Chloropropionic acid	25	193
" "f	285	431
3-Chloropropionitrile	49	348
DL-α-Chloropropionyl chloride	13	212
β-Chloropropionyl chloride	28	212
2-Chloropropiophenone	49	169
3-Chloropropiophenone	43	173
4-Chloropropiophenone	21	172
3-Chloropropyl alcohol	54	83
2-Chloropyridine	38	319
"	14	436
3-Chloropyridine	23	319
"	74	436
4-Chloropyridine	21	319
'	115	436
4-Chloropyridine-2-carboxylic acid	286	204
4-Chloroquinaldine	19	323
2-Chloroquinoline-3-carboxylic acid	372	208
2-Chloroquinoline-4-carboxylic acid	377	208
2-Chloroquinoline	11	323
3-Chloroquinoline	92	321
4-Chloroquinoline	7	323
5-Chloroquinoline	20	323
6-Chloroquinoline	15	323
7-Chloroquinoline	8	323
8-Chloroquinoline	109	321
α-Chloroquinoline	11	323
β-Chloroquinoline	92	321
γ-Chloroquinoline	7	323
4-Chlororesorcinol	214	107
3-Chlorosalicylaldehyde	36	155
5-Chlorosalicylic acid	268	204
β-Chlorostyrene	45	56
o-Chlorostyrene	11	70
p-Chlorostyrene	15	70
Chloroterephthalic acid	405	210
4-Chloro-2,3,5,6-Tetrabromophenol	534	124
1-Chloro-2,2,3,3-tetramethylbutane	5	57
2-Chlorothiophenol	37	414
4-Chlorothiophenol	16	416
2-Chlorotoluene	2	70
3-Chlorotoluene	3	70
4-Chlorotoluene	4	70
5-Chloro-*o*-toluidine	157	300
6-Chloro-*m*-toluidine	138	307
2-Chloro-5-tolunitrile	71	360
3-Chloro-2-tolunitrile	3	357
3-Chloro-4-tolunitrile	48	359
4-Chloro-2-tolunitrile	83	361
5-Chloro-2-tolunitrile	41	358
6-Chloro-2-tolunitrile	104	362
α-Chloro-3-tolunitrile	82	361
α-Chloro-4-tolunitrile	99	361
4-Chloro-1,2,3-trihydroxy-9,10-anthraquinone	36	183
2-Chloro-1,3,5-trimethylbenzene	22	70
3-Chloro-2,2,3-trimethylbutane	33	56
2-Chloro-*n*-valeric acid	43	191
(2-Chlorovinyl)acetic acid	101	429
1-Chloro-2-vinylbenzene	11	70
1-Chloro-4-vinylbenzene	15	70
5-Chloro-*m*-xylidine	27	303
Cholanic acid	252	203
Cholanthrene	169	50
Cholesterol	59	90
Cholesteryl acetate	147	280
Chrysazol	556	126
Chrysene	195	51
Chrysenequinone	39	183
α-Chrysenic acid	308	205
Chrysodiphenic acid	318	206
Chrysofluorene	179	50
Chrysoquinone	39	183
Cinchol	57	90
Cinchomeronic acid	389	209
Cinchoninic acid	385	209
Cinnamalacetone	89	175

	Compound No.	Page No.
Cinnamacetophenone	131	176
Cinnamaldehyde	90	149
Cinnamalfluorene	156	49
Cinnamamide	278	238
Cinnamanilide	287	238
cis-Cinnamic acid	262	431
trans-Cinnamic acid	181	200
" " "	379	432
Cinnamic anhydride	62	226
Cinnamonitrile	5	357
trans-Cinnamoyl bromide	2	220
Cinnamyl alcohol	13	88
trans-Cinnamyl chloride	4	216
Cinnamyl cinnamate	50	275
Cinnamyl phenyl sulfide	45	426
Cinnoline	45	436
Citraconic acid	98	196
" "	470	433
Citraconic acid diamide	392	242
Citraconic acid dianilide	359	241
Citraconic anhydride	10	223
Citral a	82	148
Citral b	83	148
d,l-Citramalic acid	154	199
Citric acid	113	197
" "	228	202
Citric acid triamide	448	244
Citric acid trianilide	425	243
d-Citronellal	76	148
d-Citronellic acid	49	191
l-Citronellic acid	12	192
Citronellol	115	86
L-Citrulline	51	286
2,3,4-Collidine	51	320
2,3,5-Collidine	45	320
2,3,6-Collidine	43	320
2,4,5-Collidine	34	319
2,4,6-Collidine	41	320
Coronene	204	51
2-Coumaramide	445	244
4-Coumaramide	415	243
trans-2-Coumaric acid	333	207
p-Coumaric acid	336	207
Coumarilic acid	312	206
Coumarilonitrile	28	358
Coumarin-2-carbonitrile	28	358
Coumarin-3-carboxylic acid	302	205
Coumarone-2-carboxylic acid	312	206
Creatine	113	289
Creatinine	117	290
Creosol	92	135
m-Cresol	5	94
"	100	434
o-Cresol	11	96
"	109	435
p-Cresol	17	97
"	108	435
m-Cresyl acetate	200	260
o-Cresyl acetate	187	259
p-Cresyl acetate	203	260
m-Cresyl benzoate	76	277
o-Cresyl benzoate	350	271
p-Cresyl benzoate	101	278
2-Cresyl ethyl ether	70	134
3-Cresyl ethyl ether	76	135
4-Cresyl ethyl ether	75	135
2-Cresyl methyl ether	62	134
3-Cresyl methyl ether	66	134
4-Cresyl methyl ether	65	134
Crotonaldehyde	22	145
Crotonamide	318	240
trans-α-Crotonanilide	182	235
Crotonchloral	58	147
α-Crotonic acid	109	197
cis-Crotonic acid	13	190
" "	369	432
trans-Crotonic acid	71	195
" " "	423	432
Crotonic anhydride	14	223
trans-Crotononitrile	15	346
trans-Crotonyl chloride	21	212
Crotylacetone	71	163
Crotyl sulfide	40	421
Cumaldehyde	87	149
Cumene	7	35
p-Cumidine	135	299
Cuminic acid	150	199
Cyanethine	404	316
1-Cyanoacenaphthene	84	361
5-Cyanoacenaphthene	155	364
Cyanoacetaldehyde	2	345
Cyanoacetamide	188	235
Cyanoacetanilide	424	243
Cyanoacetic acid	60	195
" "	79	360
" "	96	429
Cyanoacetyl chloride	15	214
Cyanoacetylene	1	345
2-Cyanoaniline	22	436
3-Cyanoaniline	70	436
4-Cyanoaniline	111	362
"	33	436
1-Cyanoanthracene	170	364
9-Cyanoanthracene	214	367
1-Cyano-9,10-anthraquinone	233	368
4-Cyanoazobenzene	166	364
2-Cyanobenzal chloride	94	353
3-Cyanobenzal chloride	99	353
4-Cyanobenzal chloride	100	353
3-Cyanobenzaldehyde	101	361
4-Cyanobenzamide	470	245
4-Cyanobenzanilide	370	241
2-Cyanobenzoic acid	299	205
"	219	367
"	163	430
3-Cyanobenzoic acid	227	367
"	218	430
4-Cyanobenzoic acid	348	207
" "	228	367
" "	213	430
2-Cyanobenzyl bromide	89	361
3-Cyanobenzyl bromide	122	362
4-Cyanobenzyl bromide	160	364
3-Cyanobenzyl chloride	82	361
4-Cyanobenzyl chloride	99	361
α-Cyanobenzyl cyanide	85	361
2-Cyanobiphenyl	16	356
4-Cyanobiphenyl	108	362
1-Cyanobutane	31	347
2-Cyanobutanoic acid	22	192
4-Cyanobutanoic acid	32	194
2-Cyanobutyric acid	15	356
4-Cyanobutyric acid	32	194
" "	40	358
" "	378	432
2-Cyanocinnamic acid	218	367
3-Cyanocoumarin	217	367
Cyanocyclobutane	36	347
1-Cyanocyclohexane	2	355
2-Cyano-2-cyclohexylacetic acid	90	429
N-Cyanodiethylamine	6	436
3-Cyano-N,N-dimethylaniline	77	436
4-Cyano-N,N-dimethylaniline	96	361
" "	34	436

	Compound No.	Page No.
4-Cyano-2,6-dimethylphenol	40	434
4-Cyano-3,5-dimethylphenol	38	434
d,l-4-Cyano-3,4-diphenylbutyric acid	206	366
2-Cyanodiphenylmethane	1	357
4-Cyanodiphenylmethane	56	359
Cyanoethane	8	345
2-Cyanoethylamine	283	438
2-Cyano-2-ethylbutyric acid	80	360
(2-Cyanoethyl)dimethylamine	274	438
Cyanoform	66	360
2-Cyanofuran	34	347
4-Cyanoheptane	57	349
2-Cyanohexanoic acid	168	364
α-Cyanohydrocinnamic acid	119	197
3-Cyanoindene	21	356
3-Cyanoindole	50	349
2-Cyano-5-iodonaphthalene	195	366
2-Cyanoisobutyric acid	95	429
1-Cyano-4-isopropenylcyclohexane	18	356
1-Cyanoisoquinoline	97	361
Cyanomethane	5	345
N-Cyano-N-methylaniline	95	353
(Cyanomethyl)diethylamine	162	437
1-(Cyanomethyl)pyridine	161	437
1-Cyanonaphthalene	25	358
2-Cyanonaphthalene	78	360
8-Cyanonaphthalene-1-sulfonamide	476	410
8-Cyanonaphthalene-1-sulfonyl chloride	223	388
1-Cyano-4-nitronaphthalene	179	365
1-Cyano-5-nitronaphthalene	223	367
2-Cyano-1-nitronaphthalene	183	365
2-Cyano-5-nitronaphthalene	213	366
2-Cyano-8-nitronaphthalene	189	365
2-Cyano-4-nitrophenol	221	367
2-Cyano-5-nitrophenol	205	366
2-Cyano-6-nitrophenol	178	365
2-Cyanopentanoic acid	11	355
1-Cyanophenanthrene	172	364
2-Cyanophenanthrene	151	364
3-Cyanophenanthrene	138	363
9-Cyanophenanthrene	149	363
2-Cyanophenol	189	106
'	132	363
4-Cyanophenol	158	364
"	34	434
(2-Cyanophenoxy)acetic acid	137	430
(3-Cyanophenoxy)acetic acid	143	430
(4-Cyanophenoxy)acetic acid	131	430
1-Cyano-2-phenylacrylonitrile	112	362
2-Cyano-3-phenylpropionic acid	137	363
3-Cyano-3-phenylpropionic acid	196	366
4-Cyano-2-phenylquinoline	187	365
1-Cyanopropane	14	345
2-Cyanopropionic acid	19	192
" "	26	358
" "	91	429
3-Cyanopropionic acid	39	194
" "	47	359
" '	284	431
(3-Cyanopropyl) diethyl amine	313	438
2-Cyano-2-propylvaleramide	197	366
2-Cyanopyridine	12	357
3-Cyanopyridine	54	359
4-Cyanopyridine	98	361
2-Cyanoquinoline	125	362
3-Cyanoquinoline	150	363
4-Cyanoquinoline	140	363
5-Cyanoquinoline	115	362
6-Cyanoquinoline	181	365
8-Cyanoquinoline	105	362
5-Cyanothiazole	60	359
2-Cyanothiophene	59	349
3-Cyanothiophene	52	349
Cyanotriphenylethylene	209	366
2-Cyanotriphenylmethane	114	362
4-Cyanotriphenylmethane	134	363
4-Cyanovaleric acid	126	363
Cyclobutane	8	3
Cyclobutanecarbonitrile	36	347
Cyclobutanecarbonyl chloride	25	212
Cyclobutanecarboxylic acid	26	191
"	435	432
Cyclobutane-1,1-dicarboxylic acid	242	203
cis-Cyclobutane-1,2-dicarboxylic acid	197	201
' ' '	265	431
cis-Cyclobutane-1,3-dicarboxylic acid	290	431
trans-Cyclobutane-1,2-dicarboxylic acid	249	431
Cyclobutanone	8	161
Cyclobutene	9	12
Cyclobutylamine	22	295
Cyclobutyl methyl ketone	37	162
Cyclodecane	248	7
cis-Cyclodecene	329	24
trans-Cyclodecene	4	25
Cyclodecyne	58	30
Δ^2-Cyclogeranic acid	128	198
α-Cyclogeraniolene	246	20
Cyclohept(fg)acenaphthene	123	48
1,3-Cycloheptadiene	211	19
Cycloheptane	68	4
Cycloheptanone	134	165
1,3,5-Cycloheptatriene	191	18
Cycloheptene	187	18
Cyclohexadecane	35	8
1,5,9,13-Cyclohexadecatetraene	5	25
1,3-Cyclohexadiene	78	14
Cyclohexane	29	3
Cyclohexencarboxaldehyde	30	151
Cyclohexancarboxanilide	272	238
Cyclohexanecarboxylic acid	10	193
Cyclohexanecarboxylic acid chloride	36	212
Cyclohexane-1,1-diacetic acid	201	430
cis-Cyclohexane-1,2-diacetic acid	372	432
trans-Cyclohexane-1,2-diacetic acid	364	432
cis-Cyclohexane-1,2-dicarboxylic acid	354	432
trans-Cyclohexane-1,2-dicarboxylic acid	319	431
cis-Cyclohexane-1,3-dicarboxylic acid	299	431
trans-Cyclohexane-1,3-dicarboxylic acid	348	432
trans-Cyclohexane-1,4-dicarboxylic acid	316	431
1,3-Cyclohexanedione	132	176
1,4-Cyclohexanedione	109	175
Cyclohexanethiol	23	414
Cyclohexane-1,2,3-tricarboxylic acid	264	431
Cyclohexanol	6	88
Cyclohexanone	79	163
Cyclohexene	81	15
Cyclohexene sulfide	45	424
2-Cyclohexenone	48	169
1-Cyclohexenylcarboxylic acid	21	193
Cyclohexylacetaldhyde	15	150
N-Cyclohexylacetamide	134	234
Cyclohexyl acetate	128	256
Cyclohexylacetic acid	46	191
Cyclohexylacetonitrile	71	350
Cyclohexylacetyl chloride	25	214
β-Cyclohexylacrylic acid	53	195
Cyclohexylamine	49	296
"	426	439
N-Cyclohexylaniline	224	437
N-Cyclohexylbenzamide	280	238
Cyclohexylbenzene	133	40
Cyclohexyl bromide	21	58

	Compound No.	Page No.
Cyclohexyl *n*-butyrate	199	260
Cyclohexylbutyric acid	460	432
Cyclohexyl carbinol	84	84
Cyclohexyl chloride	35	56
4-Cyclohexylcyclohexanone	12	172
Cyclohexyl ethyl amine	69	297
Cyclohexyl ethyl ether	55	133
Cyclohexyl formate	111	255
Cyclohexyl iodide	17	60
Cyclohexyl isobutyrate	178	259
Cyclohexyl mercaptan	23	414
Cyclohexyl methoxymethyl ketone	9	169
Cyclohexyl methyl amine	58	297
" " "	453	439
Cyclohexyl methyl ether	50	133
Cyclohexyl methyl ketone	130	165
Cyclohexyloxyacetic acid	250	431
2-Cyclohexyloxypropionic acid	228	431
2-Cyclohexylphenol	56	99
4-Cyclohexylphenol	316	112
4-Cyclohexylphenyl methyl ether	36	138
3-Cyclohexylpropene	281	21
Cyclohexyl propionate	159	257
Cyclohexylpropionic acid	457	432
2-Cyclohexylpyrrolidine	436	439
2-Cyclohexyl-2-pyrroline	290	438
Cyclononane	235	7
cis-1,4,7-Cyclononatriene	9	26
trans-Cyclononene	6	25
Cyclononyne	55	30
1,3-Cyclooctadecadiene	7	25
1,3-Cyclooctadiene	8	25
cis-1,4-Cyclooctadiene	263	21
1,5-Cyclooctadiene	270	21
Cyclooctane	142	5
Cyclooctatetraene	252	20
1,3,5-Cyclooctatriene	264	21
1,3,6-Cyclooctatriene	9	25
Cyclooctene	258	20
Cyclooctyne	49	30
Cyclopentadecane	40	8
Cyclopentadiene	23	12
Cyclopentadienophenanthrene	165	50
Cyclopentane	17	3
Cyclopentanecarboxylic acid	29	192
" " "	463	433
cis-Cyclopentane-1,2-diacetic acid	373	432
trans-Cyclopentane-1,2-diacetic acid	375	432
Cyclopentane-1,1-dicarboxylic acid	182	430
trans-Cyclopentane-1,2-dicarboxylic acid	276	431
cis-1,3-Cyclopentane-1,3-dicarboxylic acid	162	199
" " " "	337	431
trans-Cyclopentane-1,3-dicarboxylic acid	350	432
Cyclopentanol	35	81
1,2-Cyclopentanonaphthalene	171	42
Cyclopentanone	27	162
4-H-Cyclopenta(def)phenanthrene	118	47
Cyclopentene	28	13
2,3-Cyclopentenonaphthalene	97	47
1-Cyclopentenylcarboxylic acid	160	199
1-Cyclopentylacetone	35	169
Cyclopentylaldehyde	42	146
N-Cyclopentylaniline	209	437
Cyclopentyl bromide	18	58
3-Cyclopentyl-2-butanone	7	169
Cyclopentyl chloride	26	55
Cyclopentyl-1,1-diacetic acid	252	431
Cyclopentyl ethyl ether	45	133
1-Cyclopentylformaldehyde	47	146
Cyclopentyl iodide	16	60
α-Cyclopentyl-α-methylacetone	7	169
Cyclopentyl methyl ether	38	133
Cyclopentyl methyl ketone	76	163
Cyclopentyloxyacetic acid	237	431
5-Cyclopentylpentanoic acid	25	192
1-Cyclopentyl-2-propanone	35	169
d-w-Cyclopentyltridecanoic acid	69	195
α-Cyclopentylundecylamide	172	235
Cyclopropane	4	3
Cyclopropanecarbonyl chloride	19	212
Cyclopropanecarboxylic acid	19	190
" " "	444	432
Cyclopropane-1,1-dicarboxylic acid	29	429
cis-Cyclopropane-1,2-dicarboxylic acid	192	430
trans-Cyclopropane-1,2-dicarboxylic acid	232	431
Cyclopropene	3	12
Cyclopropylacetic acid	23	190
Cyclopropylamine	9	295
1,3-Cyclotetradecadiene	10	25
m-Cymene	17	35
o-Cymene	22	36
p-Cymene	21	36
p-Cymidine	158	300
L-Cysteic acid	96	288
L-Cysteine	130	290
L-Cystine	75	287

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	Compound No.	Page No.
DDT	2	64
cis-Decahydronaphthalene	246	7
trans-Decahydronaphthalene	244	7
Decahydronaphthyloxyacetic acid	227	431
cis-Decalin	246	7
trans-Decalin	244	7
cis-1-Decalone	93	170
Decamethylene glycol	44	89
Decanal	77	148
n-Decanamide	110	233
n-Decaneanilide	36	231
n-Decane	239	7
1,10-Decanedicarboxylic acid	172	200
Decanedioic acid	183	200
Decanedioic anhydride (*dimer*)	27	225
1,10-Decanediol	44	89
1,10-Decanedithiol	3	416
n-Decanoic acid	13	193
n-Decanoic anhydride	2	225
1-Decanol	121	86
d,l-2-Decanol	106	85
2-Decanone	166	166
4-Decanone	163	166
Decanonitrile	87	352
n-Decanoyl chloride	52	213
1-Decene	305	22
4-Decene	306	22
5-Decene	299	22
Decyl acetylene	60	30
n-Decyl alcohol	121	86
n-Decylbenzene	172	42
n-Decyl chloride	50	56
n-Decylcyclohexane	272	7
n-Decylcyclopentane	269	7
n-Decyl methyl ketone	2	172
1-Decylnaphthalene	186	42
Decyl sulfide	5	425
1-Decyne	52	30
3-Decyne	53	30
5-Decyne	54	30
Dehydroacetic acid monoanilide	178	235
Desoxybenzoin	73	174
6-Desoxy-D-galactose	33	331
6-Desoxy-DL-galactose	44	332

	Compound No.	Page No.
6-Desoxy-L-galactose	34	331
2-Desoxy-D-glucose	36	331
6-Desoxy-D-glucose	29	330
6-Desoxy-L-mannose	9	329
6-Desoxy-D-mannose	13	328
2-Desoxy-D-ribose	5	329
1,1-Diacenaphthene	130	48
Diacetone alcohol	59	83
" "	98	164
β,β′-Diacetoxydiethyl ether	274	265
1,3-Diacetoxypropane	193	260
Diacetylacetone	48	173
1,4-Diacetylbenzene	147	177
N,N′-Diacetylbenzidine	509	246
Diacetylene	4	28
N,N′-Diacetylethylenediamine	349	241
N,N′-Diacetyl-*m*-phenylenediamine	405	242
N,N′-Diacetyl-*o*-phenylenediamine	389	242
N,N′-Diacetyl-*p*-phenylenediamine	507	246
4,6-Diacetylpyrogallol	486	122
4,6-Diacetylresorcinol	478	121
Diacetylsulfide	30	420
N,N-Diacetyltetramethylenediamine	250	237
1,5-Diacetyl-2,3,4-trihydroxybenzene	486	122
N,N′-Diacetyltrimethylenediamine	120	234
Diallylamine	318	438
Diallyl sulfide	23	420
2,8-Diaminoacridone	478	318
1,4-Diaminoanthraquinone	463	318
1,5-Diaminoanthraquinone	475	318
1,6-Diaminoanthraquinone	468	318
1,7-Diaminoanthraquinone	466	318
1,8-Diaminoanthraquinone	462	318
2,7-Diaminoanthraquinone	476	318
2,2′-Diaminoazobenzene	300	312
3,3′-Diaminoazobenzene	350	314
4,4′-Diaminoazoxybenzene	407	316
1,2-Diaminobenzene	196	309
"	176	437
1,3-Diaminobenzene	84	305
"	190	437
1,4-Diaminobenzene	318	313
"	253	438
2,4-Diaminobenzene-1,5-disulfonamide	261	402
2,4-Diaminobenzene-1,5-disulfonanilide	404	407
2,4-Diaminobenzene-1,5-disulfonic acid	124	375
2,4-Diaminobenzene-1,5-disulfonyl chloride	284	390
3,5-Diaminobenzoic acid	55	286
2,2′-Diaminobenzophenone	299	312
3,3′-Diaminobenzophenone	381	315
4,4′-Diaminobenzophenone	456	317
Di-(2-aminobenzyl)sulfide	50	426
Di-4-aminobenzyl sulfide	59	426
2,2′-Diaminobiphenyl	134	307
2,4′-Diaminobiphenyl	33	303
3,4-Diaminobiphenyl	199	309
1,3-Diaminobutane	54	296
1,4-Diaminobutane	66	297
" "	437	439
d,l-2,3-Diaminobutane	360	438
meso-2,3-Diaminobutane	359	438
2,7-Diaminocarbazole	461	318
cis-1,2-Diaminocyclohexane	353	438
trans-1,2-Diaminocyclohexane	357	438
1,2-Diaminocyclohexane	84	297
2,2′-Diaminodibenzyl	104	306
2,2′-Diaminodibenzyl disulfide	159	307
2,2′-Diaminodibenzyl sulfide	133	307
4,4′-Diaminodibenzyl sulfide	203	309
2,2′-Diaminodiethyl sulfide	145	299
1,4-Diamino-5,8-dihydroxy-9,10-anthraquinone	57	184
1,4-Diamino-5,8-dihydroxy-9,10-anthraquinone	471	318
4,4′-Diamino-3,3′-dimethoxybiphenyl	309	312
4,4′-Diamino-2,2′-dimethylazoxybenzene	334	313
α,α′-Diamino-1,4-dimethylbenzene	15	303
1,3-Diamino-2,6-dimethylbenzene	94	305
1,3-Diamino-4,6-dimethylbenzene	205	309
2,2′-Diamino-4,4′-dimethylbiphenyl	257	310
DL-2,2′-Diamino-6,6′-dimethylbiphenyl	306	312
2,2′-Diamino-6,6′-dimethylbiphenyl	349	314
4,4′-Diamino-2,2′-dimethylbiphenyl	221	309
4,4′-Diamino-2,3′-dimethylbiphenyl	11	302
4,4′-Diamino-3,3′-dimethylbiphenyl	290	312
4,4′-Diamino-2,2′-dimethyldiphenylmethane	268	311
4,4′-Diamino-3,3′-dimethyldiphenylmethane	354	314
6,6′-Diamino-3,3′-dimethyldiphenylmethane	182	308
4,4′-Diamino-3,3′-dimethyldiphenyl sulfide	181	308
6,6′-Diamino-3,3′-dimethyldiphenyl sulfide	200	309
6,6′-Diamino-3,3′-dimethyltriphenylmethane	399	316
1,1′-Diamino-2,2′-dinaphthyl	465	318
DL-2,2′-Diamino-1,1′-dinaphthyl	410	316
4,4′-Diamino-1,1′-dinaphthyl	423	317
2,4-Diaminodiphenylamine	291	312
2,2′-Diaminodiphenyl disulfide	167	308
4,4′-Diaminodiphenyl disulfide	144	307
4,4′-Diaminodiphenylmethane	169	308
2,2′-Diaminodiphenyl sulfide	147	307
2,4′-Diaminodiphenyl sulfide	32	425
4,4′-Diaminodiphenyl sulfone	386	315
1,2-Diaminoethane	352	438
1,9-Diaminofluorene	255	310
2,7-Diaminofluorenone	467	318
1,6-Diaminohexane	30	303
" "	439	439
1,2-Diamino-4-hydroxybenzene	374	315
1,4-Diamino-2-iodobenzene	225	309
4,6-Diaminoisophthaldehyde	431	317
1,3-Diaminoisopropyl alcohol	31	303
2,6-Diamino-4-methylphenol	360	114
Di-(2-amino-5-methylphenyl) sulfide	58	426
Di-(4-amino-3-methylphenyl) sulfide	55	426
4,6-Diamino-2-methylquinoline	414	316
1,2-Diaminonaphthalene	191	308
1,4-Diaminonaphthalene	254	310
1,8-Diaminonaphthalene	99	305
2,7-Diaminonaphthalene	371	315
1,2-Diamino-4-nitrobenzene	415	316
1,3-Diamino-4-nitrobenzene	361	314
1,4-Diamino-2-nitrobenzene	307	312
1,18-Diaminooctadecane	168	308
1,8-Diaminooctane	446	439
1,5-Diaminopentane	76	297
" "	378	439
2,4-Diaminophenol	120	102
" "	130	306
3,4-Diaminophenol	450	119
" "	374	315
3,5-Diaminophenol	442	119
Di-(2-aminophenyl) sulfide	52	426
Di-(4-aminophenyl) sulfide	60	426
1,2-Diaminopropane	361	438
D,L-1,2-Diaminopropane	42	296
1,3-Diaminopropane	50	296
" "	382	439
2,4-Diaminopyridine	214	309
2,5-Diaminopyridine	217	309
2,6-Diaminopyridine	258	311
3,4-Diaminopyridine	442	317
5,8-Diaminoquinizarin	57	184
" "	471	318
cis-2,2′-Diaminostilbene	269	311
trans-2,2′-Diaminostilbene	387	315

	Compound No.	Page No.
cis-4,4′-Diaminostilbene	259	311
trans-4,4′-Diaminostilbene	451	317
DL-2,3-Diaminosuccinic acid	126	290
meso-2,3-Diaminosuccinic acid	119	290
4,4′-Diamino-2,5,2′,5′-tetramethyltriphenylmethane	434	317
2,4-Diaminotoluene	194	308
2,5-Diaminotoluene	88	305
3,4-Diaminotoluene	157	307
4,4′-Diaminotriphenylcarbinol	375	315
3,4-Diaminotriphenylmethane	111	306
α,α′-Diamino-*m*-xylene	161	300
2,4-Diamino-*m*-xylene	94	305
4,6-Diamino-*m*-xylene	205	309
Di-*n*-amylamine	97	298
Di-*n*-amyl ether	72	134
Di-*n*-amyl ketone	183	167
2,5-Dianilino-1,4-benzoquinone	477	318
Dianisalacetone	160	177
Dianisidine	309	312
9,9′-Dianthranyl-10,10′-quinone	58	184
Dianthraquinone	58	184
Dibenzalacetone	145	177
1,2,3,4-Dibenzanthracene	185	51
1,2,5,6-Dibenzanthracene	200	51
1,2,7,8-Dibenzanthracene	183	50
Dibenzofuran	50	139
Dibenzofuran-2-carboxaldehyde	57	156
4-Dibenzofurylacetic acid	340	207
Dibenzoyl	119	176
1,2-Dibenzoylbenzene	178	178
1,3-Dibenzoylbenzene	129	176
1,4-Dibenzoylbenzene	184	178
N,N′-Dibenzoylbenzidine	511	247
1,2-Dibenzoylethane	174	178
cis-1,2-Dibenzoylethylene	163	177
trans-1,2-Dibenzoylethylene	142	176
N,N′-Dibenzoylethylenediamine	491	246
Dibenzoylmethane	111	175
1,3-Dibenzoylpropane	87	175
Dibenzoyl sulfide	20	425
N,N-Dibenzoyltetramethylenediamine	364	241
4-Dibenzothienylacetic acid	248	203
N,N′-Dibenzoyltrimethylenediamine	274	238
1,2,7,8-Dibenzphenanthrene	202	51
2,3,5,6-Dibenzphenanthrene	199	51
2,3,6,7-Dibenzphenanthrene	198	51
Dibenzylacetanilide	299	239
Dibenzylacetic acid	94	196
Dibenzylacetone	221	168
Dibenzyl acetonitrile	63	350
Dibenzylacetyl chloride	17	214
Dibenzylamine	184	301
N,N-Dibenzylaniline	40	323
Dibenzyl ether	109	136
Dibenzyl ketone	19	172
4,5-Dibenzylnaphthalene-1-sulfonamide	192	399
4,5-Dibenzylnaphthalene-1-sulfonyl chloride	239	389
1,2-Dibenzyloxybenzene	39	138
1,4-Dibenzyloxybenzene	55	139
Dibenzyl phthalate	48	275
Dibenzyl succinate	64	276
2,2-Dibenzylsuccinic acid	274	431
Dibenzyl sulfide	21	425
Dibenzyl *d*-tartarate	63	276
Dibiphenyleneethylene	182	50
Dibromoacetamide	308	239
3,5-Dibromoacetic acid	35	194
3,5-Dibromoacetophenone	88	175
2,4-Dibromoaniline	127	306
" "	47	436
2,6-Dibromoaniline	139	307
" "	48	136
1,2-Dibromobenzene	12	73
1,3-Dibromobenzene	10	73
1,4-Dibromobenzene	5	74
2,4-Dibromobenzenesulfonamide	271	402
2,5-Dibromobenzenesulfonamide	297	403
3,4-Dibromobenzenesulfonamide	212	399
2,4-Dibromobenzenesulfonic acid	130	375
2,5-Dibromobenzenesulfonic acid	141	376
3,4-Dibromobenzenesulfonic acid	90	374
2,4-Dibromobenzenesulfonyl chloride	93	383
2,5-Dibromobenzenesulfonyl chloride	81	383
3,4-Dibromobenzenesulfonyl chloride	16	381
2,4-Dibromobenzoic acid	270	204
2,4-Dibromobenzonitrile	119	362
2,5-Dibromobenzonitrile	176	365
2,6-Dibromobenzonitrile	198	366
3,5-Dibromobenzonitrile	130	363
2,4′-Dibromobenzophenone	77	174
3,3′-Dibromobenzophenone	171	178
4,4′-Dibromobenzophenone	191	178
2,6-Dibromo-1,4-benzoquinone	16	182
4,4′-Dibromobiphenyl	8	74
1,2-Dibromobutane	11	65
1,3-Dibromobutane	14	65
1,4-Dibromobutane	16	65
2,3-Dibromobutane	10	65
1,2-Dibromo-1-butene	6	65
1,3-Dibromo-2-butene	13	65
3,5-Dibromo-*o*-cresol	194	106
4,6-Dibromo-*o*-cresol	58	99
2,6-Dibromo-*p*-cresol	43	98
1,3-Dibromo-2,4-dihydroxynaphthalene	303	111
1,5-Dibromo-4,8-dihydroxynaphthalene	367	115
2,6-Dibromo-1,5-dihydroxynaphthalene	589	127
2,3-Dibromo-5,6-dimethylphenol	186	106
2,5-Dibromo-1,4-dinitrobenzene	53	339
1,1-Dibromoethane	2	65
1,2-Dibromoethane	3	65
2,2-Dibromoethanol	81	84
Di-(2-bromoethyl)sulfide	8	425
Dibromogallic acid	336	113
1,7-Dibromoheptane	1	66
2,6-Dibromohydroquinone	425	118
Dibromomalononitrile	169	364
Dibromomethane	1	65
2,6-Dibromo-4-methylphenol	43	98
3,5-Dibromo-2-methylphenol	194	106
4,6-Dibromo-2-methylphenol	58	99
1,2-Dibromo-2-methylpropane	5	65
1,1-Dibromo-2-methylpropene	9	65
1,2-Dibromonaphthalene	3	74
1,4-Dibromonaphthalene	4	74
1,3-Dibromo-2,4-naphthalenediol	303	111
1,3-Dibromo-2-naphthol	107	102
1,6-Dibromo-2-naphthol	212	107
2,4-Dibromo-1-naphthol	208	107
4,6-Dibromo-2-naphthol	320	112
2,5-Dibromo-1-nitrobenzene	56	339
2,4-Dibromo-6-nitrophenol	259	109
2,6-Dibromo-4-nitrophenol	348	114
1,9-Dibromononane	21	65
1,8-Dibromooctane	20	65
1,5-Dibromopentane	18	65
2,4-Dibromophenol	18	97
2,5-Dibromophenol	104	102
2,6-Dibromophenol	52	99
3,5-Dibromophenol	127	103
Di-(4-bromophenyl)sulfide	63	426
DL-1,2-Dibromopropane	4	65
1,3-Dibromopropane	12	65

	Compound No.	Page No.
2,3-Dibromo-1-propanol	112	85
1,3-Dibromopropene	8	65
α,β-Dibromopropionamide	222	237
2,3-Dibromopropionic acid	63	195
3,5-Dibromopyridine	70	324
d,l-2,3-Dibromosuccinic acid	15	429
meso-2,3-Dibromosuccinic acid	20	429
2,5-Dibromotoluene	14	73
3,4-Dibromotoluene	15	73
2,6-Dibromo-3,4,5-trihydroxybenzoic acid	336	113
Di-(β-*n*-butoxyethyl)carbonate	344	270
Dibutyl acetylene	54	30
Di-*tert*-butyl acetylene	40	29
Di-*n*-butylamine	65	297
" "	464	439
N,N-Di-*n*-butylaniline	99	321
" "	256	438
3,5-Di-*tert*-butylaniline	188	437
1,4-Di-*sec*-butylbenzene	139	40
Di-*n*-butyl carbonate	184	259
Di-*n*-butyl ether	54	133
Di-*sec*-butyl ether	44	133
Di-*n*-butyl ketone	140	165
Di-*sec*-butyl ketone	93	164
Di-*tert*-butyl ketone	74	163
Di-*n*-butyl oxalate	266	264
Di-*n*-butyl phthalate	355	271
Di-*n*-butyl racemate	353	271
Di-*n*-butyl sebacate	356	271
Di-*n*-butyl succinate	320	268
Di-*n*-butyl sulfide	41	421
Di-*tert*-butyl sulfide	29	420
Di-*n*-butyl d-tartarate	9	273
Di-*n*-butyl *d,l*-tartarate	353	271
3,4-Dicarboxybenzenesulfonamide	287	403
3,4-Dicarboxybenzenesulfonic acid	136	376
3,4-Dicarboxybenzenesulfonyl chloride	259	389
Dichloroacetaldehyde	15	144
Dichloroacetamide	106	233
Dichloroacetanilide	184	235
2,4-Dichloroacetanilide	268	238
2,5-Dichloroacetanilide	231	237
Dichloroacetic acid	25	190
" "	11	429
Dichloroacetic anhydride	12	223
1,1-Dichloroacetone	19	161
1,3-Dichloroacetone	41	173
Dichloroacetonitrile	12	345
2,4-Dichloroacetophenone	33	173
2,5-Dichloroacetophenone	209	168
3,5-Dichloroacetophenone	4	172
Dichloroacetyl chloride	11	212
Dichloroacetyl iodide	1	222
2,4-Dichloroaniline	85	305
" "	37	436
2,5-Dichloroaniline	49	304
" "	32	436
9,10-Dichloroanthracene	34	72
meso-Dichloroanthracene	34	72
9,10-Dichloroanthracene-2-sulfonamide	457	409
9,10-Dichloroanthracene-2-sulfonanilide	428	408
9,10-Dichloroanthracene-2-sulfonic acid	212	378
9,10-Dichloroanthracene-2-sulfonyl chloride	275	390
2,3-Dichlorobenzaldehyde	55	155
2,4-Dichlorobenzaldehyde	63	156
2,5-Dichlorobenzaldehyde	45	155
2,6-Dichlorobenzaldehyde	58	156
3,4-Dichlorobenzaldehyde	19	154
3,5-Dichlorobenzaldehyde	54	155
2,5-Dichlorobenzamide	297	239
1,2-Dichlorobenzene	7	70
1,3-Dichlorobenzene	5	70
1,4-Dichlorobenzene	12	71
2,5-Dichlorobenzene-1,3-disulfonamide	348	405
4,6-Dichlorobenzene-1,3-disulfonamide	455	409
2,5-Dichlorobenzene-1,3-disulfonic acid	161	376
4,6-Dichlorobenzene-1,3-disulfonic acid	210	378
2,5-Dichlorobenzene-1,3-disulfonyl chloride	176	386
4,6-Dichlorobenzene-1,3-disulfonyl chloride	194	387
2,4-Dichlorobenzenesulfonamide	236	401
2,5-Dichlorobenzenesulfonamide	233	400
3,4-Dichlorobenzenesulfonamide	99	395
2,5-Dichlorobenzenesulfonanilide	165	398
2,4-Dichlorobenzenesulfonic acid	104	374
2,5-Dichlorobenzenesulfonic acid	100	374
3,4-Dichlorobenzenesulfonic acid	34	372
2,4-Dichlorobenzensulfonyl chloride	48	382
2,5-Dichlorobenzenesulfonyl chloride	22	381
3,4-Dichlorobenzenesulfonyl chloride	9	381
2,4-Dichlorobenzoic acid	117	430
2,5-Dichlorobenzoic acid	230	202
3,4-Dichlorobenzoic acid	322	206
2,2′-Dichlorobenzoin	63	174
2,4-Dichlorobenzonitrile	73	360
2,5-Dichlorobenzonitrile	175	365
3,4-Dichlorobenzonitrile	92	361
3,5-Dichlorobenzonitrile	75	360
4,4′-Dichlorobenzophenone	177	178
3,4-Dichlorobenzotrichloride	1	64
2,6-Dichlorobenzyl chloride	4	57
Di-(4-chlorobenzyl)sulfide	14	425
2,2′-Dichlorobiphenyl	15	71
4,4′-Dichlorobiphenyl	30	71
1,2-Dichlorobutane	15	63
2,3-Dichloro-*n*-butyraldehyde	4	150
2,4-Dichloro-*m*-cresol	7	96
2,6-Dichloro-*m*-cresol	61	99
2,6-Dichloro-*p*-cresol	23	97
4,6-Dichloro-*m*-cresol	99	101
2,5-Dichloro-3,6-dihydroxy-1,4-benzoquinone	51	184
1,5-Dichloro-4,8-dihydroxynaphthalene	495	122
2,3-Dichloro-1,4-dihydroxynaphthalene	321	112
2,5-Dichloro-1,4-dimethylbenzene	21	71
3,6-Dichloro-2,5-dimethylbenzenesulfonamide	179	398
4,6-Dichloro-2,5-dimethylbenzenesulfonamide	130	396
3,6-Dichloro-2,5-dimethylbenzenesulfonanilide	202	399
4,6-Dichloro-2,5-dimethylbenzenesulfonanilide	213	400
3,6-Dichloro-2,5-dimethylbenzenesulfonic acid	71	373
4,6-Dichloro-2,5-dimethylbenzenesulfonic acid	51	372
3,6-Dichloro-2,5-dimethylbenzenesulfonyl chloride	82	383
4,6-Dichloro-2,5-dimethylbenzenesulfonyl chloride	98	384
4,4′-Dichlorodiphenylmethane	13	71
1,1-Dichloroethane	3	63
1,2-Dichloroethane	9	63
cis-1,2-Dichloroethylene	4	63
trans-1,2-Dichloroethylene	2	63
2,2′-Dichloroethyl ether	42	133
β,β′-Dichloroethyl ether	69	134
Di-2-chloroethyl sulfide	52	421
2,6-Dichlorohydroquinone	27	434
2,4-Dichloro-3-hydroxybenzaldehyde	114	159
2,6-Dichloro-3-hydroxybenzaldehyde	113	159
3,5-Dichloro-2-hydroxybenzaldehyde	81	157
3,5-Dichloro-4-hydroxybenzaldehyde	119	159
4,6-Dichloro-3-hydroxybenzaldehyde	109	159
3,5-Dichloro-2-hydroxybenzonitrile	184	365
3,5-Dichloro-4-hydroxybenzonitrile	192	365
Dichloromethane	1	63
2,3-Dichloro-4-methylbenzenesulfonamide	405	407
2,6-Dichloro-3-methylbenzenesulfonamide	265	402

	Compound No.	Page No.
2,6-Dichloro-4-methylbenzenesulfonamide	141	397
3,4-Dichloro-2-methylbenzenesulfonamide	383	407
3,5-Dichloro-2-methylbenzenesulfonamide	253	401
3,5-Dichloro-4-methylbenzenesulfonamide	277	402
4,5-Dichloro-3-methylbenzenesulfonamide	243	401
4,6-Dichloro-2-methylbenzenesulfonamide	190	399
2,3-Dichloro-4-methylbenzenesulfonic acid	185	377
2,3-Dichloro-6-methylbenzenesulfonic acid	115	375
2,6-Dichloro-3-methylbenzenesulfonic acid	125	375
2,6-Dichloro-4-methylbenzenesulfonic acid	56	372
3,4-Dichloro-2-methylbenzenesulfonic acid	174	377
3,5-Dichloro-2-methylbenzenesulfonic acid	118	375
3,5-Dichloro-4-methylbenzenesulfonic acid	133	375
4,6-Dichloro-2-methylbenzenesulfonic acid	79	373
2,3-Dichloro-4-methylbenzenesulfonyl chloride	26	381
2,6-Dichloro-3-methylbenzenesulfonyl chloride	7	381
2,6-Dichloro-4-methylbenzenesulfonyl chloride	52	382
3,4-Dichloro-2-methylbenzenesulfonyl chloride	39	382
3,5-Dichloro-2-methylbenzenesulfonyl chloride	46	382
3,5-Dichloro-4-methylbenzenesulfonyl chloride	77	383
4,5-Dichloro-3-methylbenzenesulfonyl chloride	107	384
4,6-Dichloro-2-methylbenzenesulfonyl chloride	27	381
2',4-Dichloro-3-methylphenol	7	96
2,6-Dichloro-3-methylphenol	61	99
2,6-Dichloro-4-methylphenol	23	97
4,6-Dichloro-3-methylphenol	99	101
(2,4-Dichloro-6-methylphenoxy)acetic acid	162	430
1,3-Dichloro-2-methylpropane	17	63
Dichloromethyl sulfide	31	420
Dichloromethyl sulfide	43	421
1,2-Dichloronaphthalene	4	71
1,3-Dichloronaphthalene	16	71
1,4-Dichloronaphthalene	20	71
1,5-Dichloronaphthalene	26	71
1,6-Dichloronaphthalene	9	71
1,7-Dichloronaphthalene	18	71
1,8-Dichloronaphthalene	25	71
2,6-Dichloronaphthalene	28	71
2,7-Dichloronaphthalene	27	71
1,5-Dichloronaphthalene-2-sulfonamide	458	409
3,6-Dichloronaphthalene-2-sulfonamide	356	405
3,7-Dichloronaphthalene-1-sulfonamide	448	409
4,5-Dichloronaphthalene-1-sulfonamide	389	407
4,5-Dichloronaphthalene-2-sulfonamide	306	403
4,6-Dichloronaphthalene-1-sulfonamide	375	406
4,6-Dichloronaphthalene-2-sulfonamide	354	405
4,7-Dichloronaphthalene-1-sulfonamide	352	405
4,7-Dichloronaphthalene-2-sulfonamide	300	403
4,8-Dichloronaphthalene-2-sulfonamide	322	404
5,6-Dichloronaphthalene-1-sulfonamide	368	406
5,6-Dichloronaphthalene-2-sulfonamide	282	402
5,7-Dichloronaphthalene-1-sulfonamide	452	409
5,8-Dichloronaphthalene-2-sulfonamide	422	408
6,7-Dichloronaphthalene-1-sulfonamide	447	409
6,8-Dichloronaphthalene-2-sulfonamide	387	407
7,8-Dichloronaphthalene-1-sulfonamide	364	406
7,8-Dichloronaphthalene-2-sulfonamide	380	406
1,5-Dichloronaphthalene-1-sulfonyl chloride	201	387
3,6-Dichloronaphthalene-2-sulfonyl chloride	257	389
3,7-Dichloronaphthalene-1-sulfonyl chloride	214	388
4,5-Dichloronaphthalene-1-sulfonyl chloride	180	387
4,5-Dichloronaphthalene-2-sulfonyl chloride	246	389
4,6-Dichloronaphthalene-1-sulfonyl chloride	183	387
4,6-Dichloronaphthalene-2-sulfonyl chloride	208	388
4,7-Dichloronaphthalene-1-sulfonyl chloride	240	389
4,7-Dichloronaphthalene-2-sulfonyl chloride	244	389
4,8-Dichloronaphthalene-2-sulfonyl chloride	229	388
5,6-Dichloronaphthalene-1-sulfonyl chloride	159	386
5,6-Dichloronaphthalene-2-sulfonyl chloride	258	389
5,7-Dichloronaphthalene-1-sulfonyl chloride	238	388
5,8-Dichloronaphthalene-2-sulfonyl chloride	213	388
6,7-Dichloronaphthalene-1-sulfonyl chloride	232	388
6,8-Dichloronaphthalene-2-sulfonyl chloride	190	387
7,8-Dichloronaphthalene-1-sulfonyl chloride	219	388
7,8-Dichloronaphthalene-2-sulfonyl chloride	196	387
2,4-Dichloro-1-naphthol	219	107
1,4-Dichloro-2-naphthol	288	111
2,4-Dichloro-6-nitroaniline	4	436
2,6-Dichloro-4-nitroaniline	5	436
2,4-Dichloro-1-nitrobenzene	6	337
2,5-Dichloro-1-nitrobenzene	24	337
2,4-Dichloro-5-nitrophenol	209	107
2,4-Dichloro-6-nitrophenol	283	111
2,3-Dichlorophenol	57	99
2,4-Dichlorophenol	33	98
"	32	434
2,5-Dichlorophenol	62	99
2,6-Dichlorophenol	81	100
3,5-Dichlorophenol	85	101
(2,4-Dichlorophenoxy)acetic acid	224	431
2,5-Dichlorophenyl methyl sulfide	22	425
Di-(4-chlorophenyl)sulfide	56	426
3,5-Dichlorophthalic anhydride	37	225
3,6-Dichlorophthalic anhydride	75	226
4,5-Dichlorophthalic anhydride	72	226
1,2-Dichloropropane	11	63
1,3-Dichloropropane	16	63
2,2-Dichloropropane	6	63
1,3-Dichloro-2-propanol	72	83
2,3-Dichloropropanol	85	84
1,1-Dichloro-2-propanone	19	161
1,3-Dichloro-2-propanone	41	173
d,l-2,3-Dichloropropionaldehyde	3	152
3,5-Dichlorosalicylaldehyde	81	157
d,l-2,3-Dichlorosuccinic acid	18	429
meso-2,3-Dichlorosuccinic acid	21	429
2,3-Dichlorotoluene	23	70
2,4-Dichlorotoluene	20	70
2,5-Dichlorotoluene	19	70
2,6-Dichlorotoluene	18	70
3,4-Dichlorotoluene	24	70
3,5-Dichlorotoluene	21	70
α,α-Dichloro-*m*-tolunitrile	99	353
α,α-Dichloro-*o*-tolunitrile	94	353
α,α-Dichloro-*p*-tolunitrile	100	353
2,6-Dichloro-3,4,5-tribromophenol	524	123
2,5-Dichloro-*p*-xylene	21	71
Dicinnamalacetone	173	178
Di-*m*-cresyl carbonate	61	276
Di-*o*-cresyl carbonate	85	277
Di-*p*-cresyl carbonate	145	280
Di-*m*-cresyl oxalate	138	280
Di-*o*-cresyl oxalate	128	279
Di-*p*-cresyl oxalate	164	281
Di-*p*-cresyl succinate	153	281
Dicrotyl sulfide	40	421
m-Dicyanobenzene	204	366
o-Dicyanobenzene	188	365
p-Dicyanobenzene	229	367
4,4'-Dicyanobiphenyl	231	367
1,1-Dicyanobutane	69	350
1,4-Dicyanobutane	104	354
4,4-Dicyano-1-butene	72	350
cis-1,4-Dicyanocyclohexane	76	360
trans-1,4-Dicyanocyclohexane	185	365
Dicyanodimethylamine	94	361
4,4'-Dicyanodiphenylmethane	211	366
1,12-Dicyanododecane	17	356
1,1-Dicyanoethane	11	357
cis-1,2-Dicyanoethylene	19	357
1,11-Dicyanohendecane	14	355
1,7-Dicyanoheptane	12	355

	Compound No.	Page No.
4,4-Dicyanoheptane	23	358
" "	51	359
1,6-Dicyanohexane	20	356
1,1-Dicyano-3-methylbutane	75	351
Dicyanomethyl ethyl amine	9	436
1,3-Dicyano-2-methylpropane	97	353
1,2-Dicyanonaphthalene	220	367
1,3-Dicyanonaphthalene	216	367
1,4-Dicyanonaphthalene	224	367
1,5-Dicyanonaphthalene	226	367
1,6-Dicyanonaphthalene	225	367
1,7-Dicyanonaphthalene	210	366
1,8-Dicyanonaphthalene	230	367
2,3-Dicyanonaphthalene	234	368
2,6-Dicyanonaphthalene	236	368
2,7-Dicyanonaphthalene	235	368
1,8-Dicyanonoctane	19	356
3,3-Dicyanopentane	39	358
1,1-Dicyanopropane	67	350
1,2-Dicyanopropane	89	352
1,3-Dicyanopropane	102	353
2,2-Dicyanopropane	20	357
2,3-Dicyanopyridine	215	367
2,6-Dicyanopyridine	167	364
2,3-Dicyanothiophene	29	347
1,11-Dicyanoundecane	14	355
N,N-Dicyclohexylacetamide	130	234
Dicyclohexylamine	171	300
Dicyclohexyl oxalate	55	275
Dicyclohexyl phthalate	90	277
Dicyclopentyl ketone	43	169
Di-*n*-decyl ketone	84	174
Didecyl sulfide	5	425
Di-dichloromethyl sulfide	43	421
Di-(2,4-dinitrophenyl)sulfide	76	427
Di-(2-diphenoxyethyl)sulfide	26	420
Di-*n*-dodecylamine	448	439
Didodecyl ether	13	137
Didodecyl sulfide	12	425
Diethanolamine	10	88
"	180	301
sym-Diethoxyacetone	5	169
3,4-Diethoxybenzaldehyde	92	149
1,2-Diethoxybenzene	24	138
1,4-Diethoxybenzene	43	139
Di-(β-ethoxyethyl)carbonate	279	265
Di-(β-ethoxyethyl)phthalate	32	274
1,3-Diethoxy-2-propanone	5	169
Diethylacetaldehyde	29	145
Diethylacetic acid	27	191
Diethyl acetonedicarboxylate	287	266
Diethylacetonitrile	33	347
Diethylacetyl chloride	27	212
Diethylacetylene	22	28
Diethyl adipate	270	265
Diethylamine	11	295
"	454	439
4-(Diethylamino)benzaldehyde	17	153
" "	16	323
β-Diethylaminoethyl alcohol	29	319
2-Diethylaminoethyl alcohol	29	319
2-(Diethylamino)ethylamine	363	439
1-Diethylaminoisopropyl alcohol	37	319
1-(N,N-Diethylamino)naphthalene	182	301
2-(N,N-Diethylamino)naphthalene	189	301
3-(Diethylamino)phenol	116	102
3-Diethylaminopropyl alcohol	49	320
N,N-Diethylaniline	67	320
" "	268	438
Diethyl azelate	339	270
N,2-Diethylaziridine	293	438

	Compound No.	Page No.
1,2-Diethylbenzene	28	36
1,3-Diethylbenzene	23	36
1,4-Diethylbenzene	29	36
N,N-Diethylbenzylamine	326	438
Diethyl benzyl malonate	345	270
N,N-Diethylbenzylsulfonamide	2	392
Diethyl bromomalonate	252	263
Diethyl butylmalonate	254	264
Diethyl *d*-camphorate	334	269
Diethyl carbinol	13	80
Diethylcarbinyl acetate	64	252
Diethyl carbonate	55	252
Diethyl citraconate	241	263
Diethylcyanoacetic acid	80	360
Diethylene glycol	126	86
Diethylene glycol diacetate	274	265
Diethylene glycol diethyl ether	73	134
Diethylene glycol dimethyl ether	58	133
Diethylene glycol mono-*n*-butyl ether	118	86
Diethylene glycol mono-*n*-butyl ether acetate	280	265
Diethylene glycol monoethyl ether	100	85
Diethylene glycol monoethyl ether acetate	211	261
Diethylene glycol monomethyl ether	96	85
" "	77	135
Diethyl ether	4	131
sym-Diethylethylenediamine	61	297
unsym-Diethylethylenediamine	56	296
N,N-Diethylformamide	2	230
Diethyl fumarate	212	261
Diethyl glutarate	247	263
3,3-Diethylglutaric acid	222	431
3,3-Diethylhexane	217	6
3,4-Diethylhexane	190	6
Diethyl (2-hydroxyethyl) amine	350	438
Diethyl isophthalate	333	269
Diethyl itaconate	235	262
Diethyl ketone	9	161
Diethyl *l*-malate	291	266
Diethyl maleate	219	262
Diethyl malonate	173	258
Diethylmalonic acid	167	199
"	63	429
Diethylmalonic acid diamide	471	245
Diethylmalonic acid monoamide	271	238
Diethylmalononitrile	39	358
Diethyl malonyl dichloride	42	213
Diethyl mesaconate	236	263
Diethyl *meso*-tartrate	75	276
Diethyl methylacetic acid	32	191
Diethyl methyl amine	395	439
N,N-Diethyl-2-methylaniline	60	320
N,N-Diethyl-4-methylaniline	69	320
1,2-Diethyl-3-methylbenzene	85	38
1,2-Diethyl-4-methylbenzene	74	38
2,4-Diethyl-1-methylbenzene	80	38
2,5-Diethyl-1-methylbenzene	87	38
2,6-Diethyl-1-methylbenzene	90	38
3,5-Diethyl-1-methylbenzene	66	38
Diethyl methylmalonate	167	258
Diethyl mucate	166	281
Diethyl naphthalate	83	277
3,7-Diethylnaphthalene-1-sulfonamide	333	405
3,7-Diethylnaphthalene-1-sulfonyl chloride	158	386
Diethyl 3-nitrophthalate	53	275
Diethyl 4-nitrophthalate	36	274
Diethyl oxalate	145	257
3,3-Diethylpentane	133	5
2,4-Diethylphenol	21	97
β,β-Diethylphenylhydrazine	5	322
Diethyl phthalate	336	270
Diethyl pimelate	296	266

	Compound No.	Page No.
1,3-Diethyl-2-propylbenzene	89	38
2,4-Diethylpyridine	48	320
2,6-Diethylpyridine	2	322
3,4-Diethylpyridine	63	320
Diethyl sebacate	349	271
Diethyl suberate	330	269
Diethyl succinate	210	261
2,2-Diethylsuccinic acid	256	431
d,l-2,3-Diethylsuccinic acid	206	430
meso-2,3-Diethylsuccinic acid	223	431
Diethyl sulfate	188	259
Diethyl sulfide	6	420
Diethyl *d*-tartarate	4	273
Diethyl-*d,l*-tartronate	218	261
Diethyl terephthalate	49	275
2,5-Diethylthiophene	47	424
3,4-Diethylthiophene	50	424
2,4-Diethyltoluene	80	38
2,5-Diethyltoluene	87	38
2,6-Diethyltoluene	90	38
3,5-Diethyltoluene	66	38
N,N-Diethyltoluene-4-sulfonamide	9	392
N,N-Diethyl-*o*-toluidine	60	320
N,N-Diethyl-*p*-toluidine	69	320
Di-2-fluorenylmethane	186	51
Difluoroacetamide	8	231
Difluoroacetic acid	4	190
"	9	429
3,3-Difluoroacrylic acid	169	430
1,2-Difluorobenzene	4	69
1,3-Difluorobenzene	1	69
1,4-Difluorobenzene	3	69
1,3-Difluoropropane	2	62
Difurfuralacetone	72	174
Diglycolic acid	223	202
Diguaiacol carbonate	126	279
Di-*n*-hendecyl ketone	91	175
Di-*n*-heptadecyl ketone	117	176
Di-*n*-heptylamine	1	303
Di-*n*-heptyl ether	103	136
Di-*n*-heptyl ketone	36	173
Di-*n*-heptyl sulfide	62	422
Dihexadecyl sulfide	33	425
Di-*n*-hexylamine	450	439
Di-*n*-hexyl ether	95	135
Di-*n*-hexyl ketone	114	177
Dihydroacetic acid monoanilide	178	235
Dihydropyran	27	132
cis-1,2-Dihydroxyacenaphthene	527	124
5,6-Dihydroxyacenaphthene	497	122
1,3-Dihydroxyacetone	42	89
" "	94	175
" "	1	329
2,3-Dihydroxyacetophenone	188	106
" "	123	176
2,4-Dihydroxyacetophenone	362	115
" "	175	178
2,5-Dihydroxyacetophenone	512	123
" "	197	179
3,4-Dihydroxyacetophenone	266	110
" "	148	177
3,5-Dihydroxyacetophenone	368	115
" "	176	178
2,3-Dihydroxyacridine	564	126
2,8-Dihydroxyacridine	588	127
3,7-Dihydroxyacridine	590	127
3,9-Dihydroxyacridine	487	122
1,3-Dihydroxyacridone	592	128
3,5-Dihydroxyaniline	361	114
" "	328	313
1,2-Dihydroxyanthracene	408	117
1,5-Dihydroxyanthracene	578	127
1,8-Dihydroxyanthracene	556	126
2,3-Dihydroxyanthracene	582	127
2,6-Dihydroxyanthracene	586	127
2,7-Dihydroxyanthracene	581	127
9,10-Dihydroxyanthracene	468	120
1,2-Dihydroxy-9,10-anthraquinone	54	184
1,4-Dihydroxy-9,10-anthraquinone	33	183
1,5-Dihydroxy-9,10-anthraquinone	50	184
1,7-Dihydroxyanthrone	567	126
2,2′-Dihydroxyazobenzene	453	120
2,4-Dihydroxyazobenzene	449	119
3,3′-Dihydroxyazobenzene	521	123
3,4-Dihydroxyazobenzene	433	118
4,4′-Dihydroxyazobenzene	537	124
2,2′-Dihydroxyazoxybenzene	391	116
3,3′-Dihydroxyazoxybenzene	474	121
4,4′-Dihydroxyazoxybenzene	552	125
2,3-Dihydroxybenzaldehyde	94	158
2,4-Dihydroxybenzaldehyde	110	159
3,4-Dihydroxybenzaldehyde	117	159
3,5-Dihydroxybenzaldehyde	118	159
2,4-Dihydroxybenzanilide	208	236
1,2-Dihydroxybenzene	207	107
" "	75	434
1,3-Dihydroxybenzene	226	108
" "	74	434
1,4-Dihydroxybenzene	452	119
" "	117	435
2,4-Dihydroxybenzoic acid	530	124
" " "	338	207
" " "	179	430
3,4-Dihydroxybenzoic acid	319	206
2,4-Dihydroxybenzophenone	352	114
2,4′-Dihydroxybenzophenone	378	115
3,3′-Dihydroxybenzophenone	446	119
3,4-Dihydroxybenzophenone	355	114
4,4′-Dihydroxybenzophenone	526	124
1,1′-Dihydroxy-2,2′-binaphthyl	546	125
2,2′-Dihydroxy-1,1′-binaphthyl	543	125
4,4′-Dihydroxy-1,1′-binaphthyl	587	127
2,2′-Dihydroxybiphenyl	227	108
2,4′-Dihydroxybiphenyl	418	118
3,3′-Dihydroxybiphenyl	290	111
3,4-Dihydroxybiphenyl	357	114
4,4′-Dihydroxybiphenyl	579	127
2,4-Dihydroxy-*n*-caprylbenzene	62	174
2,2′-Dihydroxychalcone	404	117
2,4′-Dihydroxychalcone	359	114
β,β′-Dihydroxydiethylamine	10	88
β,β′-Dihydroxydiethyl ether	126	86
2,2′-Dihydroxy-3,3′-dimethylbiphenyl	237	108
2,2′-Dihydroxy-4,4′-dimethylbiphenyl	271	110
2,2′-Dihydroxy-5,5′-dimethylbiphenyl	386	116
2,2′-Dihydroxy-6,6′-dimethylbiphenyl	423	118
4,4′-Dihydroxy-2,2′-dimethylbiphenyl	240	108
4,4′-Dihydroxy-3,3′-dimethylbiphenyl	406	117
2,2′-Dihydroxy-1,1′-dinaphthylmethane	504	123
1,2-Dihydroxy-3,5-dinitrobenzene	422	118
2,4′-Dihydroxydiphenylmethane	256	109
3,3′-Dihydroxydiphenylmethane	200	106
4,4′-Dihydroxydiphenylmethane	398	116
erythro-2,3-Dihydroxy-1,4-dithiobutane	26	417
threa-2,3-Dihydroxy-1,4-dithiobutane	10	416
2,5-Dihydroxy-3-*n*-dodecyl-1,4-benzoquinone	18	182
Di-(2-hydroxyethyl)amine	180	301
2,2′-Dihydroxyhydrazobenzene	332	313
1,4-Dihydroxyisoquinoline	573	126
1,3-Dihydroxy-4-methyl-9,10-anthraquinone	45	184
1,8-Dihydroxy-2-methyl-9,10-anthraquinone	23	182
1,3-Dihydroxy-2-methylbenzene	265	110

	Compound No.	Page No.
1,3-Dihydroxy-2-methylnaphthalene	339	113
1,4-Dihydroxy-2-methylnaphthalene	447	119
3,5-Dihydroxy-2-methyl-1,4-naphthoquinone	25	182
2,7-Dihydroxy-4-methylquinoline	585	127
1,2-Dihydroxynaphthalene	64	99
1,3-Dihydroxynaphthalene	291	111
1,4-Dihydroxynaphthalene	461	120
" "	71	434
1,5-Dihydroxynaphthalene	575	127
1,6-Dihydroxynaphthalene	330	113
1,7-Dihydroxynaphthalene	462	120
1,8-Dihydroxynaphthalene	343	114
2,3-Dihydroxynaphthalene	407	117
2,6-Dihydroxynaphthalene	535	124
2,7-Dihydroxynaphthalene	484	121
2,4-Dihydroxy-5-nitroaniline	360	314
2,5-Dihydroxy-4-nitroaniline	346	314
1,2-Dihydroxy-3-nitrobenzene	148	104
1,3-Dihydroxy-2-nitrobenzene	143	103
1,3-Dihydroxy-4-nitrobenzene	280	110
1,2-Dihydroxyphenanthrene	463	120
1,9-Dihydroxyphenanthrene	477	121
2,5-Dihydroxyphenanthrene	467	120
2,6-Dihydroxyphenanthrene	561	126
2,7-Dihydroxyphenanthrene	576	127
2,8-Dihydroxyphenanthrene	513	123
3,4-Dihydroxyphenanthrene	345	114
3,6-Dihydroxyphenanthrene	548	125
3,8-Dihydroxyphenanthrene	570	126
9,10-Dihydroxyphenanthrene	371	115
(3,4-Dihydroxyphenyl)alanine	75	429
1,5-Di-(2-hydroxyphenyl)-1,4-pentadiene-3-one	441	119
Di-(2-hydroxyphenyl)sulfide	69	426
Di-(3-hydroxyphenyl)sulfide	67	426
Di-(4-hydroxyphenyl)sulfide	72	427
1,3-Dihydroxy-2-propanone	42	89
2,3-Dihydroxypropylamine	179	300
1,2-Dihydroxy-3-propylbenzene	97	101
1,2-Dihydroxy-4-propylbenzene	63	99
1,3-Dihydroxy-5-propylbenzene	135	103
1,4-Dihydroxy-2-propylbenzene	159	104
1,6-Dihydroxypyrene	568	126
3,5-Dihydroxypyrene	547	125
3,8-Dihydroxypyrene	591	127
2,5-Dihydroxypyridine	572	126
2,3-Dihydroxyquinoline	574	126
2,2′-Dihydroxystilbene	172	105
3,5-Dihydroxystilbene	392	116
4,4′-Dihydroxystilbene	583	127
α,4-Dihydroxytoluene	294	111
2,3-Dihydroxytoluene	84	101
2,5-Dihydroxytoluene	293	111
2,6-Dihydroxytoluene	265	110
3,4-Dihydroxytoluene	76	100
3,5-Dihydroxytoluene	217	107
1,3-Dihydroxy-2,4,6-tribromobenzene	234	108
4,4′-Dihydroxytriphenylmethane	411	117
2,6-Dihydroxy-*p*-xylene	419	118
3,6-Dihydroxy-*o*-xylene	549	125
4,5-Dihydroxy-*m*-xylene	102	101
4,6-Dihydroxy-*m*-xylene	295	111
2,4-Di-iodoaniline	184	308
1,3-Di-iodobenzene	3	76
1,4-Di-iodobenzene	6	76
2,4-Di-iodobenzenesulfonamide	391	407
3,4-Di-iodobenzenesulfonamide	379	406
2,4-Di-iodobenzenesulfonic acid	177	377
3,4-Di-iodobenzenesulfonic acid	171	377
2,4-Di-iodobenzenesulfonyl chloride	91	383
3,4-Di-iodobenzenesulfonyl chloride	100	384
1,2-Di-iodoethane	1	68
Di-iodomethane	1	67
2,4-Di-iodophenol	100	101
2,5-Di-iodophenol	191	106
2,6-Di-iodophenol	86	101
3,4-Di-iodophenol	133	103
3,5-Di-iodophenol	202	106
3,4-Di-iodophthalic anhydride	76	226
1,3-Di-iodopropane	2	67
DL-3,5-Di-iodotyrosine	52	429
L-3,5-Di-iodotyrosine	44	286
Di-isoamylamine	86	297
	440	439
Di-isoamyl carbonate	246	263
Di-isoamyl ether	64	134
Di-isoamyl oxalate	312	268
Di-isoamyl phthalate	357	271
Di-isobutylamine	52	296
" "	438	439
Di-isobutyl carbinol	63	83
Di-isobutyl carbonate	154	257
Di-isobutyl ether	46	133
Di-isobutyl ketone	101	164
Di-isobutyl oxalate	237	263
Di-isobutyl sulfide	37	421
Di-isobutyl *d*-tartarate	106	278
Di-isobutyl *d,l*-tartarate	80	277
Di-isobutyryl	63	163
Di-isopropylamine	23	295
" "	460	439
N,N-Di-isopropylaniline	277	438
1,2-Di-isopropylbenzene	75	38
1,3-Di-isopropylbenzene	73	38
1,4-Di-isopropylbenzene	95	38
Di-isopropyl carbonate	90	254
Di-isopropyl ether	18	131
Di-isopropylideneacetone	8	172
Di-isopropyl ketone	20	161
2,4-Di-isopropyl-1-methylbenzene	122	39
2,6-Di-isopropyl-1-methylbenzene	126	39
Di-isopropyl oxalate	160	258
Di-isopropyl phthalate	347	270
Di-isopropyl sulfide	17	420
Di-isopropyl *d*-tartarate	323	268
Di-isopropyl *d,l*-tartarate	34	274
2,4-Di-isopropyltoluene	122	39
2,6-Di-isopropyltoluene	126	39
2,4-Diketo-*n*-valeric acid	117	197
Dilauryl ether	13	137
Dimedone	181	178
1,4-Dimercaptobenzene	31	417
sym-Dimethoxyacetone	19	169
3,4-Dimethoxyacetophenone	55	174
3,4-Dimethoxyaniline	148	307
3,5-Dimethoxyaniline	114	436
2,3-Dimethoxybenzaldehyde	32	154
2,4-Dimethoxybenzaldehyde	59	156
3,4-Dimethoxybenzaldehyde	23	134
1,2-Dimethoxybenzene	2	137
1,3-Dimethoxybenzene	89	135
1,4-Dimethoxybenzene	34	138
2,4-Dimethoxybenzenesulfonamide	186	399
2,4-Dimethoxybenzenesulfonyl chloride	78	383
4,4′-Dimethoxybenzil	56	140
" "	161	177
3,4-Dimethoxybenzoic acid	281	204
4,4′-Dimethoxybenzoin	54	139
" "	146	177
3,4-Dimethoxybenzyl alcohol	132	86
2,3-Dimethoxybenzylamine	324	438
3,4-Dimethoxybenzylamine	323	438
Di-(β-methoxyethyl)carbonate	245	263

	Compound No.	Page No.
3,5-Dimethoxy-4-hydroxybenzoic acid	515	123
6,7-Dimethoxy-8-hydroxy-1,2,3,4-tetrahydroisoquinoline	58	140
2,5-Dimethoxy-3,4-methylenedioxybenzoic acid	273	204
2,5-Dimethoxy-3,4-methylenedioxybenzonitrile	182	365
(3,4-Dimethoxyphenyl)acetic acid	352	432
Di-(2-methoxyphenyl)carbonate	126	279
Di-(2-methoxyphenyl)sulfide	43	426
Di-(4-methoxyphenyl)sulfide	19	425
1,3-Dimethoxy-2-propanone	19	169
3,5′-Dimethoxy-5,7,4′-trihydroxyflavonol	584	127
Dimethylethylacetaldehyde	23	145
2,3-Dimethylacetanilide	244	237
2,4-Dimethylacetanilide	234	237
2,5-Dimethylacetanilide	253	237
2,6-Dimethylacetanilide	366	241
3,5-Dimethylacetanilide	265	238
2,2-Dimethylacetoacetonitrile	39	348
2,4-Dimethylacetophenone	187	167
2,5-Dimethylacetophenone	193	167
3,4-Dimethylacetophenone	204	168
3,5-Dimethylacetophenone	198	167
Dimethyl acetylene	6	28
3,3-Dimethylacrylic acid	64	195
" " "	466	433
3,3-Dimethylacrylonitrile	30	347
Dimethyl adipate	3	272
1,1-Dimethylallene	22	12
1,3-Dimethylallene	31	13
Di-2-methylallyl sulfide	38	421
Dimethylamine	2	295
"	434	439
Dimethylaminoacetone	10	319
3-(Dimethylamino)aniline	181	301
4-Dimethylaminoazobenzene	74	324
2-Dimethylaminobenzaldehyde	74	321
3-Dimethylaminobenzaldehyde	6	322
4-Dimethylaminobenzaldehyde	64	156
"	44	323
4-Dimethylaminobenzoic acid	67	287
4-Dimethylaminobenzophenone	58	324
2-Dimethylaminodiethyl ether	9	319
2-(Dimethylamino)ethylamine	330	438
2-(Dimethylamino)ethyl alcohol	14	319
N,N-1-(Dimethylamino)naphthalene	101	321
" " "	180	437
2-(Dimethylamino)naphthalene	22	323
" "	164	437
3-(Dimethylamino)phenol	144	103
N,N-Dimethyl-3-aminophenol	51	324
4-(Dimethylamino)phenol	111	102
N,N-Dimethyl-4-aminophenol	46	323
4-Dimethylaminothiophenol	7	416
2-Dimethylamino-*m*-xylene	56	320
4-Dimethylamino-*m*-xylene	59	320
2-Dimethylamino-*p*-xylene	58	320
N,N-Dimethylaniline	52	320
" "	194	437
N,2-Dimethylaniline	103	298
"	167	437
N,3-Dimethylaniline	191	437
N,4-Dimethylaniline	109	298
"	214	437
2,3-Dimethylaniline	124	299
"	173	437
2,4-Dimethylaniline	117	298
"	182	437
2,5-Dimethylaniline	112	298
"	160	437
2,6-Dimethylaniline	115	298
"	120	436
3,4-Dimethylaniline	43	304
"	203	437
3,5-Dimethylaniline	121	299
"	184	437
1,3-Dimethylanthracene	83	46
1,4-Dimethylanthracene	64	45
1,5-Dimethylanthracene	140	48
9,10-Dimethylanthracene	175	50
Dimethyl azelate	2	272
2,2-Dimethylaziridine	301	438
cis-2,3-Dimethylaziridine	303	438
trans-2,3-Dimethylaziridine	302	438
1,2-Dimethylazulene	41	44
1,3-Dimethylazulene	30	44
4,8-Dimethylazulene	59	45
2,6-Dimethylbenzaldehyde	84	149
3,5-Dimethylbenzaldehyde	80	148
2,4-Dimethylbenzamide	374	242
3,4-Dimethylbenzamide	221	237
3,5-Dimethylbenzamide	235	237
3,4-Dimethylbenzanilide	131	234
2,6-Dimethyl-1,2-benzanthracene	164	50
3,9-Dimethyl-1,2-benzanthracene	96	47
4,9-Dimethyl-1,2-benzanthracene	66	45
4,10-Dimethyl-1,2-benzanthracene	117	47
5,6-Dimethyl-1,2-benzanthracene	177	50
5,8-Dimethyl-1,2-benzanthracene	135	48
5,10-Dimethyl-1,2-benzanthracene	173	50
6,7-Dimethyl-1,2-benzanthracene	171	50
8,10-Dimethyl-1,2-benzanthracene	146	49
9,10-Dimethyl-1,2-benzanthracene	126	48
2,5-Dimethylbenzene-1,3-disulfonamide	464	409
2,5-Dimethylbenzene-1,4-disulfonamide	470	410
4,5-Dimethylbenzene-1,3-disulfonamide	414	408
4,6-Dimethylbenzene-1,3-disulfonamide	431	408
2,5-Dimethylbenzene-1,3-disulfonanilide	210	399
2,5-Dimethylbenzene-1,4-disulfonanilide	367	406
4,5-Dimethylbenzene-1,3-disulfonanilide	312	404
4,6-Dimethylbenzene-1,3-disulfonanilide	299	403
2,5-Dimethylbenzene-1,3-disulfonic acid	217	378
4,5-Dimethylbenzene-1,3-disulfonic acid	189	378
4,6-Dimethylbenzene-1,3-disulfonic acid	197	378
2,5-Dimethylbenzene-1,3-disulfonyl chloride	97	384
2,5-Dimethylbenzene-1,4-disulfonyl chloride	253	389
4,5-Dimethylbenzene-1,3-disulfonyl chloride	94	383
4,6-Dimethylbenzene-1,3-disulfonyl chloride	210	388
2,3-Dimethylbenzenesulfonamide	189	399
2,4-Dimethylbenzenesulfonamide	94	395
2,5-Dimethylbenzenesulfonamide	125	396
2,6-Dimethylbenzenesulfonamide	50	393
3,4-Dimethylbenzenesulfonamide	111	396
3,5-Dimethylbenzenesulfonamide	87	395
2,4-Dimethylbenzenesulfonanilide	43	393
3,5-Dimethylbenzene sulfonanilide	57	394
2,3-Dimethylbenzene sulfonic acid	75	373
2,4-Dimethylbenzene sulfonic acid	32	372
2,5-Dimethylbenzene sulfonic acid	48	372
2,6-Dimethylbenzene sulfonic acid	13	371
3,4-Dimethylbenzene sulfonic acid	40	372
3,5-Dimethylbenzene sulfonic acid	28	371
2,3-Dimethylbenzenesulfonyl chloride	33	381
2,4-Dimethylbenzenesulfonyl chloride	15	381
2,5-Dimethylbenzenesulfonyl chloride	11	381
2,6-Dimethylbenzenesulfonyl chloride	23	381
3,4-Dimethylbenzenesulfonyl chloride	40	382
3,5-Dimethylbenzenesulfonyl chloride	126	385
4,4′-Dimethylbenzhydrol	38	89
4,4′-Dimethylbenzil	133	176
1,2-Dimethylbenzimidazole	71	324
1,2-Dimethylbenzimidazole	264	438
1,5-Dimethylbenzimidazole	60	324

	Compound No.	Page No.
2,3-Dimethylbenzoic acid	242	431
2,4-Dimethylbenzoic acid	169	200
" "	318	431
2,5-Dimethylbenzoic acid	179	200
" "	281	431
2,6-Dimethylbenzoic acid	185	430
3,4-Dimethylbenzoic acid	257	203
" "	370	432
3,5-Dimethylbenzoic acid	259	203
" "	344	432
2,6-Dimethylbenzonitrile	116	362
2,2′-Dimethylbenzophenone	86	174
4,4′-Dimethylbenzophenone	118	176
2,3-Dimethyl-1,4-benzoquinone	3	181
2,5-Dimethyl-1,4-benzoquinone	15	182
2,6-Dimethyl-1,4-benzoquinone	7	181
α,4-Dimethylbenzyl alcohol	110	85
N,N-Dimethylbenzylamine	306	438
2,4-Dimethylbenzylamine	119	298
3,5-Dimethylbenzylamine	123	299
Di-(4-methylbenzyl)sulfide	44	426
N,N-Dimethylbenzyl sulfonamide	33	393
7,7-Dimethylbicyclo(3,1,1)heptane	140	5
2,3-Dimethylbicyclo(2,1,1)hept-2-ene	250	20
6,6′-Dimethyl-2,2′-bipyridyl	53	324
2,3-Dimethyl-1,3-butadiene	52	13
2,2-Dimethylbutanamide	227	237
d,l-2,3-Dimethylbutanamide	228	237
3,3-Dimethylbutanamide	230	237
2,2-Dimethylbutananilide	81	233
d,l-2,3-Dimethylbutananilide	47	232
3,3-Dimethylbutananilide	229	237
2,2-Dimethylbutane	18	3
2,3-Dimethylbutane	20	3
3,3-Dimethylbutanesulfonamide	28	393
3,3-Dimethylbutane-1-sulfonyl chloride	28	381
2,2-Dimethylbutanoic acid	21	190
d,l-2,3-Dimethylbutanoic acid	24	190
3,3-Dimethylbutanoic acid	17	190
2,2-Dimethyl-1-butanol	31	81
2,3-Dimethyl-1-butanol	38	82
2,3-Dimethyl-2-butanol	17	80
3,3-Dimethyl-2-butanol	16	80
3,3-Dimethyl-2-butanone	12	161
2,3-Dimethyl-1-butene	34	13
2,3-Dimethyl-2-butene	60	14
3,3-Dimethyl-1-butene	25	12
Dimethyl *sec*-butyl amine	405	439
1,3-Dimethyl-5-*tert*-butylbenzene	83	38
Di-(3-methylbutyl)sulfide	50	421
3,3-Dimethyl-1-butyne	8	28
2,2-Dimethylbutyric acid	464	433
Dimethyl *d*-camphorate	308	267
2,6-Dimethylcarbazole	449	317
3,6-Dimethylcarbazol	444	317
Dimethylethylcarbinyl acetate	50	252
Dimethyl carbonate	18	250
3,5-Dimethylcatechol	102	101
1,4-Dimethylchrysene	144	49
2,8-Dimethylchrysene	192	51
6,12-Dimethylchrysene	194	51
Dimethyl citraconate	196	260
1,1-Dimethylcyclohexane	70	4
cis-1,2-Dimethylcyclohexane	86	4
trans-1,2-Dimethylcyclohexane	78	4
cis-1,3-Dimethylcyclohexane	71	4
trans-1,3-Dimethylcyclohexane	81	4
cis-1,4-Dimethylcyclohexane	80	4
trans-1,4-Dimethylcyclohexane	69	4
5,5-Dimethyl-1,3-cyclohexanedione	181	178
2,2-Dimethylcyclohexanol	77	84
cis-2,4-Dimethylcyclohexanol	74	84
trans-2,4-Dimethylcyclohexanol	71	83
cis-2,5-Dimethylcyclohexanol	70	83
trans-2,5-Dimethylcyclohexanol	76	84
2,6-Dimethylcyclohexanol	69	83
3,3-Dimethylcyclohexanol	88	84
3,4-Dimethylcyclohexanol	92	84
cis-3,5-Dimethylcyclohexanol	89	84
trans-3,5-Dimethylcyclohexanol	90	84
2,2-Dimethylcyclohexanone	109	164
2,3-Dimethylcyclohexanone	125	165
cis-2,4-Dimethylcyclohexanone	123	165
trans-2,4-Dimethylcyclohexanone	111	164
d-2,5-Dimethylcyclohexanone	116	164
d,l-2,5-Dimethylcyclohexanone	113	164
2,6-Dimethylcyclohexanone	118	165
3,3-Dimethylcyclohexanone	127	165
3,4-Dimethylcyclohexanone	141	165
cis-3,5-Dimethylcyclohexanone	136	165
trans-3,5-Dimethylcyclohexanone	131	165
4,4-Dimethylcyclohexanone	26	173
1,2-Dimethylcyclohexene	239	19
1,3-Dimethylcyclohexene	240	19
1,4-Dimethylcyclohexene	223	19
1,5-Dimethylcyclohexene	224	19
1,6-Dimethylcyclohexene	232	19
3,3-Dimethylcyclohexene	201	18
4,4-Dimethylcyclohexene	197	18
1,2-Dimethylcyclohexen-3-one	95	170
1,5-Dimethylcyclohexen-3-one	164	166
1,5-Dimethylcyclohexen-4-one	147	165
2,5-Dimethylcyclohexen-3-one	143	165
5,5-Dimethylcyclohexen-3-one	79	170
1,2-Dimethylcyclooctatetraene	11	25
1,1-Dimethylcyclopentane	32	3
cis-1,2-Dimethylcyclopentane	43	3
trans-1,2-Dimethylcyclopentane	38	3
cis-1,3-Dimethylcyclopentane	36	3
trans-1,3-Dimethylcyclopentane	35	3
3,3-Dimethylcyclopentanone	73	163
1,2-Dimethylcyclopentene	136	16
1,3-Dimethylcyclopentene	99	15
1,4-Dimethylcyclopentene	102	15
3,3-Dimethylcyclopentene	94	15
2,3-Dimethyl-2-cyclopentenone	100	170
1,1-Dimethylcyclopropane	9	3
cis-1,2-Dimethylcyclopropane	15	3
trans-1,2-Dimethylcyclopropane	11	3
cis-1,1-Dimethyl-2,3-cyclopropanedicarboxylic acid	81	429
trans-1,1-Dimethyl-2,3-cyclopropanedicarboxylic acid	255	431
1,10-Dimethyl-*cis*-decahydronaphthalene	255	7
1,10-Dimethyl-*trans*-decahydronaphthalene	252	7
1′,10-Dimethyl-1,2-dibenzanthracene	125	48
4,4′-Dimethyldibenzylamine	11	303
2,3-Dimethyl-1,4-dinitrobenzene	61	339
2,4-Dimethyl-1,3-dinitrobenzene	54	339
2,5-Dimethyl-1,3-dinitrobenzene	88	340
2,5-Dimethyl-1,4-dinitrobenzene	102	341
3,4-Dimethyl-1,2-dinitrobenzene	49	338
3,5-Dimethyl-1,2-dinitrobenzene	93	340
3,5-Dimethyl-1,4-dinitrobenzene	72	340
3,6-Dimethyl-1,2-dinitrobenzene	63	339
4,5-Dimethyl-1,2-dinitrobenzene	82	340
4,5-Dimethyl-1,3-dinitrobenzene	42	338
4,6-Dimethyl-1,3-dinitrobenzene	64	339
3,5-Dimethyl-2,4-dinitrophenol	249	109
Dimethylethyl acetic acid	21	190
Dimethyl ethyl amine	2	319
" "	372	439

	Compound No.	Page No.
1,2-Dimethyl-3-ethylbenzene	47	37
1,2-Dimethyl-4-ethylbenzene	39	36
1,3-Dimethyl-2-ethylbenzene	40	36
1,3-Dimethyl-4-ethylbenzene	37	36
1,3-Dimethyl-5-ethylbenzene	30	36
1,4-Dimethyl-2-ethylbenzene	33	33
3,3-Dimethyl-2-ethyl-1-butene	155	17
2,2-Dimethylethylene sulfide	4	423
2,2-Dimethyl-3-ethylhexane	172	5
2,2-Dimethyl-4-ethylhexane	134	5
2,3-Dimethyl-3-ethylhexane	231	6
2,3-Dimethyl-4-ethylhexane	203	6
2,4-Dimethyl-3-ethylhexane	199	6
2,4-Dimethyl-4-ethylhexane	171	5
2,5-Dimethyl-3-ethylhexane	167	5
3,3-Dimethyl-4-ethylhexane	208	6
3,4-Dimethyl-3-ethylhexane	233	7
2,2-Dimethyl-3-ethylpentane	97	4
2,3-Dimethyl-3-ethylpentane	122	5
2,4-Dimethyl-3-ethylpentane	104	4
2,6-Dimethyl-4-ethylpyridine	47	320
3,5-Dimethyl-2-ethylpyridine	55	320
1,7-Dimethylfluorene	111	47
N,N-Dimethylformamide	1	230
Dimethyl fumarate	135	280
2,5-Dimethylfuran	32	132
Dimethyl glutarate	206	260
3,3-Dimethylglutaric acid	238	431
Dimethylglycolic acid	80	196
2,6-Dimethyl-1,3-heptadiene	251	20
2,6-Dimethyl-1,5-heptadiene	254	20
2,6-Dimethyl-2,4-heptadiene	247	20
2,6-Dimethyl-2,5-heptadiene	279	21
3,5-Dimethyl-2,4-heptadiene	233	19
3,6-Dimethyl-2,4-heptadiene	259	20
2,2-Dimethylheptane	91	4
2,3-Dimethylheptane	117	4
2,4-Dimethylheptane	93	4
2,5-Dimethylheptane	100	4
2,6-Dimethylheptane	99	4
3,3-Dimethylheptane	106	4
3,4-Dimethylheptane	118	5
3,5-Dimethylheptane	101	4
4,4-Dimethylheptane	98	4
2,6-Dimethyl-4-heptanol	63	83
2,2-Dimethyl-3-heptanone	100	164
2,5-Dimethyl-4-heptanone	103	164
2,6-Dimethyl-4-heptanone	101	164
3,5-Dimethyl-4-heptanone	93	164
2,6-Dimethyl-2-heptene	225	19
2,3-Dimethyl-2-hepten-6-one	45	169
2,4-Dimethyl-2,4-hexadiene	184	18
2,5-Dimethyl-1,3-hexadiene	195	18
2,5-Dimethyl-1,5-hexadiene	203	18
2,5-Dimethyl-2,4-hexadiene	235	19
3,3-Dimethyl-1,5-hexadiene	121	16
3,4-Dimethyl-1,5-hexadiene	122	16
3,4-Dimethyl-2,4-hexadiene	228	19
3,5-Dimethylhexahydrobenzaldehyde	19	150
2,2-Dimethylhexane	47	3
2,3-Dimethylhexane	57	3
2,4-Dimethylhexane	50	3
2,5-Dimethylhexane	48	3
3,3-Dimethylhexane	53	3
3,4-Dimethylhexane	63	4
2,5-Dimethyl-3,4-hexanedione	63	163
2,2-Dimethylhexanoic acid	41	191
2,2-Dimethyl-3-hexanone	57	163
2,4-Dimethyl-3-hexanone	53	162
3,4-Dimethyl-2-hexanone	83	163
4,4-Dimethyl-3-hexanone	68	163
2,2-Dimethyl-*cis*-3-hexene	134	16
2,2-Dimethyl-*trans*-3-hexene	118	16
2,3-Dimethyl-1-hexene	161	17
2,3-Dimethyl-2-hexene	214	19
2,3-Dimethyl-3-hexene	182	18
2,4-Dimethyl-1-hexene	164	17
2,4-Dimethyl-2-hexene	162	17
2,4-Dimethyl-*cis*-3-hexene	154	17
2,4-Dimethyl-*trans*-3-hexene	147	17
2,5-Dimethyl-1-hexene	165	17
2,5-Dimethyl-2-hexene	172	17
2,5-Dimethyl-3-hexene	123	16
3,3-Dimethyl-1-hexene	130	16
3,4-Dimethyl-1-hexene	167	17
3,4-Dimethyl-2-hexene	192	18
3,4-Dimethyl-*trans*-3-hexene	215	19
3,5-Dimethyl-1-hexene	129	16
3,5-Dimethyl-2-hexene	169	17
4,4-Dimethyl-1-hexene	144	17
4,4-Dimethyl-2-hexene	138	16
4,5-Dimethyl-1-hexene	152	17
4,5-Dimethyl-2-hexene	157	17
5,5-Dimethyl-1-hexene	124	16
5,5-Dimethyl-*cis*-2-hexene	140	16
5,5-Dimethyl-*trans*-2-hexene	131	16
3,4-Dimethyl-3-hexen-2-one	84	163
4,5-Dimethyl-4-hexen-3-one	99	164
4,5-Dimethyl-5-hexen-3-one	92	164
5,5-Dimethyl-3-hexen-2-one	55	170
sym-Dimethylhydrazine	21	295
unsym-Dimethylhydrazine	14	295
2,3-Dimethylhydroquinone	549	125
2,5-Dimethylhydroquinone	540	124
2,6-Dimethylhydroquinone	377	115
N,N-Dimethyl-3-hydroxyaniline	51	324
N,N-Dimethyl-4-hydroxyaniline	46	323
2,4-Dimethyl-6-hydroxyaniline	366	314
2,5-Dimethyl-4-hydroxyaniline	454	317
2,6-Dimethyl-4-hydroxyaniline	393	315
3,5-Dimethyl-2-hydroxyaniline	301	312
3,5-Dimethyl-4-hydroxyaniline	310	312
4,5-Dimethyl-2-hydroxyaniline	382	315
4,5′-Dimethyl-2-hydroxyazobenzene	235	108
2,6-Dimethyl-4-hydroxybenzene-1,3-disulfonamide	332	405
3,5-Dimethyl-2-hydroxybenzene-1,4-disulfonamide	166	398
2,6-Dimethyl-4-hydroxybenzene-1,3-disulfonanilide	326	404
2,6-Dimethyl-4-hydroxybenzene-1,3-disulfonic acid	157	376
4,6-Dimethyl-2-hydroxy benzene-1,3-disulfonic acid	64	373
3,5-Dimethyl-2-hydroxybenzene-1,3-disulfonyl chloride	116	384
3,5-Dimethyl-2-hydroxybenzenesulfonanilide	103	395
3,5-Dimethyl-2-hydroxybenzenesulfonic acid	5	380
2,6-Dimethyl-4-hydroxybenzenesulfonyl chloride	181	387
2,6-Dimethyl-4-hydroxybenzonitrile	38	434
3,5-Dimethyl-4-hydroxybenzonitrile	40	434
Dimethyl (2-hydroxyethyl) amine	319	438
2,2-Dimethyl-3-hydroxypropionaldehyde	84	157
2,4-Dimethyl-8-hydroxyquinoline	18	434
3,4-Dimethyl-8-hydroxyquinoline	13	434
2,4-Dimethylimidazole	297	438
3,5-Dimethylindole	116	306
Dimethyl isobutyl amine	365	439
Dimethyl isophthalate	93	277
Dimethyl isopropyl amine	397	439
1,4-Dimethyl-7-isopropylazulene	6	43

	Compound No.	Page No.
1,2-Dimethyl-3-isopropylbenzene	71	38
1,2-Dimethyl-4-isopropylbenzene	69	38
1,3-Dimethyl-2-isopropylbenzene	61	37
1,3-Dimethyl-4-isopropylbenzene	62	37
1,3-Dimethyl-5-isopropylbenzene	51	37
1,4-Dimethyl-2-isopropylbenzene	56	37
Dimethyl isopropyl carbinol	17	80
1,7-Dimethyl-4-isopropylnaphthalene	43	44
2,4-Dimethyl-3-isopropylpentane	169	5
Dimethyl itaconate	41	275
Dimethyl *l*-malate	263	264
Dimethyl maleate	179	259
Dimethyl malonate	142	257
Dimethylmalonic acid	313	206
" "	170	430
Dimethylmalononitrile	20	357
Dimethyl mesaconate	175	259
Dimethyl mesotartarate	144	280
3,3-Dimethyl-1-methoxy-2-butanone	87	163
2,4-Dimethyl-2-methoxyphenol	286	111
2,2-Dimethyl-3-methylene-bicyclo(2,2,1)heptene	10	26
2,2-Dimethyl-5-methylene-bicyclo(2,2,1)heptane	278	21
3,5-Dimethyl-4-(methylsulfonyl)phenol	37	434
Dimethyl mucate	168	281
Dimethyl naphthalate	137	280
1,3-Dimethylnaphthalene	155	41
1,4-Dimethylnaphthalene	159	41
1,5-Dimethylnaphthalene	75	46
1,6-Dimethylnaphthalene	154	41
1,7-Dimethylnaphthalene	153	41
1,8-Dimethylnaphthalene	53	45
2,3-Dimethylnaphthalene	109	47
2,6-Dimethylnaphthalene	114	47
2,7-Dimethylnaphthalene	100	47
1,3-Dimethyl-2-naphthol	158	104
1,4-Dimethyl-2-naphthol	326	113
2,4-Dimethyl-1-naphthol	139	103
3,4-Dimethyl-1-naphthol	276	110
2,5-Dimethyl-1,4-naphthoquinone	9	181
3,7-Dimethyl-1,2-naphthoquinone	20	182
1,4-Dimethyl-2-naphthylamine	119	306
N,N-Dimethyl-α-naphthylamine	101	321
N,N-Dimethyl-β-naphthylamine	22	323
2,6-Dimethyl-1-naphthylamine	161	307
3,6-Dimethyl-2-naphthylamine	313	312
3,7-Dimethyl-2-naphthylamine	286	311
Dimethylneopentylacetic acid	33	194
N,N-Dimethyl-2-nitroaniline	1	322
N,N-Dimethyl-3-nitroaniline	33	323
" "	60	436
N,N-Dimethyl-4-nitroaniline	17	436
2,3-Dimethyl-4-nitroaniline	36	436
2,4-Dimethyl-5-nitroaniline	270	311
2,5-Dimethyl-4-nitroaniline	325	313
2,6-Dimethyl-4-nitroaniline	23	436
3,5-Dimethyl-4-nitroaniline	57	436
4,6-Dimethyl-2-nitroaniline	123	306
1,2-Dimethyl-3-nitrobenzene	30	336
1,3-Dimethyl-2-nitrobenzene	24	336
1,3-Dimethyl-4-nitrobenzene	29	336
1,4-Dimethyl-2-nitrobenzene	27	336
3,4-Dimethyl-1-nitrobenzene	4	337
3,5-Dimethyl-1-nitrobenzene	41	338
2,4-Dimethyl-3-nitrobenzenesulfonamide	205	399
2,4-Dimethyl-5-nitrobenzenesulfonamide	260	402
2,4-Dimethyl-6-nitrobenzenesulfonamide	40	393
2,5-Dimethyl-3-nitrobenzenesulfonamide	207	399
2,5-Dimethyl-4-nitrobenzenesulfonamide	307	403
2,5-Dimethyl-6-nitrobenzenesulfonamide	284	403
3,4-Dimethyl-5-nitrobenzenesulfonamide	230	400
2,5-Dimethyl-3-nitrobenzenesufonanilide	107	396
2,5-Dimethyl-4-nitrobenzenesulfonanilide	78	394
2,5-Dimethyl-6-nitrobenzenesulfonanilide	237	401
2,4-Dimethyl-3-nitrobenzenesulfonic acid	86	373
2,4-Dimethyl-5-nitrobenzenesulfonic acid	120	375
2,5-Dimethyl-3-nitrobenzenesulfonic acid	87	374
2,5-Dimethyl-4-nitrobenzenesulfonic acid	145	376
2,5-Dimethyl-6-nitrobenzenesulfonic acid	134	375
2,4-Dimethyl-3-nitrobenzenesulfonyl chloride	134	385
2,4-Dimethyl-5-nitrobenzenesulfonyl chloride	143	385
2,5-Dimethyl-3-nitrobenzenesulfonyl chloride	60	382
2,5-Dimethyl-4-nitrobenzenesulfonyl chloride	87	383
2,5-Dimethyl-6-nitrobenzenesulfonyl chloride	167	386
3,4-Dimethyl-5-nitrobenzenesulfonyl chloride	80	383
2,6-Dimethyl-4-nitrophenol	25	434
3,5-Dimethyl-4-nitrophenol	39	434
Dimethyl-3-nitrophthalate	96	278
Dimethyl-4-nitrophthalate	89	277
N,N-Dimethyl-4-nitrosoaniline	50	324
2,3-Dimethyl-2-norbornene	250	20
2,4-Dimethyl-2,4-octadiene	289	22
2,6-Dimethyl-2,5-octadiene	12	25
2,6-Dimethyl-2,6-octadiene	296	22
2,6-Dimethyl-2,7-octadiene	286	21
2,7-Dimethyl-2,6-octadiene	292	22
3,6-Dimethyl-2,6-octadiene	285	21
3,7-Dimethyl-2,4-octadiene	293	22
4,4-Dimethyl-1,7-octadiene	265	21
4,5-Dimethyl-2,6-octadiene	283	21
2,2-Dimethyloctane	156	5
2,3-Dimethyloctane	205	6
2,4-Dimethyloctane	160	5
d,l-2,5-Dimethyloctane	162	5
2,6-Dimethyloctane	182	6
2,7-Dimethyloctane	176	5
3,3-Dimethyloctane	188	6
3,4-Dimethyloctane	212	6
3,5-Dimethyloctane	178	6
3,6-Dimethyloctane	177	6
4,4-Dimethyloctane	185	6
4,5-Dimethyloctane	189	6
2,6-Dimethyl-1-octene-8-carboxylic acid	49	191
2,6-Dimethyl-1-octen-8-carboxylic acid	12	192
2,6-Dimethylol-4-methylphenol	91	434
2,4-Dimethylolphenol	85	434
2,6-Dimethylolphenol	83	434
Dimethyl oxalate	73	276
2,4-Dimethyl-1,3-pentadiene	101	15
2,4-Dimethyl-2,3-pentadiene	89	15
4,4-Dimethyl-1,2-pentadiene	77	14
3,3-Dimethylpentanal	40	146
2,2-Dimethylpentane	27	3
2,3-Dimethylpentane	33	3
2,4-Dimethylpentane	28	3
3,3-Dimethylpentane	31	3
2,3-Dimethylpentanoic acid	18	192
4,4-Dimethylpentanoic acid	434	432
2,4-Dimethyl-1-pentanol	53	82
2,4-Dimethyl-3-pentanol	34	81
3,3-Dimethyl-1-pentanol	40	146
2,2-Dimethyl-3-pentanone	23	161
2,4-Dimethyl-3-pentanone	20	161
3,3-Dimethyl-2-pentanone	26	162
3,4-Dimethyl-2-pentanone	42	162
2,3-Dimethyl-1-pentene	84	15
2,3-Dimethyl-2-pentene	113	16
2,4-Dimethyl-2-pentene	82	15
3,3-Dimethyl-1-pentene	69	14
3,4-Dimethyl-1-pentene	80	15
3,4-Dimethyl-2-pentene	91	15
4,4-Dimethyl-1-pentene	58	14
4,4-Dimethyl-*cis*-2-pentene	79	14

	Compound No.	Page No.
4,4-Dimethyl-*trans*-2-pentene	68	14
3,4-Dimethyl-3-penten-2-one	61	163
3,4-Dimethyl-4-penten-2-one	51	162
4,4-Dimethyl-1-pentyne	19	28
4,4-Dimethyl-2-pentyne	23	29
1,2-Dimethylphenanthrene	145	49
1,3-Dimethylphenanthrene	68	45
1,4-Dimethylphenanthrene	26	44
1,5-Dimethylphenanthrene	38	44
1,6-Dimethylphenanthrene	88	46
1,7-Dimethylphenanthrene	86	46
1,8-Dimethylphenanthrene	180	50
1,9-Dimethylphenanthrene	89	46
2,3-Dimethylphenanthrene	72	46
2,4-Dimethylphenanthrene	115	47
2,5-Dimethylphenanthrene	20	43
2,6-Dimethylphenanthrene	7	43
2,7-Dimethylphenanthrene	105	47
2,9-Dimethylphenanthrene	37	44
3,4-Dimethylphenanthrene	45	44
3,5-Dimethylphenanthrene	29	44
3,6-Dimethylphenanthrene	142	49
2,3-Dimethylphenol	109	103
" "	114	435
2,4-Dimethylphenol	8	96
" "	113	435
2,5-Dimethylphenol	108	102
" "	107	435
2,6-Dimethylphenol	115	435
3,4-Dimethylphenol	69	100
" "	111	435
3,5-Dimethylphenol	82	100
" "	102	434
(2,6-Dimethylphenoxy)acetic acid	193	430
2,4-Dimethylphenyl acetate	224	262
2,5-Dimethylphenyl acetate	256	264
2,6-Dimethylphenyl acetate	207	261
3,4-Dimethylphenyl acetate	10	273
3,5-Dimethylphenyl acetate	1	272
1,1-Dimethyl-2-phenylethanol	4	88
sym-Dimethyl-*p*-phenylenediamine	61	304
2,2-Dimethyl-1-phenylpropane	32	36
3,4-Dimethyl-1-phenylpyrazole	108	321
3,5-Dimethyl-1-phenylpyrazole	104	321
2,3-Dimethyl-1-phenyl-5-pyrazolone	72	324
Dimethyl phthalate	332	269
3,4-Dimethylphthalic anhydride	56	226
4,5-Dimethylphthalic anhydride	78	226
Dimethyl pimelate	9	272
cis-2,5-Dimethylpiperazine	239	310
trans-2,5-Dimethylpiperazine	247	310
1,2-Dimethylpiperidine	377	439
cis-2,6-Dimethylpiperidine	457	439
2,6-Dimethylpiperidine	45	296
2,2-Dimethylpropane	7	3
2,2-Dimethyl-1-propanol	28	89
Dimethylpropyl amine	371	439
2,2-Dimethyl-*n*-propylamine	369	439
1,2-Dimethyl-3-propylbenzene	96	38
1,2-Dimethyl-4-propylbenzene	91	38
1,3-Dimethyl-4-propylbenzene	84	38
1,3-Dimethyl-5-propylbenzene	92	38
1,4-Dimethyl-2-propylbenzene	76	38
Dimethyl *n*-propyl carbinol	19	81
1,3-Dimethylpyrazole	15	319
" "	82	436
3,5-Dimethylpyrazole	151	437
2,3-Dimethylpyridine	31	319
" "	265	438
2,4-Dimethylpyridine	25	319
" "	271	438
2,5-Dimethylpyridine	26	319
" "	257	438
2,6-Dimethylpyridine	18	319
" "	266	438
3,4-Dimethylpyridine	32	319
" "	261	438
3,5-Dimethylpyridine	40	319
4,6-Dimethylpyrimidine	2	323
1,2-Dimethylpyrrolidine	5	319
"	376	439
1,3-Dimethylpyrrolidine	6	319
2,4-Dimethylpyrrolidine	38	296
2,5-Dimethylpyrrolidine	37	296
1,2-Dimethyl-2-pyrroline	469	439
2,3-Dimethylquinoline	37	323
2,4-Dimethylquinoline	96	321
2,6-Dimethylquinoline	32	323
2,8-Dimethylquinoline	3	323
3,4-Dimethylquinoline	42	323
4,6-Dimethylquinoline	87	321
4,7-Dimethylquinoline	107	321
4,8-Dimethylquinoline	30	323
5,8-Dimethylquinoline	102	321
6,8-Dimethylquinoline	98	321
2,5-Dimethylresorcinol	419	118
4,6-Dimethylresorcinol	295	111
Dimethyl sebacate	17	273
2,2′-Dimethylstilbene	84	46
3,3′-Dimethylstilbene	34	44
Dimethyl suberate	313	268
Dimethyl succinate	1	273
d,l-2,3-Dimethylsuccinic acid	458	432
meso-2,3-Dimethylsuccinic acid	246	431
α,α-Dimethylsuccinic anhydride	5	225
unsym-Dimethylsuccinic anhydride	5	225
cis-α,β-Dimethylsuccinic anhydride	36	225
trans-α,β-Dimethylsuccinic anhydride	14	225
d,l-2,3-Dimethylsuccinonitrile	70	360
meso-2,3-Dimethylsuccinonitrile	43	358
Dimethyl sulfate	150	257
Dimethyl sulfide	1	420
Dimethyl *d*-tartarate	87	277
Dimethyl *d,l*-tartarate	127	279
Dimethyl tartaronate	72	276
Dimethyl terephthalate	161	281
1,1-Dimethyl-1,2,3,4-tetrahydronaphthalene	117	39
1,5-Dimethyl-1,2,3,4-tetrahydronaphthalene	140	40
2,2-Dimethyl-1,2,3,4-tetrahydronaphthalene	129	40
2,5-Dimethyl-1,2,3,4-tetrahydronaphthalene	135	40
2,6-Dimethyl-1,2,3,4-tetrahydronaphthalene	138	40
2,7-Dimethyl-1,2,3,4-tetrahydronaphthalene	137	40
2,8-Dimethyl-1,2,3,4-tetrahydronaphthalene	136	40
5,6-Dimethyl-1,2,3,4-tetrahydronaphthalene	147	40
5,7-Dimethyl-1,2,3,4-tetrahydronaphthalene	149	40
5,8-Dimethyl-1,2,3,4-tetrahydronaphthalene	150	41
6,7-Dimethyl-1,2,3,4-tetrahydronaphthalene	148	40
1,3-Dimethyl-1,2,3,4-tetrahydroquinoline	4	322
2,3-Dimethyl-1,2,3,4-tetrahydroquinoline	25	303
2,3-Dimethyl-5,6,7,8-tetrahydroquinoline	12	323
2,4-Dimethyl-5,6,7,8-tetrahydroquinoline	84	321
DL-2,6-Dimethyl-1,2,3,4-tetrahydroquinoline	7	303
1,1-Dimethyltetralin	117	39
1,5-Dimethyltetralin	140	40
2,2-Dimethyltetralin	129	40
2,5-Dimethyltetralin	135	40
2,6-Dimethyltetralin	138	40
2,7-Dimethyltetralin	137	40
2,8-Dimethyltetralin	136	40
5,6-Dimethyltetralin	147	40
5,7-Dimethyltetralin	149	40
5,8-Dimethyltetralin	150	41

	Compound No.	Page No.
6,7-Dimethyltetralin	148	40
1,1-Dimethyl-2-tetralone	83	170
2,4-Dimethyltetramethylene sulfide	52	424
cis-2,5-Dimethyltetramethylene sulfide	21	423
trans-2,5-Dimethyltetramethylene-sulfide	20	423
2,2-Dimethylthietane	11	423
2,4-Dimethylthietane	9	423
2,2-Dimethylthiirane	4	423
1,4-(Dimethylthio)benzene	14	416
2,4-Dimethylthiolane	52	424
cis-2,5-Dimethylthiolane	21	423
trans-2,5-Dimethylthiolane	20	423
2,3-Dimethylthiophene	19	423
2,4-Dimethylthiophene	17	423
2,5-Dimethylthiophene	16	423
3,4-Dimethylthiophene	22	423
2,4-Dimethylthiophenol	39	414
2,5-Dimethylthiophenol	38	414
2,6-Dimethyl-1,4-thioxane	33	424
3,5-Dimethyl-1,4-thioxane	36	424
N,N-Dimethyltoluene-4-sulfonamide	22	392
N,N-Dimethyl-*m*-toluidine	65	320
N,N-Dimethyl-*o*-toluidine	46	320
N,N-Dimethyl-*p*-toluidine	62	320
2,2-Dimethyltrimethylene sulfide	11	423
2,4-Dimethyltrimethylene sulfide	9	423
sym-Dimethylurea	145	234
unsym-Dimethylurea	381	242
N,N-Dimethyl-*m*-2-xylidine	56	320
N,N-Dimethyl-*m*-4-xylidine	59	320
N,N-Dimethyl-*p*-2-xylidine	58	320
Di-1-naphthastilbene	161	49
Di-2-naphthastilbene	196	51
Di-(1-naphthyl)acetyl chloride	33	217
N,N′-Di-(1-naphthyl)benzene-1,3-disulfonamide	425	408
Di-1-naphthylethylene	161	49
Di-2-naphthylethylene	196	51
Di-1-naphthyl ketone	128	176
1,1′-Dinaphthylmethane	112	47
Di-(1-naphthyl) sulfide	61	426
1,2′-Dinaphthyl sulfide	70	426
Di-(2-naphthyl) sulfide	71	426
Dineopentylacetic acid	93	196
3,8-Dinitroacenaphthene	105	341
2,4-Dinitroaniline	391	315
" "	2	436
2,6-Dinitroaniline	311	312
2,4-Dinitroanisole	67	339
9,10-Dinitroanthracene	139	343
1,3-Dinitroanthraquinone	133	342
1,5-Dinitroanthraquinone	143	343
1,6-Dinitroanthraquinone	134	342
1,7-Dinitroanthraquinone	140	343
1,8-Dinitroanthraquinone	142	343
2,7-Dinitroanthraquinone	137	342
2,2′-Dinitroazobenzene	126	342
4,4′-Dinitroazobenzene	128	342
2,4-Dinitrobenzamide	436	243
3,5-Dinitrobenzamide	385	242
3,5-Dinitrobenzanilide	483	245
1,2-Dinitrobenzene	80	340
1,3-Dinitrobenzene	60	339
1,4-Dinitrobenzene	114	341
2,4-Dinitrobenzenesulfonamide	153	397
3,5-Dinitrobenzenesulfonamide	397	407
2,4-Dinitrobenzenesulfonic acid	60	373
3,5-Dinitrobenzenesulfonic acid	180	377
2,4-Dinitrobenzenesulfonyl chloride	154	386
3,5-Dinitrobenzenesulfonyl chloride	148	385
2,3-Dinitrobenzoic acid	32	429
2,4-Dinitrobenzoic acid	287	204
" " "	16	429
2,5-Dinitrobenzoic acid	25	429
2,6-Dinitrobenzoic acid	7	429
3,4-Dinitrobenzoic acid	119	430
3,5-Dinitrobenzoic acid	328	206
" "	120	430
2,4-Dinitrobenzoic anhydride	68	226
3,5-Dinitrobenzoic anhydride	48	226
2,4-Dinitrobenzonitrile	144	363
2,6-Dinitrobenzonitrile	69	360
3,5-Dinitrobenzoyl bromide	4	220
2,4-Dinitrobenzoyl chloride	8	216
3,5-Dinitrobenzoyl chloride	14	216
Di-(4-nitrobenzyl) sulfide	73	427
2,2′-Dinitrobiphenyl	91	340
2,4′-Dinitrobiphenyl	65	339
3,3′-Dinitrobiphenyl	124	342
4,4′-Dinitrobiphenyl	132	342
3,5-Dinitrocatechol	422	118
4,6-Dinitro-*m*-cresol	195	106
4,6-Dinitro-*o*-cresol	147	104
2,2′-Dinitrodiphenylmethane	108	341
2,4′-Dinitrodiphenylmethane	81	340
3,3′-Dinitrodiphenylmethane	115	341
4,4′-Dinitrodiphenylmethane	119	342
2,4-Dinitrodiphenyl sulfide	64	426
1,3-Dinitro-4-ethoxybenzene	58	339
2,5-Dinitrofluorene	125	342
2,6-Dinitrohydroquinone	325	113
"	7	434
3,5-Dinitro-2-hydroxyaniline	380	315
3,5-Dinitro-2-hydroxybenzoic acid	284	204
2,6-Dinitro-4-iodophenol	238	108
4,6-Dinitro-2-iodophenol	211	107
2,4-Dinitromesitylene	55	339
1,3-Dinitro-4-methoxybenzene	67	339
2,6-Dinitro-4-methylaniline	377	315
" "	3	436
3,5-Dinitro-4-methylbenzoic acid	136	430
4,6-Dinitro-2-methylphenol	147	104
4,6-Dinitro-3-methylphenol	195	106
1,2-Dinitronaphthalene	73	340
1,3-Dinitronaphthalene	99	341
1,4-Dinitronaphthalene	92	340
1,5-Dinitronaphthalene	127	342
1,6-Dinitronaphthalene	109	341
1,8-Dinitronaphthalene	110	341
2,7-Dinitronaphthalene	131	342
1,6-Dinitro-2-naphthol	496	122
2,4-Dinitro-1-naphthol	331	113
1,5-Dinitro-2-naphthylamine	409	316
1,8-Dinitro-2-naphthylamine	450	317
2,4-Dinitro-1-naphthylamine	453	317
2,5-Dinitrophenanthrenequinone	129	342
2,7-Dinitrophenanthrenequinone	141	343
2,4-Dinitrophenetole	58	339
2,4-Dinitrophenol	243	108
" "	6	434
2,5-Dinitrophenol	9	434
2,6-Dinitrophenol	70	100
"	5	434
3,4-Dinitrophenol	10	434
3,5-Dinitrophenol	298	111
(2,4-Dinitrophenyl)acetic acid	204	430
2,4-Dinitrophenyl hydrazine	416	316
2,4-Dinitrophenyl phenyl sulfide	64	426
Di-(2-nitrophenyl) sulfide	65	426
Di-(3-nitrophenyl) sulfide	75	427
Di-(4-nitrophenyl) sulfide	74	427
2,4-Dinitrophenyl sulfide	76	427
3,5-Dinitrophthalic anhydride	71	226
2,4-Dinitroresorcinol	369	115
4,6-Dinitroresorcinol	533	124

	Compound No	Page No.
3,5-Dinitrosalicylamide	378	242
3,5-Dinitrosalicylic acid	284	204
" " "	455	120
2,2′-Dinitrostilbene	122	342
2,4-Dinitrostilbene	98	341
trans-4,4′-Dinitrostilbene	138	343
2,β-Dinitrostyrene	75	340
4,β-Dinitrostyrene	123	342
2,4-Dinitrothiophenol	43	417
2,3-Dinitrotoluene	33	338
2,4-Dinitrotoluene	37	338
2,6-Dinitrotoluene	35	338
3,4-Dinitrotoluene	31	338
3,5-Dinitrotoluene	62	339
Di-*n*-octadecylamine	445	439
Dioctadecyl sulfide	39	426
Di-*n*-octylamine	451	439
Di-*n*-octyl ketone	50	173
Di-*n*-octyl sulfide	30	425
1,4-Dioxane	36	132
2,4-Dioxopentanoic acid	117	197
"	107	430
Di-*n*-pentadecylamine	449	439
Dipentene	319	23
Dipentylacetylene	59	30
Di-*n*-pentylamine	461	439
2,2′-Diphenanilide	481	245
2,2′-Diphenic acid	354	208
2,2′-Diphenic acid diamide	452	244
2,2′-Diphenic acid dichloride	22	216
2,2′-Diphenic acid mononitrile	212	366
2,2′-Diphenic anhydride	79	227
2,4′-Diphenol	418	118
1,2-Diphenoxyethane	52	139
1,3-Diphenoxypropane	38	138
Diphenylacetaldehyde	93	149
Diphenylacetamide	333	240
N,N-Diphenylacetamide	118	234
Diphenylacetanilide	377	242
Diphenylacetic acid	222	202
" "	273	431
Diphenylacetic anhydride	41	225
Diphenylacetoin	56	174
1,1-Diphenylacetone	76	174
1,3-Diphenylacetone	19	172
Diphenylacetonitrile	95	361
Diphenylacetyl chloride	12	216
Sym-Diphenylacetylene	47	44
cis-2,3-Diphenylacrylonitrile	110	362
trans-2,3-Diphenylacrylonitrile	52	359
3,3-Diphenylacrylonitrile	49	359
Diphenyl adipate	140	280
2,2-Diphenyladipic acid	313	431
3,4-Diphenyladipic acid	326	431
Diphenylamine	62	304
"	19	436
Diphenylaminoformyl chloride	21	216
2,2-Diphenylazelaic acid	351	432
2,6-Diphenyl-1,4-benzoquinone	17	182
trans-trans-1,4-Diphenyl-1,3-butadiene	155	49
2,3-Diphenylbutyronitrile	173	365
2,4-Diphenylbutyronitrile	8	355
Diphenylcarbamyl chloride	21	216
Diphenyl carbinol	39	89
Diphenyl carbonate	115	279
Diphenyl-4-carbonyl chloride	26	216
2,3-Diphenylcinnamonitrile	209	366
Diphenylclycolaldehyde	121	159
Diphenylene ketone oxide	189	178
1,1-Diphenylethane	160	41
1,2-Diphenylethane	27	44
1,2-Diphenylethanol	37	89

	Compound No.	Page No.
Diphenyl ether	7	137
1,2-Diphenylethylamine	186	301
2,2-Diphenylethylamine	24	303
Di-(2-phenylethyl)sulfide	53	426
N,N-Diphenylformamide	39	232
2,2-Diphenylglutaric acid	270	431
d,l-2,3-Diphenylglutaromononitrile	206	366
2,2-Diphenylglutaronitrile	90	361
2,4-Diphenylglutaronitrile	81	361
unsym-Diphenylhydrazine	14	303
Diphenylmethane	2	43
1,6-Diphenylnaphthalene	87	46
1,5-Diphenyl-3-pentadienone	145	177
1,5-Diphenyl-1,5-pentanedione	87	175
1,5-Diphenyl-3-pentanone	221	168
Diphenyl phthalate	108	278
2,2-Diphenylpimelic acid	340	432
1,3-Diphenyl-2-propanone	19	172
2,3-Diphenylpropionaldehyde	34	154
2,2-Diphenylpropionic acid	265	204
α,α-Diphenylpropionyl chloride	23	216
β,β-Diphenylpropiophenone	120	176
2,2-Diphenylpropylamine	7	302
2,3-Diphenylpropylamine	187	301
Di-(3-phenylpropyl)sulfide	42	426
2,2-Diphenylsuberic acid	349	432
Diphenyl succinate	152	281
d,l-2,3-Diphenylsuccinic acid	216	430
meso-2,3-Diphenylsuccinic acid	203	430
d,l-2,3-Diphenylsuccinonitrile	203	366
l-2,3-Diphenylsuccinonitrile	232	367
Diphenyl sulfide	61	422
Diphenyl triketone	92	175
sym-Diphenylurea	488	245
unsym-Diphenylurea	399	242
2,3-Diphenylvaleronitrile	159	364
2,5-Diphenylvaleronitrile	100	361
Dipicolinonitrile	167	364
Dipicryl sulfide	77	427
Dipropargyl	29	29
Di-*n*-propylacetaldehyde	54	146
Di-*n*-propyl acetylene	43	29
Di-*n*-propyladipate	7	272
Di-*n*-propylamine	36	296
"	447	439
N,N-Di-*n*-propylaniline	76	321
" "	229	437
1,3-Dipropylbenzene	106	39
1,4-Dipropylbenzene	114	39
Di-*n*-propyl carbinol	48	82
Di-*n*-propyl carbonate	119	255
Dipropylcyanoacetamide	197	366
Di-*n*-propyl ether	30	132
3,3-Di-*n*-propylglutaric acid	236	431
Di-*n*-propyl ketone	52	162
Di-*n*-propyl maleate	10	272
Di-*n*-propylmalonic acid	47	429
Dipropylmalononitrile	23	358
"	51	359
Di-*n*-propyl oxalate	204	260
Di-*n*-propyl succinate	283	265
Di-*n*-propyl sulfide	26	420
Di-*n*-propyl *d*-tartarate	342	270
Di-*n*-propyl *d,l*-tartarate	16	273
2,2′-Dipyridylamine	49	324
4,4′-Dipyridylamine	101	325
1,2-Di-(2-pyrrolyl)ethanedione	94	325
trans-trans-Distyryl	155	49
Ditetradecyl sulfide	25	425
Di-2-thenoylmethane	127	176
1,3-Dithiacyclopentane	43	424

	Compound No	Page No
1,3-Dithiane	27	425
1,4-Dithiane	62	426
Dithiocatechol	8	416
1,3-Dithiolane	43	424
Dithioresorcinol	6	416
DL-*erythro*-Dithiothreitol	26	417
threo-Dithiothreitol	10	416
2,2′-Ditolylamine	59	304
Di-*o*-tolylamine	59	304
Di-4-tolyl carbinol	38	89
Di-2-tolyl carbonate	85	277
Di-3-tolyl carbonate	61	276
Di-4-tolyl carbonate	145	280
sym-Di-*m*-tolylethylene	34	44
sym-Di-*o*-tolylethylene	84	46
Di-2-tolyl ketone	86	174
Di-4-tolyl ketone	118	176
Di-2-tolyl oxalate	128	279
Di-3-tolyl oxalate	138	280
Di-4-tolyl oxalate	164	281
Di-4-tolyl succinate	153	281
Di-(2-tolyl) sulfide	35	425
Di-(3-tolyl) sulfide	60	421
Di-(4-tolyl) sulfide	31	425
sym-Di-2-tolylurea	494	246
sym-Di-3-tolylurea	463	244
sym-Di-4-tolylurea	502	246
Di-*n*-tridecylamine	444	439
Di-*n*-tridecyl ketone	110	175
Di-(2,4,6-trinitrophenyl) sulfide	77	427
Di-*n*-undecyl ketone	91	175
Diundecyl sulfide	7	425
Divarinol	135	103
Divinyl acetylene	26	29
Divinyl sulfide	4	420
p-Dixylylamine	11	303
L-Djenkolic acid	108	289
n-Docosane	20	8
n-Docosanoic acid	83	196
1-Docosene	5	26
cis-13-Docosenoic acid	17	193
Docosylcyclohexane	31	8
Docosylcyclopentane	21	8
1-Docosyne	9	31
Dodecanal	18	153
Dodecanamide	160	235
Dodecananilide	46	232
n-Dodecane	254	7
α,ω-Dodecanedicyanide	17	356
n-Dodecanoic acid	29	194
n-Dodecanoic anhydride	12	225
1-Dodecanol	3	88
2-Dodecanone	2	172
3-Dodecanone	4	169
Dodecanonitrile	101	353
Dodecanoyl chloride	13	214
1-Dodecene	330	24
Dodecyl acetylene	62	30
n-Dodecyl alcohol	3	88
n-Dodecylamine	6	303
n-Dodecylbenzene	178	42
n-Dodecyl bromide	29	58
n-Dodecyl chloride	53	56
n-Dodecylcylohexane	277	7
n-Dodecylcylopentane	274	7
n-Dodecyl ether	13	137
n-Dodecyl methyl ketone	17	172
n-Dodecyl sulfide	12	425
1-Dodecyne	60	30
6-Dodecyne	59	30
n-Dotriacontane	55	9
1-Dotriacontene	15	26
Dotriacontylcyclohexane	66	9
Dotriacontylcyclopentane	54	9
1-Dotriacontyne	19	31
Droserone	25	182
Dulcin	353	241
Dulcitol	64	90
Dunnione	10	181
Durene	73	46
Durenol	257	109
Duridine	117	306
Durohydroquinone	119	435
Dypnone	220	168

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	Compound No.	Page No.
n-Eicosane	14	8
Eicosanoic acid	78	196
n-Eicosanoic anhydride	32	225
Eicosanol	35	89
Eicosanonitrile	53	359
Eicosene	2	26
Eicosylcyclohexane	24	8
Eicosylcyclopentane	16	8
1-Eicosyne	6	31
Elaidamide	84	233
Elaidic acid	31	194
Elaidyl alcohol	15	88
Embelin	18	182
Enanthaldehyde	52	146
n-Enanthophenone	213	168
Enanthoyl chloride	35	212
α-Epichlorohydrin	41	133
1,2-Epoxybutane	13	131
2,3-Epoxybutane	11	131
Epoxyethane	1	131
1,2-Epoxypropane	5	131
Ergosterol	61	90
Ericanilide	30	231
Erucic acid	17	193
Erythritol	41	89
meso-Erythritol	54	90
D-Erythrose	5	328
DL-Erythrose	6	328
L-Erythrose	4	328
DL-Erythrulose	7	328
L-Erythrulose	8	328
Ethanal	3	144
Ethane	2	3
Ethane-1,2-dicarboxylic acid	294	205
1,2-Ethanediol	101	85
Ethane-1,2-disulfonanilide	14	392
Ethane-1,2-disulfonic acid	1	380
Ethane-1,2-disulfonyl chloride	130	385
1,2-Ethanedithiol	20	413
Ethanesulfonamide	7	392
Ethanesulfonanilide	8	392
Ethanesulfonic acid	2	371
Ethanethiol	2	413
Ethanoic acid	3	190
Ethanol	2	80
Ethanolamine	62	83
"	71	297
Ethene	1	12
Ethoxyacetaldehyde	24	145
Ethoxyacetamide	57	232
Ethoxyacetic acid	34	191
" "	231	431
Ethoxyacetone	6	169
Ethoxyacetonitrile	25	347
α-Ethoxyacetophenone	23	169

	Compound No	Page No
Ethoxyacetyl chloride	20	212
2-Ethoxyaniline	141	299
" "	155	437
3-Ethoxyaniline	163	300
" "	135	437
4-Ethoxyaniline	164	300
" "	204	437
2-Ethoxybenzaldehyde	3	153
3-Ethoxybenzaldehyde	88	149
4-Ethoxybenzaldehyde	91	149
3-Ethoxybenzamide	252	237
4-Ethoxybenzamide	435	243
4-Ethoxybenzanilide	347	241
2-Ethoxybenzene-2,5-disulfonamide	396	407
1-Ethoxybenzene-2,5-disulfonic acid	178	377
2-Ethoxybenzene-1,4-disulfonyl chloride	164	386
2-Ethoxybenzenesulfonamide	172	398
3-Ethoxybenzenesulfonamide	79	395
4-Ethoxybenzenesulfonamide	129	396
2-Ethoxybenzenesulfonanilide	160	398
2-Ethoxybenzenesulfonic acid	66	373
3-Ethoxybenzenesulfonic acid	22	371
4-Ethoxybenzenesulfonic acid	50	372
2-Ethoxybenzenesulfonyl chloride	70	383
3-Ethoxybenzenesulfonyl chloride	20	381
4-Ethoxybenzenesulfonyl chloride	24	381
2-Ethoxybenzoic acid	5	193
" "	325	431
3-Ethoxybenzoic acid	193	201
" "	312	431
4-Ethoxybenzoic acid	316	206
4-Ethoxybenzoic anhydride	46	226
3-Ethoxybenzoyl chloride	20	214
4-Ethoxybenzoyl chloride	32	214
2-Ethoxybiphenyl	14	137
3-Ethoxybiphenyl	16	137
4-Ethoxybiphenyl	46	139
1-Ethoxy-2-butanone	62	163
2-Ethoxyethanethiol	17	413
2-Ethoxyethanol	29	81
"	51	133
2-(2-Ethoxyethoxy)ethanol	100	85
β-Ethoxyethyl acetate	104	255
β-Ethoxyethyl benzoate	300	267
1-Ethoxy-4-iodobenzene	6	137
4-Ethoxy-3-methoxybenzaldehyde	53	155
1-Ethoxy-2-methoxyethane	37	133
3-Ethoxy-2-methyl-2-butanol	52	133
Ethoxymethyl ethyl ketone	62	163
3-Ethoxy-2-methyloibenzoic acid	219	430
2-Ethoxy-1-naphthaldehyde	100	158
4-Ethoxy-1-naphthaldehyde	61	156
1-Ethoxynaphthalene	108	136
2-Ethoxynaphthalene-1-sulfonamide	158	397
4-Ethoxynaphthalene-1-sulfonamide	198	399
4-Ethoxynaphthalene-2-sulfonamide	241	401
5-Ethoxynaphthalene-1-sulfonamide	238	401
6-Ethoxynaphthalene-1-sulfonamide	140	397
6-Ethoxynaphthalene-2-sulfonamide	239	401
7-Ethoxynaphthalene-2-sulfonamide	101	395
2-Ethoxynaphthalene-1-sulfonanilide	257	401
4-Ethoxynaphthalene-1-sulfonanilide	229	400
4-Ethoxynaphthalene-2-sulfonanilide	110	396
5-Ethoxynaphthalene-1-sulfonanilide	75	394
6-Ethoxynaphthalene-1-sulfonanilide	293	403
6-Ethoxynaphthalene-2-sulfonanilide	138	397
7-Ethoxynaphthalene-2-sulfonanilide	133	396
2-Ethoxynaphthalene-1-sulfonyl chloride	179	387
4-Ethoxynaphthalene-1-sulfonyl chloride	156	386
4-Ethoxynaphthalene-2-sulfonyl chloride	106	384
5-Ethoxynaphthalene-1-sulfonyl chloride	187	387
6-Ethoxynaphthalene-1-sulfonyl chloride	182	387
6-Ethoxynaphthalene-2-sulfonyl chloride	165	386
7-Ethoxynaphthalene-2-sulfonyl chloride	157	386
2-Ethoxy-6-nitroaniline	44	304
4-Ethoxy-2-nitroaniline	235	310
1-Ethoxy-4-nitrobenzene	30	338
3-Ethoxy-1-nitrobenzene	8	337
6-Ethoxy-1-nitronaphthalene-2-sulfonamide	357	406
7-Ethoxy-8-nitronaphthalene-1-sulfonamide	209	399
6-Ethoxy-1-nitronaphthalene-2-sulfonyl chloride	234	388
7-Ethoxy-8-nitronaphthalene-1-sulfonyl chloride	241	389
2-Ethoxyphenol	9	96
3-Ethoxyphenol	24	97
1-Ethoxy-2-propanone	6	169
3-Ethoxypropionic acid	1	192
3-Ethoxypropionitrile	47	348
β-Ethoxypropionyl chloride	1	214
4-Ethoxypyridine	269	438
2-Ethoxytoluene	70	134
3-Ethoxytoluene	76	135
4-Ethoxytoluene	75	135
1-Ethoxy-2,4,6-trinitrobenzene	45	338
N-Ethylacetanilide	12	231
2-Ethylacetanilide	165	235
Ethyl acetate	10	250
Ethyl acetoacetate	133	165
" "	140	256
2-Ethylacetophenone	59	170
Ethyl acetopyruvate	201	260
Ethyl acetylene	3	28
Ethyl acetylglycolate	136	256
Ethyl acrylate	28	251
2-Ethylacrylonitrile	11	345
N-Ethylalanine	65	429
Ethyl alcohol	2	80
Ethylallene	29	13
Ethyl allylacetoacetate	182	259
Ethylamine	3	295
"	431	439
(Ethylamino)acetonitrile	43	348
Ethyl 2-aminobenzoate	15	273
2-(Ethylamino)ethylamine	404	439
1-(Ethylamino)naphthalene	136	437
Ethyl-*n*-amyl alcohol	56	83
N-Ethylaniline	99	298
"	197	437
2-Ethylaniline	110	298
"	149	437
3-Ethylaniline	175	437
4-Ethylaniline	116	298
Ethyl anisate	315	268
Ethyl anthranilate	15	273
2-Ethylaziridine	294	438
N-Ethylaziridine	291	438
2-Ethylazulene	19	43
N-Ethylbenzanilide	23	231
Ethylbenzene	3	35
2-Ethylbenzenesulfonamide	30	393
4-Ethylbenzenesulfonamide	44	393
2-Ethylbenzenesulfonyl chloride	2	381
4-Ethylbenzenesulfonyl chloride	4	381
Ethyl benzilate	37	274
1-Ethylbenzimidazole	222	437
2-Ethylbenzimidazole	255	438
Ethyl benzoate	202	260
2-Ethylbenzoic acid	247	431
4-Ethylbenzoic acid	358	432
Ethyl benzoylacetate	212	168
" "	311	268
Ethyl 2-benzoylbenzoate	82	277
Ethyl benzoylformate	297	266

	Compound No	Page No.
N-Ethylbenzylamine	340	438
N-Ethylbenzylsulfonamide	12	392
Ethyl bromide	3	58
Ethyl bromoacetate	107	255
Ethyl-α-bromopropionate	110	255
Ethyl β-bromopropionate	135	256
2-Ethyl-1,3-butadiene	61	14
2-Ethylbutanamide	168	235
2-Ethylbutananilide	209	236
2-Ethylbutane-1,1-dicarboxylic acid	50	194
2-Ethylbutanoic acid	27	194
Ethylbutanol	42	82
2-Ethyl-1-butene	41	13
Ethyl *n*-butoxyethyl carbonate	221	262
2-Ethylbutyraldehyde	29	145
Ethyl *n*-butyrate	48	252
2-Ethylbutyric acid	429	432
Ethyl *n*-caprate	269	264
Ethyl *n*-caproate	116	255
α-Ethylcaproic acid	45	191
Ethyl *n*-caprylate	190	259
Ethyl carbamate	4	231
Ethyl carbonate	55	252
Ethyl cellosolve acetate	104	255
Ethyl chloride	3	55
Ethyl chloroacetate	83	253
Ethyl chloroformate	20	250
Ethyl α-chloropropionate	87	253
Ethyl cinnamate	319	268
Ethyl crotonate	73	253
Ethyl cyanoacetate	68	350
Ethylcyclobutane	25	3
Ethylcyclohexane	90	4
Ethyl cyclohexanecarboxylate	166	258
2-Ethylcyclohexanone	44	169
3-Ethylcyclohexanone	146	165
1-Ethylcyclohexene	238	19
3-Ethylcyclohexene	236	19
4-Ethylcyclohexene	231	19
3-Ethyl-2-cyclohexenone	64	170
2-Ethylcyclohexylamine	70	297
Ethylcyclooctatetraene	13	25
Ethylcyclopentane	45	3
2-Ethylcyclopentanone	90	164
1-Ethylcyclopentene	139	16
3-Ethylcyclopentene	115	16
4-Ethylcyclopentene	137	16
Ethylcyclopropane	12	3
S-Ethylcysteine	45	429
9-Ethyl-*cis*-decahydronaphthalene	259	7
9-Ethyl-*trans*-decahydronaphthalene	258	7
Ethyl *n*-decanoate	269	264
Ethyl dichloroacetate	106	255
Ethyl difluoroacetate	25	250
Ethyl 3,5-dinitrobenzoate	129	279
Ethyl 3,5-dinitrosalicylate	134	280
Ethyl diphenylacetate	81	277
2-Ethyl-1,3-dithiolane	51	424
Ethyl enanthate	152	257
Ethylene	1	12
Ethylene bromohydrin	43	82
Ethylene chlorohydrin	24	81
Ethylene cyanohydrin	78	351
1,2-Ethylenediamine	39	296
" "	352	438
Ethylenediamine N,N′-diacetic acid	472	433
Ethylenediamine-N,N′-dipropionic acid	473	433
Ethylenediamine-N,N,N′,N′-tetraacetic acid	471	433
Ethylene dichloride	9	63
Ethylene dithioglycol	20	413
Ethylene glycol diacetate	156	257
Ethylene glycol dibenzoate	104	278
Ethylene glycol di-*n*-butyrate	253	264
Ethylene glycol diformate	126	256
Ethylene glycol di-(β-hydroxyethyl)ether	130	86
Ethylene glycol dilaurate	69	276
Ethylene glycol dimethyl ether	26	132
Ethylene glycol dimyristate	88	277
Ethylene glycol dipalmitate	98	278
Ethylene glycol diphenyl ether	52	139
Ethylene glycol dipropionate	198	260
Ethylene glycol di-*n*-stearate	111	278
Ethylene glycol monoacetate	148	257
Ethylene glycol monobenzyl ether	128	86
Ethylene glycol mono-*n*-butyl ether	61	83
" " " "	60	134
Ethylene glycol mono-*sec*-butyl ether	52	82
Ethylene glycol monoethyl ether	29	81
" " "	51	133
Ethylene glycol monoethyl ether acetate	104	255
Ethylene glycol monoethyl monomethyl ether	37	133
Ethylene glycol monoformate	138	256
Ethylene glycol monoisobutyl ether	51	82
Ethylene glycol monoisopropyl ether	36	81
Ethylene glycol monomethyl ether	20	81
Ethylene glycol monomethyl ether acetate	78	253
Ethylene glycol monomethyl mono-*n*-propyl ether	47	133
Ethylene glycol monophenyl ether	122	86
Ethylene glycol mono-*n*-propyl ether	44	82
Ethyleneimine	10	295
Ethylene oxide	1	131
cis-Ethylene oxide-1,2-dicarboxylic acid	36	429
trans-Ethylene oxide-1,2-dicarboxylic acid	35	429
Ethylene sulfide	1	423
Ethylenesulfonic acid	2	380
Ethyl ether	4	131
Ethyl ethoxyacetate	62	252
Ethyl 4-ethoxybenzoate	324	268
Ethyl β-ethoxyethyl carbonate	161	258
Ethyl ethylacetoacetate	169	258
2-Ethylethylene sulfide	6	423
N-Ethylformamide	5	230
N-Ethylformanilide	9	230
Ethyl formate	3	250
Ethyl 2-furoate	35	274
Ethyl furoylacetate	5	272
Ethyl β-(2-furyl)acrylate	244	263
Ethyl 2-furyl ketone	11	172
N-Ethylglycine	22	285
" "	82	429
N-Ethylglycinonitrile	43	348
Ethyl glycolate	108	255
3-Ethylglutaric acid	341	432
Ethyl hendecylenate	309	267
3-Ethylheptane	127	5
4-Ethylheptane	120	5
Ethyl *n*-heptanoate	152	257
5-Ethyl-3-heptanone	115	164
5-Ethyl-4-hepten-3-one	128	165
Ethyl hexadecyl sulfide	2	425
Ethyl hexahydrobenzoate	166	258
2-Ethylhexanal-1	57	147
3-Ethylhexane	66	4
Ethyl *n*-hexanoate	116	255
2-Ethylhexanoic acid	45	191
2-Ethyl-1-hexanol	87	84
2-Ethyl-2-hexenal	13	150
2-Ethyl-3-hexenal	14	150
2-Ethyl-1-hexene	204	18
3-Ethyl-1-hexene	160	17
3-Ethyl-2-hexene	207	18
3-Ethyl-3-hexene	193	18
4-Ethyl-1-hexene	177	18

	Compound No.	Page No.
2-Ethyl-2-hexene	178	18
2-Ethyl-3-hexenoic acid	9	192
2-Ethyl-1-hexen-3-one	86	163
3-Ethyl-5-hexen-2-one	70	163
2-Ethyl-1-hexylacetate	171	258
Ethyl hexyl acetylene	53	30
Ethyl *n*-hexyl ketone	142	165
Ethyl hydrocinnamate	282	265
2-Ethyl-4-hydroxybenzaldehyde	30	154
Ethyl 2-hydroxybenzoate	16	94
Ethyl 3-hydroxybenzoate	106	102
" "	107	278
Ethyl 4-hydroxybenzoate	247	109
" "	148	280
" "	50	434
4-Ethyl-4-hydroxy-3-hexanone	124	165
Ethyl α-hydroxyisobutyrate	95	254
Ethyl 3-hydroxy-2-naphthoate	125	279
Ethyl 3-hydroxy-4-nitrobenzoate	16	434
Ethylidene diacetate	121	255
Ethylidenefluorene	110	47
1-Ethylidene-2-methylcyclohexane	288	22
1-Ethylidene-3-methylcyclohexane	284	21
1-Ethylidene-4-methylcyclohexane	282	21
Ethyl iodide	3	60
Ethyl isoamyl ketone	94	164
Ethyl isobutylacetaldehyde	53	146
Ethyl isobutylacetic acid	13	192
Ethyl isobutyl ether	23	132
Ethyl isobutyl ketone	31	162
Ethyl isobutyl sulfide	22	420
Ethyl isobutyrate	36	251
Ethyl isocrotonate	53	252
Ethyl isopropyl ketone	18	161
Ethyl isopropylacetaldehyde	39	146
1-Ethyl-2-isopropylbenzene	45	37
1-Ethyl-3-isopropylbenzene	42	37
1-Ethyl-4-isopropylbenzene	57	37
Ethyl isopropyl carbinol	21	81
Ethyl isopropyl ether	9	131
3-Ethyl-4-isopropyl-1-methylbenzene	100	39
Ethyl isopropyl sulfide	12	420
1-Ethylisoquinoline	83	321
3-Ethylisoquinoline	88	321
Ethyl isovalerate	67	252
Ethyl *d,l*-lactate	100	254
Ethyl laurate	316	268
Ethyl levulinate	162	166
" "	181	259
Ethyl malonate	173	258
Ethylmalonic acid	136	198
" "	139	430
Ethyl malonic acid diamide	454	244
Ethylmalonic acid monoanilide	284	238
Ethyl malononitrile	67	350
d,l-Ethyl mandelate	40	275
Ethyl margarate	6	273
Ethyl mercaptan	2	413
Ethyl methacrylate	45	251
Ethyl methoxyacetate	60	252
Ethyl 2-methoxybenzoate	305	267
Ethyl 3-methoxybenzoate	299	267
Ethyl 4-methoxybenzoate	315	268
Ethyl β-methoxyethyl carbonate	143	257
Ethyl 1-methoxyethyl ketone	36	162
Ethyl methoxymethyl ketone	29	162
Ethylmethylacetic acid	14	190
Ethyl methylacetoacetate	139	256
D,L-Ethylmethylacetyl chloride	15	212
Ethyl methyl acetylene	13	28
3-Ethyl-2-methylacrolein	43	146
trans-β-Ethyl-α-methylacrylic acid	2	193
Ethyl methyl amine	5	295
N-Ethyl-N-methylaniline	57	320
N-Ethyl-3-methylaniline	122	299
1-Ethyl-2-methylbenzene	12	35
1-Ethyl-3-methylbenzene	9	35
1-Ethyl-4-methylbenzene	10	35
Ethyl 2-methylbenzoate	230	262
2-Ethyl-2-methylbutanoic acid	32	191
2-Ethyl-3-methylbutanoic acid	24	192
4-Ethyl-4-methylbutanoic acid	42	191
2-Ethyl-3-methyl-1-butene	95	15
Ethyl 3-methylbutyl sulfide	34	421
Ethyl methyl carbinol	7	80
1-Ethyl-2-methylcyclohexane	143	5
d,l-cis-1-Ethyl-3-methylcyclohexane	161	5
cis-1-Ethyl-4-methylcyclohexane	148	5
trans-1-Ethyl-4-methylcyclohexane	146	5
1-Ethyl-2-methyl-3-cyclohexenone	101	171
2-Ethyl-4-methylcyclohexanone	161	166
d-2-Ethyl-5-methylcyclohexanone	39	169
d,l-2-Ethyl-5-methylcyclohexanone	154	166
1-Ethyl-3-methylcyclohexene	274	21
1-Ethyl-4-methylcyclohexene	273	21
1-Ethyl-5-methylcyclohexene	277	21
5-Ethyl-1-methylcyclohexene-3-one	180	167
1-Ethyl-1-methylcyclopentane	75	4
cis-1-Ethyl-2-methylcyclopentane	85	4
trans-1-Ethyl-2-methylcyclopentane	73	4
cis-1-Ethyl-3-methylcyclopentane	74	4
trans-1-Ethyl-3-methylcyclopentane	72	4
3-Ethyl-2-methylcyclopentanone	117	164
3-Ethyl-4-methylcyclopentanone	129	165
Ethyl methyl ether	2	131
3-Ethyl-3-methylglutaric acid	221	430
β-Ethyl-β-methylglutaric anhydride	3	225
3-Ethyl-2-methylheptane	211	6
3-Ethyl-3-methylheptane	198	6
3-Ethyl-4-methylheptane	220	6
4-Ethyl-2-methylheptane	181	6
4-Ethyl-3-methylheptane	221	6
4-Ethyl-4-methylheptane	222	6
5-Ethyl-2-methylheptane	175	5
5-Ethyl-3-methylheptane	187	6
3-Ethyl-2-methylhexane	109	4
3-Ethyl-3-methylhexane	119	5
4-Ethyl-2-methylhexane	96	4
4-Ethyl-3-methylhexane	115	4
Ethyl methyl ketone	3	161
Ethylmethylmalonic acid	125	430
1-Ethyl-5-methylnaphthalene	13	43
2-Ethyl-6-methylnaphthalene	16	43
3-Ethyl-2-methylpentane	58	3
3-Ethyl-3-methylpentane	65	4
2-Ethyl-4-methylpentanoic acid	13	192
2-Ethyl-3-methyl-1-pentene	174	17
2-Ethyl-4-methyl-1-pentene	159	17
3-Ethyl-2-methyl-1-pentene	156	17
3-Ethyl-3-methyl-1-pentene	166	17
3-Ethyl-4-methyl-1-pentene	145	17
3-Ethyl-4-methyl-*cis*-2-pentene	189	18
3-Ethyl-4-methyl-*trans*-2-pentene	186	18
1-Ethyl-2-methylphenanthrene	74	46
1-Ethyl-7-methylphenanthrene	79	46
3-Ethyl-6-methylphenanthrene	22	43
7-Ethyl-1-methylphenanthrene	92	46
3-Ethyl-5-methylphenol	101	434
1-Ethyl-2-methylpiperidine	423	439
3-Ethyl-4-methylpyridine	54	320
Ethyl-2-methylstyryl ketone	56	170
Ethyl methyl-sulfide	2	420

	Compound No.	Page No.
2-Ethyl-3-methylthiophene	32	424
2-Ethyl-5-methylthiophene	31	423
3-Ethyl-5-methylthiophene	37	424
N-Ethylmorpholine	282	438
Ethyl myristate	341	270
1-Ethylnaphthalene	152	41
2-Ethylnaphthalene	151	41
Ethyl-1-naphthoate	351	271
Ethyl-2-naphthoate	28	274
Ethyl-1-naphthyl ether	108	136
Ethyl-2-naphthyl ether	19	137
Ethyl-1-naphthyl ketone	216	168
Ethyl-2-naphthyl ketone	71	174
Ethyl-2-naphthyl sulfide	1	425
Ethyl nitrate	16	250
Ethyl nitrite	1	250
N-Ethyl-4-nitroacetanilide	185	235
N-Ethyl-4-nitroaniline	183	308
1-Ethyl-2-nitrobenzene	23	336
1-Ethyl-4-nitrobenzene	28	336
Ethyl-2-nitrobenzoate	26	274
" " "	321	268
Ethyl-3-nitrobenzoate	54	275
Ethyl-4-nitrobenzoate	77	277
Ethyl-2-nitrocinnamate	51	275
Ethyl-3-nitrocinnamate	117	279
Ethyl-4-nitrocinnamate	160	281
Ethyl-4-nitrophenyl-sulfide	17	425
Ethyl-3-nitrosalicylate	150	280
Ethyl-5-nitrosalicylate	136	280
3-Ethyloctane	225	6
4-Ethyloctane	226	6
Ethyl-*n*-octanoate	190	259
Ethyl orthoformate	85	253
Ethyl orthosilicate	113	255
Ethyl oxalate	145	257
Ethyl oxamate	176	235
" "	146	280
Ethyl oxanilate	33	231
" "	92	277
Ethyl palmitate	14	273
Ethyl pelargonate	231	262
2-Ethylpentanamide	136	234
2-Ethylpentananilide	86	233
3-Ethylpentane	39	3
Ethyl *n*-pentanoate	86	253
2-Ethyl pentanoic acid	36	191
" " "	428	432
2-Ethyl-1-pentanol	56	83
3-Ethyl-3-pentanol	37	82
3-Ethyl-2-pentanone	46	162
2-Ethyl-1-pentene	106	16
3-Ethyl-1-pentene	85	15
3-Ethyl-2-pentene	112	16
3-Ethyl-3-penten-1-yne	33	29
3-Ethyl-1-pentyne	28	29
1-Ethylphenanthrene	46	44
2-Ethylphenanthrene	55	45
9-Ethylphenanthrene	48	44
2-Ethylphenol	6	94
" "	106	435
3-Ethylphenol	9	94
" "	90	434
4-Ethylphenol	40	98
" "	99	434
Ethyl phenoxyacetate	289	266
Ethyl phenoxymethyl ketone	10	169
d,l-α-Ethylphenylacetamide	65	232
Ethyl phenylacetate	233	262
d,l-α-Ethylphenylacetic acid	26	193
(4-Ethylphenyl)acetic acid	362	432
Ethylphenylglycolaldehyde	22	150
3-Ethyl-3-phenylhexane	141	40
sym-Ethylphenylhydrazine	153	300
unsym-Ethylphenylhydrazine	152	299
Ethyl-β-phenylpropionate	282	265
Ethyl phenyl sulfide	47	424
Ethyl phthalate	336	270
α-Ethylpimelic acid	27	191
N-Ethylpiperidine	12	319
"	393	439
2-Ethylpiperidine	59	297
3-Ethylpiperidine	63	297
4-Ethylpiperidine	62	297
α-Ethylpiperidine	59	297
β-Ethylpiperidine	63	297
γ-Ethylpiperidine	62	297
Ethyl piperonylate	3	273
Ethyl pivalate	44	251
Ethylpropiolic acid	42	194
Ethyl propionate	27	251
Ethyl-*n*-propylacetic acid	36	191
Ethyl propyl acetylene	38	29
2-Ethyl-3-*n*-propylacrolein	61	147
Ethyl propyl amine	20	295
1-Ethyl-2-propylbenzene	72	38
1-Ethyl-3-propylbenzene	68	38
1-Ethyl-4-propylbenzene	78	38
Ethyl *n*-propyl carbinol	30	81
Ethyl-*n*-propyl ether	14	131
Ethyl *n*-propyl ketone	22	161
Ethyl *n*-propylmalonic acid	165	430
Ethyl 3-propylphenyl ketone	24	169
Ethyl *n*-propylsulfide	16	420
2-Ethylpyridine	22	319
	239	437
3-Ethylpyridine	28	319
	221	437
4-Ethylpyridine	33	319
"	238	437
Ethyl pyromucate	35	274
2-Ethyl-2-pyrroline	288	438
Ethyl pyruvate	101	254
2-Ethylquinoline	77	321
3-Ethylquinoline	9	322
4-Ethylquinoline	100	321
α-Ethylquinoline	77	321
γ-Ethylquinoline	9	322
β-Ethylquinoline	100	321
Ethyl salicylate	249	263
" "	16	94
Ethyl stearate	33	274
Ethyl succinic acid	300	431
Ethyl sulfate	188	259
Ethyl sulfide	6	420
1-Ethyl-1,2,3,4-tetrahydronaphthalene	134	40
2-Ethyl-1,2,3,4-tetrahydronaphthalene	132	40
5-Ethyl-1,2,3,4-tetrahydronaphthalene	144	40
6-Ethyl-1,2,3,4-tetrahydronaphthalene	142	40
1-Ethyltetralin	134	40
2-Ethyltetralin	132	40
5-Ethyltetralin	144	40
6-Ethyltetralin	142	40
2-Ethyltetramethylene sulfide	28	423
Ethyl α-thienyl ketone	185	167
2-Ethylthiirane	6	423
2-Ethylthiolane	28	423
2-Ethylthiophene	14	423
3-Ethylthiophene	15	423
Ethyl 2-toluate	230	262
Ethyl 3-toluate	248	263
Ethyl 4-toluate	251	263

	Compound No.	Page No.
m-Ethyltoluene	9	35
o-Ethyltoluene	12	35
p-Ethyltoluene	10	35
N-Ethyltoluene-4-sulfonamide	11	392
N-Ethyl-*m*-toluidine	122	299
Ethyl 2-(-4-toluyl) benzoate	94	277
Ethyl 2-tolyl ether	70	134
Ethyl 3-tolyl ether	76	135
Ethyl 4-tolyl ether	75	135
Ethyl 4-tolyl sulfide	54	421
Ethyl trichloroacetate	117	255
Ethyl trifluoroacetate	5	250
Ethyl trimethylacetate	44	251
2-Ethyl-1,3,5-trimethylbenzene	99	39
3-Ethyl-1,2,4-trimethylbenzene	108	39
4-Ethyl-1,2,3-trimethylbenzene	113	39
5-Ethyl-1,2,3-trimethylbenzene	107	39
5-Ethyl-1,2,4-trimethylbenzene	101	39
6-Ethyl-1,2,4-trimethylbenzene	102	39
3-Ethyl-2,2,3-trimethylpentane	227	6
3-Ethyl-2,2,4-trimethylpentane	157	5
3-Ethyl-2,4,5-trimethylthiophene	53	424
Ethyl undecylenate	309	267
Ethylurethane	4	231
Ethyl *n*-valerate	86	253
Ethyl vinyl accetylene	25	29
Ethyl vinyl ether	6	131
Ethyl vinyl ketone	11	161
Ethyl vinyl sulfide	7	420
Ethyne	1	28
Ethynyl methyl ketone	4	161
Ethynyl phenyl ketone	54	173
Eucarvane	192	6
Eucarvene	290	22
Eugenol	23	95
"	97	434
Eugenol acetate	23	274
Eugenol methyl ether	99	136
Euxanthone	567	126

F

	Compound No.	Page No.
Fenchane	145	5
α-Fenchane	197	6
β-Fenchene	278	21
δ-Fenchene	245	20
ξ-Fenchene	266	21
β-Fencholenonitrile	73	351
d-Fenchone	149	166
d, *l*-Fenchyl alcohol	16	88
Flavol	586	127
Flavopurpurin	62	185
Fluoranthrene	113	47
Fluorene	116	47
Fluorene-2-acetic acid	301	205
Fluorene-9-carboxylic acid	353	208
Fluorene-9-carboxylic acid chloride	18	216
Fluorene-2-sulfonamide	342	405
Fluorene-2-sulfonyl chloride	252	389
Fluorenone	115	176
Fluorenone-1-carboxylic acid chloride	30	216
Fluorenone-4-carboxylic acid chloride	29	216
Di-2-fluorenylmethane	186	51
Fluoroacetamide	151	234
4-Fluoroacetanilide	288	239
Fluoroacetic acid	12	193
" "	103	429
Fluoroacetonitrile	4	345
4-Fluoroacetophenone	153	166
Fluoroacetyl chloride	3	212
Fluoroacetyl fluoride	3	211
2-Fluoroacrylic acid	106	430
2-Fluoroaniline	75	297
"	86	436
3-Fluoroaniline	85	297
" "	103	436
4-Fluoroaniline	82	297
" "	170	437
2-Fluorobenzaldehyde	65	147
3-Fluorobenzaldehyde	62	147
4-Fluorobenzaldehyde	64	147
4-Fluorobenzamide	293	239
Fluorobenzene	2	69
4-Fluorobenzenesulfonamide	67	394
4-Fluorobenzenesulfonic acid	19	371
4-Fluorobenzenesulfonyl chloride	19	381
2-Fluorobenzoic acid	187	430
3-Fluorobenzoic acid	267	431
4-Fluorobenzoic acid	285	204
" "	304	431
4-Fluorobenzonitrile	27	358
2-Fluorobenzoyl chloride	43	213
3-Fluorobenzoyl chloride	37	212
4-Fluorobenzoyl chloride	39	212
2-Fluoroethanol	9	80
3-Fluoromandelic acid	328	431
1-Fluoronaphthalene	8	69
2-Fluoronaphthalene	9	69
4-Fluoronaphthalene-1-sulfonamide	328	404
5-Fluoronaphthalene-1-sulfonamide	303	403
6-Fluoronaphthalene-2-sulfonamide	82	395
4-Fluoronaphthalene-1-sulfonanilide	112	396
6-Fluoronaphthalene-2-sulfonanilide	74	394
2-Fluoronaphthalene-6-sulfonic acid	24	371
4-Fluoronaphthalene-1-sulfonic acid	153	376
5-Fluoronaphthalene-1-sulfonic acid	143	376
4-Fluoronaphthalene-1-sulfonyl chloride	109	384
5-Fluoronaphthalene-1-sulfonyl chloride	193	387
6-Fluoronaphthalene-2-sulfonyl chloride	139	385
4-Fluoro-1-naphthylamine	41	304
4-Fluoro-1-nitrobenzene	2	337
3-Fluoro-2-nitrophenol	22	97
3-Fluoro-4-nitrophenol	29	97
5-Fluoro-2-nitrophenol	13	96
2-Fluorophenol	53	434
3-Fluorophenol	70	434
4-Fluorophenol	93	434
(2-Fluorophenoxy) acetic acid	153	430
(3-Fluorophenoxy) acetic acid	152	430
(4-Fluorophenoxy) acetic acid	161	430
(4-Fluorophenyl) acetic acid	333	431
3-(2-Fluorophenyl) alanine	53	429
3-(3-Fluorophenyl) alanine	49	429
3-(4-Fluorophenyl) alanine	54	429
2-Fluoropropionic acid	5	192
2-Fluoropyridine	10	436
3-Fluoropyridine	78	436
2-Fluorotoluene	5	69
3-Fluorotoluene	6	69
4-Fluorotoluene	7	69
Formaldehyde	1	144
Formaldehyde cyanohydrine	55	349
Formamide	4	230
Formanilide	5	231
Formic acid	2	190
" "	243	431
Form-N-piperidide	6	230
4-Formylbenzenesulfonamide	62	394
4-Formylbenzenesulfonic acid	17	371
2-Formylbenzoic acid	86	157
3-Formylbenzoic acid	122	159
" "	271	204
4-Formylbenzoic acid	130	160

	Compound No.	Page No.
3-Formylbenzonitrile	101	361
3-Formylbenzoyl chloride	31	214
4-Formylbenzoyl chloride	9	216
N-Formylglycine	198	430
2-Formyl-6-methoxyphenol	33	434
4-Formyl-2-methoxyphenol	28	434
5-Formyl-2-methoxyphenol	54	434
5-Formyl-2-nitrophenol	14	434
2-Formylphenol	21	434
3-Formylphenol	204	106
" "	35	434
4-Formylphenol	30	434
N-Formylpiperidine	6	230
3-Formylsalicylic acid	123	160
5-Formylsalicylic acid	129	160
4-Formylstyrene	18	152
Fritzschés reagent	137	342
D-Fructose	7	329
D-Fucose	33	331
DL-Fucose	44	332
L-Fucose	34	331
Fumaric acid	399	209
" "	142	430
Fumaric acid diamide	501	246
Fumaric acid dianilide	508	246
Fumaronitrile	127	363
Fumaryl dichloride	38	215
3-Furaldehyde	46	146
Furamide	262	238
Furan	3	131
2-Furanacrylamide	335	240
Furanacrylic acid	208	201
Furancarbinol	59	134
2-Furancarbonitrile	34	347
2-Furancarboxaldehyde	55	147
2-Furancarboxylic acid	184	200
3-Furancarboxylic acid	159	199
Furanilide	197	236
Furfural	55	147
Furfuralacetone	23	172
Furfuralacetophenone	10	172
Furfural diacetate	27	154
Furfuryl acetate	130	256
Furfuryl alcohol	64	83
" "	59	134
Furfurylamine	57	296
2-(Furfurylamino) ethylamine	345	438
Furfuryl diacetate	68	276
Furil	185	178
2-Furoic acid	184	200
3-Furoic acid	159	199
Furoin	58	90
"	166	177
α-Furonitrile	34	347
Furoyl chloride	34	212
Furoyl furyl carbinol	58	90
2-Furylacetic acid	65	195
2-(2-Furyl)acrolein	31	154
β-(2-Furyl) acrylic acid	208	201
" " "	335	240
2-Furylcarbinol	64	83
α-Furylmethylamine	57	296
2-Furyl methyl ketone	15	172
2-Furyl phenyl ketone	40	173
3-(2-Furyl) propionaldehyde	2	150
2-Furyl-2-thenoylmethane	59	174

G

G-Acid	12	380
α-D-Galactose	53	332
β-D-Galacturonic acid	42	332
DL-Galactose	47	332
L-Galactose	46	332
3-(β-D-Galactosido)-D-arabinose	52	332
4-(β-D-Galactosido)-D-glucose	64	333
6-(α-D-Galactosido)-D-glucose	2	329
2-[6-(α-D-Galactosido]α-D-glucoside)-β-D-fructose	14	330
Gallacetophenone	454	120
"	188	178
Gallaldehyde	128	160
Gallaldehyde trimethyl ether	67	156
Gallamide	492	246
Gallanilide	442	244
Gallic acid	386	209
Gallodiacetophenone	486	122
Gammexane, 666	3	64
Gentiobiose	60	333
Geranial	82	148
Geraniol	120	86
Geraniolene	254	20
Geranyl acetate	264	264
Gibberene	111	47
α-D-Glucoheptose	61	333
D-Glucoheptulose	56	333
Glucosamine	12	329
α-D-Glucose	35	331
α-L-Glucose	30	331
β-D-Glucose	37	331
2-(α-D-Glucosido)-β-D-fructose	55	332
3-[α-D-Glucosido]-D-fructose	39	331
2-[3-(α-D-Glucosido)-D-fructosido]-α-D-glucose	38	331
1-(α-D-Glucosido)-α-D-glucose	62	333
4-(α-D-Glucosido)-β-D-glucose	43	332
4-(α-D-Glucosido)-β-D-glucose	65	333
6-(β-D-Glucosido)-D-glucose	60	333
4-(β-D-Glucosido)-β-D-mannose	57	333
β-D-Glucuronic acid	48	332
trans-Glutaconic acid	192	201
" " "	245	431
L-Glutamamide	328	240
DL-Glutamic acid	30	285
" "	58	429
L-Glutamic acid	41	286
L-Glutamine	24	285
Glutaraldehyde	69	147
Glutaric acid	107	197
" "	357	432
Glutaric acid diamide	360	241
Glutaric acid dianilide	472	245
Glutaric anhydride	20	225
Glutaronitrile	102	353
Glutaryl dichloride	46	213
DL-Glyceraldehyde (*dimer*)	115	159
" "	28	330
Glycerol	131	86
α-Glyceryl phenyl ether	40	89
" " " "	41	138
Glyceryl triacetate	298	267
Glyceryl tribenzoate	102	278
Glyceryl tributyrate	352	271
Glyceryl tripropionate	335	269
Glyceryl tristearate	100	278
Glycine	57	286
"	83	429
Glycineamide	95	305
Glycinonitrile	22	356
Glycol	101	85
Glycolaldehyde	82	157
"	6	329
Glycolaldehyde phenyl ether	79	148
Glycolanilide	102	233

	Compound No.	Page No.
Glycolamide	189	236
Glycolic acid	79	196
Glycolic acid ethyl ether	34	191
Glycolic acid methyl ether	31	191
Glycollic aldehyde	6	329
Glycolonitrile	55	349
Glycylglycine	77	288
Glyoxal	5	144
Guaiacol	12	96
"	9	137
Guaiacol acetate	261	264
Guaiacol carbonate	126	279
δ-Guaiazulene	6	43
Guaiene	109	47
Guanidinoacetic acid	121	430
D-Gulose	10	328
DL-Gulose	3	330

H

Hemimellitene	18	36
Hendecanal	6	150
n-Hendecanamide	128	234
n-Hendecananilide	37	231
1-Hendecane	247	7
n-Hendecanoic acid	7	193
n-Hendecanoic anhydride	8	225
1-Hendecanol	125	86
d, *l*-2-Hendecanol	117	86
2-Hendecanone	186	167
6-Hendecanone	183	167
1-Hendecanonitrile	90	352
10-Hendecanonitrile	92	352
1-Hendecene	328	24
2-Hendecene	326	24
5-Hendecene	327	24
10-Hendecen-1-oic acid	4	193
w-Hendecenoyl chloride	6	214
n-Hendecylamine	155	300
"	418	439
n-Hendecylbenzene	175	42
n-Hendecyl chloride	52	56
n-Hendecylcyclohexane	275	7
n-Hendecylcyclopentane	271	7
α-Hendecyleneamide	67	232
n-Hendecyl methyl ketone	9	172
n-Hendecyl phenyl ketone	45	173
n-Hendecyl sulfide	7	425
1-Hendecyne	57	30
n-Heneicosane	17	8
11-Heneicosanone	84	174
1-Heneicosene	4	26
Heneicosylcyclohexane	28	8
Heneicosylcyclopentane	19	8
1-Heneicosyne	8	31
2-Heneicosyne	7	31
n-Hentriacontane	52	9
1-Hentriacontene	14	26
Hentriacontylcyclohexane	63	9
Hentriacontylcyclopentane	51	9
1-Hentriacontyne	18	31
n-Heptacosane	38	8
1-Heptacosene	12	26
Heptacosylcyclohexane	50	9
Heptacosylcyclopentane	37	8
1-Heptacosyne	14	31
Heptadecanamide	149	234
n-Heptadecane	5	8
Heptadecane-1,1-dicarboxylic acid	161	199
n-Heptadecanoic acid	55	195
n-Heptadecanoic anhydride	25	225
1-Heptadecanol	30	89
"	11	153
9-Heptadecanone	50	173
Heptadecanonitrile	24	358
1-Heptadecene	336	24
Heptadecylamine	45	304
Heptadecylcyclohexane	15	8
Heptadecylcyclopentane	7	8
n-Heptadecyl methyl ketone	61	174
1-Heptadecyne	1	31
1,2-Heptadiene	135	16
1,4-Heptadiene	119	16
2,4-Heptadiene	146	17
1,6-Heptadiyne	41	29
Heptafluoro-*n*-butyric acid	1	429
4,4,5,5,6,6,6-Heptafluorohexanoic acid	317	431
Heptanal	52	146
Heptanamide	95	233
Heptananilide	35	231
n-Heptane	41	3
Heptane-1,7-dicarboxylic acid	132	198
2,4-Heptanedione	121	165
Heptane-1-sulfonamide	16	392
Heptane-1-sulfonic acid	4	371
Heptane-1-sulfonyl chloride	6	381
1-Heptanethiol	29	414
2,4,6-Heptanetrione	48	173
n-Heptanoic acid	44	191
" "	455	432
n-Heptanoic anhydride	16	223
1-Heptanol	75	84
d, *l*-2-Heptanol	50	82
d, *l*-4-Heptanol	48	82
2-Heptanone	69	163
3-Heptanone	64	163
4-Heptanone	52	162
Heptanonitrile	56	349
n-Heptanoyl chloride	35	212
Heptatriacontane	70	9
1-Heptatriacontene	20	26
1-Heptatriacontyne	24	31
2-Heptenal	17	150
1-Heptene	104	15
cis-2-Heptene	116	16
trans-2-Heptene	114	16
cis-3-Heptene	110	16
trans-3-Heptene	109	16
1-Hepten-4-one	60	163
1-Hepten-5-one	3	169
1-Hepten-6-one	12	169
2-Hepten-4-one	81	163
cis-3-Hepten-2-one	37	169
trans-3-Hepten-2-one	21	169
3-Hepten-6-one	15	169
5-Hepten-2-one	71	163
n-Heptoic acid	44	191
n-Heptyl acetate	158	257
n-Heptyl acetylene	47	30
n-Heptyl alcohol	75	84
sec-Heptyl alcohol	50	82
n-Heptylamine	64	297
"	424	439
n-Heptylbenzene	145	40
n-Heptyl bromide	22	58
n-Heptyl *n*-butyrate	223	262
n-Heptyl *n*-caproate	304	267
n-Heptyl *n*-caprylate	337	270
n-Heptyl chloride	37	56
n-Heptylcyclohexane	264	7
n-Hepthylcyclopentane	257	7
n-Heptyl *n*-enanthate	327	269
n-Heptyl ether	103	136

	Compound No.	Page No.
n-Heptyl formate	132	256
n-Heptyl *n*-heptanoate	327	269
n-Heptyl *n*-hexanoate	304	267
n-Heptyl iodide	19	60
n-Heptyl mercaptan	29	414
n-Heptyl methyl ketone	150	166
1-Heptylnaphthalene	179	42
2-Heptylnaphthalene	180	42
n-Heptyl *n*-octanoate	337	270
n-Heptyl *n*-pentanoate	276	265
n-Heptyl propionate	195	260
n-Heptyl sulfide	62	422
n-Heptyl *n*-valerate	276	265
2-Heptynal	4	152
1-Heptyne	35	29
2-Heptyne	39	29
3-Heptyne	38	29
Heptyne-1-carboxylic acid	16	190
2-Heptynoic acid	3	192
3-Heptynoic acid	2	192
Hexabenzobenzene	204	51
Hexachlorobenzene	35	72
Hexachloroethane	5	64
n-Hexacosane	34	8
Hexacosylcyclohexane	46	9
Hexacosylcyclopentane	32	8
1-Hexacosyne	13	31
n-Hexadecanal	6	153
n-Hexadecane	2	8
Hexadecane-1-sulfonamide	29	393
Hexadecane-1-sulfonic acid	7	371
Hexadecane-1-sulfonyl chloride	47	382
Hexadecanethiol	2	416
n-Hexadecanoic acid	58	195
n-Hexadecanoic anhydride	24	225
1-Hexadecanol	25	88
Hexadecanonitrile	18	357
1-Hexadecene	335	24
n-Hexadecylacetate	13	273
n-Hexadecyl bromide	1	59
Hexadecyl chloride	54	56
Hexadecylcyclohexane	12	8
Hexadecylcyclopentane	4	8
n-Hexadecyl iodide	1	61
n-Hexadecyl palmitate	66	276
n-Hexadecyl stearate	79	277
n-Hexadecyl sulfide	33	425
1-Hexadecyne	64	30
2,4-Hexadienal	5	152
1,2-Hexadiene	65	14
trans-1,3-Hexadiene	42	13
1,(*cis*-or *trans*)3-Hexadiene	59	14
1,4-Hexadiene	57	14
1,5-Hexadiene	38	13
2,3-Hexadiene	51	13
2,4-Hexadiene	75	14
2,4-Hexadien-1-ol	11	88
1,5-Hexadien-3-yne	26	29
1,4-Hexadiyne	21	28
1,5-Hexadiyne	29	29
Hexahydrobenzaldehyde	56	147
Hexahydrobenzanilide	272	238
Hexahydrobenzoic acid	10	193
Hexahydrobenzoic anhydride	4	225
Hexahydrobenzoyl chloride	36	212
Hexahydrobenzyl alcohol	84	84
Hexahydrobenzylamine	68	297
cis-Hexahydro-*m*-cresol	65	83
trans-Hexahydro-*m*-cresol	68	83
cis-Hexahydro-*o*-cresol	58	83
trans-Hexahydro-*o*-cresol	60	83
cis-Hexahydro-*p*-cresol	66	83
trans-Hexahydro-*p*-cresol	67	83
1,2,3,4,5,6-Hexahydrocyclohexane	67	90
cis-Hexahydroisophthalic anhydride	19	223
Hexahydrophenylacetyl chloride	25	214
cis-Hexahydrophthalic anhydride	6	225
trans-DL-Hexahydrophthalic acid anhydride	63	226
L-Hexahydrotyrosine	93	288
Hexahydroxybenzene	503	122
Hexamethylbenzene	167	50
Hexamethylenediamine	30	303
Hexamethylene sulfide	41	424
Hexamethylene tetramine	102	325
Hexanal	38	146
n-Hexanamide	115	233
n-Hexananilide	88	233
n-Hexane	24	3
1,6-Hexanedial	26	151
Hexane-1,6-dicarboxylic acid	215	202
2,3-Hexanedione	82	163
2,5-Hexanedione	148	165
1,6-Hexanedithiol	46	415
1,2,3,4,5,6-Hexanehexol	64	90
1-Hexanethiol	21	413
2-Hexanethiol	19	413
n-Hexanoic acid	33	191
" "	454	432
n-Hexanoic anhydride	15	223
1-Hexanol	49	82
d, *l*-2-Hexanol	33	81
3-Hexanol	30	81
2-Hexanone	24	161
3-Hexanone	22	161
n-Hexanonitrile	42	348
n-Hexanoyl bromide	12	218
n-Hexanoyl chloride	32	212
Hexatriacontane	68	9
1-Hexatriacontene	19	26
Hexatriacontylcyclohexane	75	9
Hexatriacontylcyclopentane	67	9
1-Hexatriacontyne	23	31
cis-1,3,5-Hexatriene	73	14
trans-1,3,5-Hexatriene	72	14
2-Hexenal	50	146
3-Hexenal	51	146
1-Hexene	40	13
cis-2-Hexene	53	13
trans-2-Hexene	49	13
2-Hexene (*cis*,*trans* mixture)	50	13
cis-3-Hexene	44	13
trans-3-Hexene	46	13
3-Hexene (*cis*, *trans* mixture)	45	13
2-Hexenoic acid	15	193
" "	425	432
3-Hexenoic acid	394	432
4-Hexenoic acid	426	432
5-Hexenoic acid	427	432
4-Hexen-3-one	43	162
5-Hexen-2-one	28	162
1-Hexen-3-yne	25	29
1-Hexen-4-yne	27	29
2-Hexen-4-yne	30	29
n-Hexyl acetate	133	256
n-Hexyl acetylene	42	29
n-Hexyl alcohol	49	82
n-Hexylamine	46	296
N-*n*-Hexylaniline	216	437
n-Hexylbenzene	124	39
n-Hexyl bromide	20	58
2-Hexyl bromide	19	58
n-Hexyl *n*-butyrate	186	259
n-Hexyl *n*-caproate	278	265
n-Hexyl *n*-caprylate	328	269

	Compound No.	Page No.
n-Hexyl chloride	34	56
2-Hexyl chloride	31	56
3-Hexyl chloride	30	56
n-Hexylcyclohexane	256	7
n-Hexylcyclopentane	250	7
n-Hexyl *n*-decanoate	278	265
n-Hexyl *n*-enanthate	303	267
n-Hexyl ether	95	135
n-Hexyl ethyl ether	53	133
n-Hexyl formate	103	254
n-Hexyl *n*-heptanoate	303	267
n-Hexyl iodide	18	60
n-Hexyl mercaptan	21	413
sec-Hexyl mercaptan	19	413
n-Hexyl methyl acetylene	45	29
n-Hexyl methyl ether	48	133
n-Hexylmethylglycolic acid	22	193
n-Hexyl methyl ketone	114	164
1-Hexylnaphthalene	176	42
2-Hexylnaphthalene	177	42
n-Hexyl *n*-octanoate	328	269
n-Hexyl *n*-pentanoate	228	262
n-Hexyl phenyl carbinol	129	86
n-Hexyl phenyl ketone	213	168
n-Hexyl propionate	155	257
2-Hexylpyridine	242	437
n-Hexyl *n*-valerate	228	262
1-Hexyne	17	28
2-Hexyne	24	29
3-Hexyne	22	28
Hippuramide	383	242
Hippuranilide	444	244
Hippuric acid	296	205
" "	398	242
" "	25	285
DL-Histidine	31	429
L-Histidine	95	288
Homoanthranilic acid	18	284
DL-Homoaspartic acid	61	287
Homophenetole	71	134
Homophthalic acid	292	205
Homophthalic anhydride	64	226
Homopimanthrene	79	46
d-Hydnocarpamide	172	235
Hydnocarponitrile	4	355
Hydrazobenzene	278	311
1-Hydrindamine	125	299
2-Hydrindamine	143	299
4-Hydrindamine	150	299
5-Hydrindamine	21	303
α-Hydrindone	32	173
Hydrocinnamaldehyde	81	148
Hydrocinnamamide	140	234
Hydrocinnamanilide	104	233
Hydrocinnamic acid	38	194
Hydrocinnamoyl chloride	48	213
Hydrocinnamyl alcohol	123	86
Hydrophlorone	540	124
Hydroquinone	452	119
"	117	435
Hydroquinone diacetate	154	281
Hydroquinone dibenzoate	170	281
Hydroquinone dibenzyl ether	55	139
Hydroquinone diethyl ether	43	139
Hydroquinone dimethyl ether	34	138
Hydroquinone monomethyl ether	48	99
" " "	32	138
Hydroquinone triacetate	133	279
Hydrotropilidene	211	19
1-Hydroxyacenaphthene	353	114
Hydroxyacetaldehyde	82	157
2-Hydroxyacetanilide	511	123
3-Hydroxyacetanilide	375	115
4′-Hydroxyacetanilide	443	119
'	340	240
Hydroxyacetic acid	79	196
' "	263	431
α-Hydroxyacetophenone	47	89
' '	150	177
2-Hydroxyacetophenone	10	96
' "	7	172
3-Hydroxyacetophenone	180	105
" "	121	176
4-Hydroxyacetophenone	223	107
" '	141	176
2-Hydroxyaniline	456	120
" "	383	315
" "	88	434
3-Hydroxyaniline	277	110
" "	263	311
' "	88	434
4-Hydroxyaniline	476	121
"	396	316
1-Hydroxyanthracene	381	115
9-Hydroxyanthracene	269	110
1-Hydroxy-9,10-anthraquinone	32	183
2-Hydroxy-9,10-anthraquinone	60	185
Hydroxyanthrarufin	49	184
2-Hydroxyazobenzene	134	103
4-Hydroxyazobenzene	383	116
2-Hydroxybenzaldehyde	4	94
"	71	148
3-Hydroxybenzaldehyde	204	106
'	90	158
'	35	434
4-Hydroxybenzaldehyde	102	158
"	252	109
"	30	434
2-Hydroxybenzaldehyde-3-carboxylic acid	123	160
4-Hydroxybenzaldehyde-3-carboxylic acid	129	160
3-Hydroxybenzamide	342	240
4-Hydroxybenzamide	322	240
2-Hydroxybenzanilide	437	119
3-Hydroxybenzanilide	457	120
'	311	239
4-Hydroxybenzanilide	539	124
"	421	243
4-Hydroxybenzene-1,3-disulfonamide	412	408
4-Hydroxybenzene-1,3-disulfonanilide	324	404
4-Hydroxybenzene-1,3-disulfonic acid	190	378
4-Hydroxybenzene-1,3-disulfonyl chloride	115	384
4-Hydroxybenzenesulfonamide	218	400
4-Hydroxybenzenesulfonic acid	95	374
4-Hydroxybenzenesulfonyl chloride	228	388
4-Hydroxybenzenethiol	9	416
2-Hydroxybenzoic acid	400	117
" " "	244	203
" " "	116	430
3-Hydroxybenzoic acid	505	123
" " '	320	206
" " "	268	431
4-Hydroxybenzoic acid	532	124
" " "	343	207
" " "	406	432
2-Hydroxybenzonitrile	132	363
4-Hydroxybenzonitrile	158	364
" "	34	434
2-Hydroxybenzophenone	26	97
" "	28	173
3-Hydroxybenzophenone	251	109
" "	149	177
4-Hydroxybenzophenone	322	112
" "	165	177
7-Hydroxybenzo[a]pyrene	544	125

	Compound No.	Page No.
2-Hydroxybenzyl alcohol	49	89
" " "	146	103
4-Hydroxybenzyl alcohol	294	111
4-Hydroxybenzylamine	177	308
2-Hydroxybenzylaniline	234	310
N-4-Hydroxybenzylaniline	432	317
2-Hydroxybenzyl cyanide	163	364
4-Hydroxybenzyl cyanide	87	361
2-Hydroxybiphenyl	51	99
"	98	434
3-Hydroxybiphenyl	117	102
"	81	434
4-Hydroxybiphenyl	431	118
"	76	434
6-Hydroxybiphenyl-2-carboxylic acid	389	116
3-Hydroxy-2-butanone	39	82
" "	54	162
4-Hydroxy-*n*-butylamine	387	439
2-Hydroxybutyraldehyde	23	150
4-Hydroxybutyraldehyde	6	152
2-Hydroxybutyric acid	251	431
2-Hydroxybutyronitrile	3	355
4-Hydroxybutyronitrile	82	352
3-Hydroxycarbostyril	574	126
2-Hydroxy-3-chlorobutyric acid	151	430
2-Hydroxy-3-chloroisobutyric acid	174	430
2-Hydroxychrysazin	40	183
trans-2-Hydroxycinnamic acid	333	207
" " "	405	432
3-Hydroxycinnamic acid	367	432
4-Hydroxycinnamic acid	336	207
4-Hydroxycoumarin	516	123
5-Hydroxycoumarin	558	126
trans-2-Hydroxycyclohexanecarboxylic acid	419	432
cis-3-Hydroxycyclohexanecarboxylic acid	404	432
trans-3-Hydroxycyclohexanecarboxylic acid	442	432
cis-4-Hydroxycyclohexanecarboxylic acid	448	432
trans-4-Hydroxycyclohexanecarboxylic acid	420	432
2-(1′-Hydroxycyclopentyl)cyclopetanone	13	172
3-Hydroxydimethylaniline	144	103
α-Hydroxydiphenylacetic acid	227	202
α-Hydroxydiphenylacetyl chloride	23	214
2-Hydroxydiphenyl ether	216	107
2-Hydroxydiphenylmethane	46	99
4-Hydroxydiphenylmethane	137	103
2-Hydroxyethanethiol	22	413
β-Hydroxyethyl acetate	148	257
Di-2-Hydroxyethylamine	180	301
2-Hydroxyethylamine	329	438
4-Hydroxyethylbenzene	40	98
β-Hydroxyethyl formate	138	256
2-Hydroxyethyl 4-tolyl sulfide	59	421
1-Hydroxyfluorenone	246	109
3-Hydroxyglutaric acid	77	429
6-Hydroxy-*n*-hexylamine	406	439
4-Hydroxy-3-iodo-5-methoxybezaldehyde	470	121
2-Hydroxyisobutanoic acid	80	196
α-Hydroxyisobutyramide	105	233
α-Hydroxyisobutyranilide	249	237
α-Hydroxyisobutyric acid	80	196
" "	291	431
2-Hydroxyisobutyronitrile	18	346
4-Hydroxyisocaproic acid	453	432
3-Hydroxy-2-isopropylpropionaldehyde	7	152
Hydroxymalonic acid	240	202
2-Hydroxy-4-methoxyacetophenone	45	99
3-Hydroxy-4-methoxyaniline	275	311
2-Hydroxy-3-methoxybenzaldehyde	33	434
3-Hydroxy-4-methoxybenzaldehyde	54	434
4-Hydroxy-3-methoxybenzaldehyde	126	103
" " "	70	156
" " "	28	434
4-Hydroxy-3-methoxybenzoic acid	525	124
3-Hydroxy-4-methoxybenzonitrile	19	346
4-Hydroxy-3-methoxybenzyl alcohol	245	109
2-Hydroxy-3-methoxybenzylamine	51	434
3-Hydroxy-2-methoxybenzylamine	55	434
4-Hydroxy-3-methoxybenzylamine	56	434
4-Hydroxy-3-methoxystyryl methyl ketone	159	177
2-Hydroxy-3-methylaniline	156	307
2-Hydroxy-4-methylaniline	363	314
2-Hydroxy-5-methylaniline	302	312
3-Hydroxy-4-methylaniline	362	314
4-Hydroxy-2-methylaniline	390	315
4-Hydroxy-3-methylaniline	384	315
5-Hydroxy-2-methylaniline	324	313
2-Hydroxy-5-methylbenzaldehyde	41	155
3-Hydroxy-3-methyl-2-butanone	47	162
3-Hydroxy-3-methylbutyraldehyde	8	152
2-Hydroxy-2-methylbutyric acid	283	431
7-Hydroxy-4-methylcoumarin	480	121
5-Hydroxymethylfurfural	10	153
3-Hydroxy-3-methyl-2-heptanone	38	169
5-Hydroxy-5-methyl-3-heptanone	22	169
2-Hydroxy-2-methylhexanal	11	150
2-Hydroxy-5-methyl-4-nitroaniline	417	316
3-Hydroxy-3-methyl-2-pentanone	34	169
4-Hydroxy-4-methyl-2-pentanone	59	83
" " "	98	164
4-Hydroxy-2-methylquinoline	98	325
5-Hydroxy-2-methylquinoline	100	325
6-Hydroxy-2-methylquinoline	96	325
8-Hydroxy-2-methylquinoline	43	323
8-Hydroxy-4-methylquinoline	12	434
d,l-2-Hydroxy-2-methylsuccinic acid	154	199
1-Hydroxy-2-naphthaldehyde	49	155
2-Hydroxy-1-naphthaldehyde	132	103
" "	71	156
3-Hydroxy-2-naphthaldehyde	87	157
4-Hydroxy-1-naphthaldehyde	124	160
7-Hydroxynaphthalene-1,3-disulfonamide	294	403
2-Hydroxynaphthalene-1,5-disulfonanilide	392	407
2-Hydroxynaphthalene-1,6-disulfonanilide	276	402
2-Hydroxynaphthalene-1,7-disulfonanilide	394	407
2-Hydroxynaphthalene-3,6-disulfonanilide	316	404
2-Hydroxynaphthalene-1,5-disulfonic acid	19	380
2-Hydroxynaphthalene-1,6-disulfonic acid	9	380
2-Hydroxynaphthalene-1,7-disulfonic acid	20	380
2-Hydroxynaphthalene-3,6-disulfonic acid	16	380
7-Hydroxynaphthalene-1,3-disulfonic acid	12	380
2-Hydroxynaphthalene-1,5-disulfonyl chloride	280	390
2-Hydroxynaphthalene-1,6-disulfonyl chloride	171	386
2-Hydroxynaphthalene-1,7-disulfonyl chloride	262	389
7-Hydroxynaphthalene-1,3-disulfonyl chloride	251	389
3-Hydroxynaphthalene-2-sulfonamide	45	393
4-Hydroxynaphthalene-1-sulfonamide	188	399
6-Hydroxynaphthalene-2-sulfonamide	411	408
8-Hydroxynaphthalene-1-sulfonamide	365	406
4-Hydroxynaphthalene-1-sulfonanilide	310	404
5-Hydroxynaphthalene-1-sulfonanilide	315	404
6-Hydroxynaphthalene-2-sulfonanilide	167	398
7-Hydroxynaphthalene-1-sulfonanilide	296	403
1-Hydroxynaphthalene-2-sulfonic acid	8	380
3-Hydroxynaphthalene-2-sulfonic acid	11	371
4-Hydroxynaphthalene-1-sulfonic acid	14	380
5-Hydroxynaphthalene-1-sulfonic acid	15	380
6-Hydroxynaphthalene-2-sulfonic acid	186	377
7-Hydroxynaphthalene-1-sulfonic acid	13	380
3-Hydroxynaphthalene-2-sulfonyl chloride	173	386
2-Hydroxy-1-naphthalenethiol	17	416
4-Hydroxy-1-naphthalenethiol	38	417
6-Hydroxy-2-naphthalenethiol	44	417
2-Hydroxynaphthalene-3,6,8-trisulfonanilide	132	396
7-Hydroxynaphthalene-1,3,6-trisulfonic acid	7	380

	Compound No.	Page No.
7-Hydronaphthalene-1,3,6-trisulfonyl chloride	269	390
3-Hydroxy-2-naphthamide	462	244
4-Hydroxy-2-naphthamide	460	244
3-Hydroxy-2-naphthanilide	493	246
3-Hydroxy-1-naphthoic acid	571	126
3-Hydroxy-2-naphthoic acid	550	125
" " "	350	207
" " '	113	430
4-Hydroxy-2-naphthoic acid	351	208
5-Hydroxy-1-naphthoic acid	563	126
5-Hydroxy-1,4-naphthoquinone	21	182
3-Hydroxy-1-naphthylamine	397	316
3-Hydroxy-2-naphthylamine	452	317
6-Hydroxy-1-naphthylamine	406	316
6-Hydroxy-2-naphthylamine	436	317
7-Hydroxy-1-naphthylamine	430	317
7-Hydroxy-2-naphthylamine	421	316
8-Hydroxy-1-naphthylamine	179	308
2-Hydroxy-5-nitroaniline	319	313
2-Hydroxy-6-nitroaniline	441	317
3-Hydroxy-4-nitroaniline	365	314
4-Hydroxy-2-nitroaniline	347	314
4-Hydroxy-3-nitroaniline	295	312
5-Hydroxy-2-nitroaniline	398	316
4-Hydroxy-4′-nitroazobenzene	528	124
3-Hydroxy-4-nitrobenzaldehyde	14	434
4-Hydroxy-3-nitrobenzene	308	112
2-Hydroxy-5-nitrobenzoic acid	559	126
2-Hydroxy-3-nitrobenzonitrile	178	365
2-Hydroxy-4-nitrobenzonitrile	205	366
2-Hydroxy-5-nitrobenzonitrile	221	367
2-Hydroxy-2′-nitrobiphenyl	337	113
3-Hydroxy-2-nitrobiphenyl	145	103
3-Hydroxy-4-nitrobiphenyl	206	107
3-Hydroxy-6-nitrobiphenyl	59	99
4-Hydroxy-2-nitrobiphenyl	342	114
4-Hydroxy-2′-nitrobiphenyl	229	108
4-Hydroxy-3-nitrobiphenyl	79	100
4-Hydroxy-4′-nitrobiphenyl	514	123
4-Hydroxy-3-nitro-1-naphthylamine	359	314
9-Hydroxynonanal	33	154
DL-β-Hydroxynorvaline	59	286
5-Hydroxy-4-octanone	132	165
4-Hydroxypentanoic acid	424	432
5-Hydroxy-2-pentanone	40	169
5-Hydroxy-1-pentylamine	396	439
1-Hydroxyphenanthrene	393	116
2-Hydroxyphenanthrene	440	119
3-Hydroxyphenanthrene	282	111
4-Hydroxyphenanthrene	236	108
9-Hydroxyphenanthrene	396	116
4-Hydroxyphenylacetamide	358	241
α-Hydroxyphenylacetic acid	151	199
(2-Hydroxyphenyl)acetic acid	220	202
(4-Hydroxyphenyl)acetic acid	225	202
(2-Hydroxyphenyl)acetonitrile	163	364
(4-Hydroxyphenyl)acetonitrile	87	361
2-Hydroxy-2-phenylbutyraldehyde	22	150
4-Hydroxy-*m*-phenylenediamine	120	102
' " '	130	306
4-Hydroxyphenylethyl alcohol	167	104
4-Hydroxyphenylglycine	71	287
3-Hydroxyphenyl methyl sulfide	77	434
4-Hydroxyphenyl methyl sulfide	78	434
2-Hydroxy-2-phenylpropionaldehyde	20	150
2-Hydroxy-2-phenylpropionic acid	208	430
2-Hydroxy-3-phenylpropionic acid	105	197
3-Hydroxy-2-phenylpropionic acid	149	199
3-Hydroxy-3-phenylpropionic acid	195	430
2-Hydroxyphenyl sulfide	69	426
3-Hydroxyphenyl sulfide	67	426
4-Hydroxyphenyl sulfide	72	427
3-Hydroxyphthalic acid	412	117
DL-Hydroxyproline	30	429
L-Hydroxyproline	83	288
2-Hydroxypropane-1,2,3-tricarboxylic acid	228	202
1-Hydroxy-2-propanone	40	82
' "	58	163
2-Hydroxypropionaldehyde	8	150
3-Hydroxypropionitrile	74	351
4-Hydroxypropiophenone	370	115
" '	180	178
DL-2-Hydroxy-*n*-propylamine	67	297
3-Hydroxypropylamine	358	438
4-Hydroxypyrazole	250	310
α-Hydroxypyridine	68	324
β-Hydroxypyridine	76	324
γ-Hydroxypyridine	80	324
2-Hydroxypyridine	215	107
"	68	324
"	120	435
3-Hydroxypyridine	307	112
'	76	324
"	52	434
"	196	437
4-Hydroxypyridine	373	115
"	80	324
"	118	435
"	85	436
2-Hydroxypyrimidine	3	434
4-Hydroxypyrimidine	2	434
6-Hydroxypyrimidine	85	325
Hydroxypyruvic aldehyde	120	159
4-Hydroxyquinaldine	98	325
5-Hydroxyquinaldine	100	325
6-Hydroxyquinaldine	96	325
8-Hydroxyquinaldine	43	323
"	11	434
β-Hydroxyquinoline	93	325
γ-Hydroxyquinoline	95	325
2-Hydroxyquinoline	500	122
3-Hydroxyquinoline	507	123
"	93	325
4-Hydroxyquinoline	95	325
5-Hydroxyquinoline	553	126
"	97	325
6-Hydroxyquinoline	493	122
"	91	325
7-Hydroxyquinoline	566	126
"	99	325
8-Hydroxyquinoline	110	102
" "	45	323
" "	8	434
w-Hydroxyresacetophenone	483	121
6-Hydroxyretene	409	117
Hydroxysuccinanilide	420	243
Hydroxysuccinic acid	115	197
2-Hydroxythiophenol	40	415
3-Hydroxythiophenol	1	416
4-Hydroxy-3,5-toluenediamine	360	114
2-Hydroxy-*p*-toluidine	362	314
3-Hydroxy-*p*-toluidine	363	314
4-Hydroxy-*m*-toluidine	302	312
4-Hydroxy-*o*-toluidine	324	313
5-Hydroxy-*o*-toluidine	390	315
1-Hydroxytriacontane	48	89
5-Hydroxy-2,4,6-tribromoaniline	253	310
3-Hydroxy-2,4,6-trichlorobenzaldehyde	99	158
5-Hydroxy-1,2,3-trimethoxybenzene	57	140
β-Hydroxyvaline	49	286
9-Hydroxyxanthene	154	177

	Compound No.	Page No.
I		
L-Idose	9	328
Imidazole	272	438
Iminodipropionic acid	301	431
Indane	20	36
Indane-4-sulfonamide	55	394
Indane-5-sulfonamide	89	395
Indane-4-sulfonic acid	15	371
Indane-5-sulfonic acid	29	372
Indane-4-sulfonyl chloride	43	382
Indane-5-sulfonyl chloride	31	381
4-Indanol	110	435
1-Indanone	32	173
2-Indanone	67	174
Indene	25	36
Indene-3-carbonitrile	21	356
Indole	57	304
Indole-3-acetonitrile	29	358
Indole-3-carbonitrile	50	349
Indole-3-carboxaldehyde	125	160
2-(2-Indolyl)ethylamine	256	310
3-(3-Indolyl)propylamine	75	305
3-Indolylpyruvic acid	435	317
meso-Inositol	67	90
Iodoacetamide	93	233
Iodocacetanilide	264	238
2-Iodoacetanilide	156	235
3-Iodoacetanilide	187	235
4-Iodoacetanilide	387	242
Iodoacetic acid	86	196
" "	172	430
Iodoacetic anhydride	15	225
4-Iodoacetophenone	116	176
Iodoacetyl chloride	8	214
2-Iodoaniline	77	305
"	58	436
3-Iodoaniline	13	303
"	107	436
4-Iodoaniline	102	306
"	112	436
4-Iodoanisole	30	138
2-Iodobenzaldehyde	13	153
3-Iodobenzaldehyde	42	155
4-Iodobenzaldehyde	68	156
2-Iodobenzamide	386	242
3-Iodobenzamide	394	242
4-Iodobenzamide	458	244
2-Iodobenzanilide	257	238
4-Iodobenzanilide	447	244
Iodobenzene	1	75
4-Iodobenzenesulfonamide	240	401
4-Iodobenzenesulfonanilide	106	396
4-Iodobenzenesulfonic acid	105	374
4-Iodobenzenesulfonyl chloride	105	384
2-Iodobenzoic acid	246	203
" " "	126	430
3-Iodobenzoic acid	297	205
" "	258	431
4-Iodobenzoic acid	392	209
" "	126	430
3-Iodobenzoic anhydride	59	226
4-Iodobenzoic anhydride	82	227
2-Iodobenzonitrile	63	359
4-Iodobenzoyl bromide	3	220
2-Iodobenzoyl chloride	3	216
4-Iodobenzoyl chloride	20	216
4-Iodobenzyl cyanide	55	359
4-Iodobiphenyl	5	76
4-Iododiphenyl sulfide	9	425
Iodoform	2	68
1-Iodo-4-isopropylbenzene	4	75
3-Iodomandelic acid	186	430
2-Iodo-4-methylaniline	26	303
2-Iodo-5-methylaniline	40	304
3-Iodo-4-methylaniline	20	303
4-Iodo-2-methylaniline	151	307
2-Iodo-4-methylbenzonitrile	68	360
3-Iodo-2-methylolbenzoic acid	173	430
1-Iodonaphthalene	5	75
2-Iodonaphthalene	4	76
1-Iodonaphthalene-2-sulfonamide	427	408
2-Iodonaphthalene-1-sulfonamide	139	397
4-Iodonaphthalene-1-sulfonamide	327	404
5-Iodonaphthalene-1-sulfonamide	413	408
6-Iodonaphthalene-1-sulfonamide	341	405
6-Iodonaphthalene-2-sulfonamide	366	406
7-Iodonaphthalene-1-sulfonamide	415	408
7-Iodonaphthalene-2-sulfonamide	337	405
8-Iodonaphthalene-1-sulfonamide	259	401
4-Iodonaphthalene-1-sulfonanilide	91	395
2-Iodonaphthalene-1-sulfonic acid	55	372
4-Iodonaphthalene-1-sulfonic acid	152	376
5-Iodonaphthalene-1-sulfonic acid	182	377
8-Iodonaphthalene-1-sulfonic acid	123	375
1-Iodonaphthalene-2-sulfonyl chloride	128	385
2-Iodonaphthalene-1-sulfonyl chloride	168	386
4-Iodonaphthalene-1-sulfonyl chloride	197	387
5-Iodonaphthalene-1-sulfonyl chloride	230	388
6-Iodonaphthalene-1-sulfonyl chloride	121	384
6-Iodonaphthalene-2-sulfonyl chloride	225	388
7-Iodonaphthalene-1-sulfonyl chloride	255	389
7-Iodonaphthalene-2-sulfonyl chloride	150	385
8-Iodonaphthalene-1-sulfonyl chloride	226	388
4-Iodo-2-naphthol	304	112
5-Iodo-2-naphthonitrile	195	366
3-Iodo-1-naphthylamine	142	307
2-Iodo-1-nitrobenzene	20	337
3-Iodo-1-nitrobenzene	11	337
4-Iodo-1-nitrobenzene	113	341
2-Iodo-4-nitrophenol	170	105
2-Iodo-6-nitrophenol	225	108
3-Iodo-2-nitrophenol	105	102
3-Iodo-4-nitrophenol	292	111
4-Iodo-2-nitrophenol	125	103
4-Iodo-3-nitrophenol	394	116
5-Iodo-2-nitrophenol	181	105
5-Iodo-3-nitrophenol	328	113
4-Iodo-3-nitrotoluene	25	337
2-Iodophenetole	100	136
4-Iodophenetole	6	137
2-Iodophenol	31	98
"	46	434
3-Iodophenol	25	97
"	63	434
4-Iodophenol	168	105
"	65	434
(2-Iodophenoxy)acetic acid	168	430
(3-Iodophenoxy)acetic acid	160	430
(4-Iodophenoxy)acetic acid	167	430
(2-Iodophenyl)acetic acid	292	431
(3-Iodophenyl)acetic acid	311	431
(4-Iodophenyl)acetic acid	314	431
(4-Iodophenyl)acetonitrile	55	359
2-Iodo-*p*-phenylenediamine	225	309
4-Iodophenyl phenyl sulfide	9	425
3-Iodophthalic anhydride	67	226
4-Iodophthalic anhydride	55	226
β-Iodopropionamide	119	234
α-Iodopropionic acid	156	430
β-Iodopropionic acid	84	196
" "	298	431
β-Iodopropionyl chloride	9	214

	Compound No.	Page No.
α-Iodopyridine	3	322
"	35	436
β-Iodopyridine	29	323
"	88	436
2-Iodopyridine	3	322
"	35	436
3-Iodopyridine	29	323
"	88	436
4-Iodopyridine	127	437
α-Iodoquinoline	28	323
γ-Iodoquinoline	63	324
2-Iodoquinoline	28	323
4-Iodoquinoline	63	324
5-Iodoquinoline	65	324
6-Iodoquinoline	55	324
8-Iodoquinoline	9	323
4-Iodothiophenol	27	417
2-Iodotoluene	3	75
3-Iodotoluene	2	75
4-Iodotoluene	1	76
4-Iodo-*m*-toluidine	40	304
5-Iodo-*o*-toluidine	151	307
2-Iodo-*p*-toluidine	20	303
3-Iodo-*p*-toluidine	26	303
2-Iodo-4-tolunitrile	68	360
1-Iodo-2,4,5-trimethylbenzene	2	76
5-Iodovanillin	470	121
Isatin	431	243
"	425	317
Isoamyl acetate	75	253
prim-Isoamyl alcohol	26	81
sec-Isoamyl alcohol	12	80
Isoamylamine	28	295
Isoamylbenzoate	307	267
Isoamyl bromide	16	58
Isoamyl *n*-butyrate	134	256
Isoamyl carbamate	29	231
Isoamyl carbinol	47	82
Isoamyl chloride	21	55
Isoamyl chloroformate	99	254
Isoamylcyclohexane	245	7
Isoamyl ether	64	134
N-Isoamylformanilide	12	230
Isoamyl formate	52	252
Isoamyl iodide	14	60
Isoamyl isobutyrate	122	255
Isoamyl isovalerate	157	257
Isoamyl levulinate	286	266
Isoamyl mercaptan	12	413
Isoamyl-1-naphthyl ether	110	136
Isoamyl 2-naphthyl ether	8	137
Isoamyl nitrite	24	250
Isoamyl oxalate	312	268
Isoamyl phthalate	357	271
Isoamyl propionate	109	255
Isoamyl salicylate	28	95
" "	326	269
Isoamyl stearate	12	273
Isoamyl succinate	343	270
Isoamyl sulfide	50	421
Isoamyl urethane	29	231
Isoaspartic acid	72	287
d,l-Isobornane	48	9
Isobutane	5	3
Isobutanoic acid	8	190
2-Isobutoxyethanol	51	82
Isobutylacetaldehyde	33	145
Isobutyl acetate	43	251
Isobutylacetic acid	30	191
Isobutyl acetylene	15	28
Isobutyl alcohol	10	80
Isobutylallene	111	16
Isobutylamine	16	295
"	432	439
N-Isobutylaniline	137	299
	154	437
4-Isobutylaniline	149	299
Isobutylbenzene	15	35
Isobutyl benzoate	265	264
Isobutyl bromide	9	58
Isobutyl *n*-butyrate	105	255
Isobutyl carbamate	16	231
Isobutyl carbonate	154	257
Isobutyl chloride	11	55
Isobutyl chloroformate	59	252
Isobutyl enanthate	191	260
Isobutylene glycol	79	84
Isobutyl ether	46	133
N-Isobutylformanilide	11	230
Isobutyl formate	23	250
N-Isobutylglycine	87	429
Isobutyl *n*-heptanoate	191	260
Isobutyl 2-hydroxybenzoate	24	95
Isobutyl iodide	9	60
Isobutyl isobutyrate	93	254
Isobutyl isovalerate	124	255
Isobutyl levulinate	239	263
Isobutylmalononitrile	75	351
Isobutyl mercaptan	7	413
Isobutyl methoxymethyl ketone	96	164
2-Isobutyl-1-methylbenzene	55	37
3-Isobutyl-1-methylbenzene	49	37
4-Isobutyl-1-methylbenzene	53	37
Isobutyl methyl carbinol	25	81
Isobutyl methyl ketone	15	161
Isobutyl methyl sulfide	13	420
Isobutyl 2-naphthyl ether	12	137
Isobutyl oxalate	237	263
Isobutyl *n*-pentanoate	137	256
4-Isobutylphenol	18	94
Isobutyl phenylacetate	281	265
Isobutyl phenyl ketone	195	167
Isobutyl propionate	72	253
Isobutyl *n*-propyl ketone	67	163
Isobutyl salicylate	301	267
" "	24	429
Isobutyl stearate	11	273
Isobutyl succinate	310	267
Isobutyl sulfide	37	421
m-Isobutyltoluene	49	37
p-Isobutyltoluene	53	37
o-Isobutyltoluene	55	37
Isobutyl urethane	16	231
Isobutyl *n*-valerate	137	256
Isobutyraldehyde	9	144
Isobutyramide	217	236
Isobutyranilide	137	234
Isobutyric acid	8	190
" "	451	432
Isobutyric anhydride	7	223
Isobutyronitrile	9	345
Isobutyrophenone	177	167
Isobutyryl chloride	6	212
Isocaproaldehyde	33	145
Isocaproamide	190	236
Isocaproanilide	169	235
Isocaproic acid	30	191
" "	449	432
Isocapronitrile	38	348
Isocaproyl chloride	29	212
Isocarvestrene	317	23
Isocrotonamide	126	234
Isocrotonanilide	127	234
Isocrotonic acid	13	190

	Compound No.	Page No.
Isodurene	59	37
Isodurenol	122	102
Isoduridine	170	300
Isoeugenol	26	95
Isoeugenol methyl ether	104	136
Isoeugenyl acetate	118	279
Isogeraniolene	251	20
Isohexanamide	190	236
Isohexyl alcohol	47	82
Isohexylamine	43	296
Isohexyl methyl ketone	110	164
Isolaurolene	153	17
D-(-)-Isoleucine	94	288
DL-Isoleucine	99	289
L-(+)Isoleucine	91	288
Isonicotinic acid	406	210
" "	447	432
Isopentane-1,1-dicarboxylic acid	76	196
Isopentylbenzene	60	37
Isopentyl salicylate	28	95
Isophorone	172	166
Isophthalaldehyde	75	157
Isophthalic acid	408	210
" "	220	430
Isophthalic acid diamide	504	246
Isophthalic acid monoamide	503	246
Isophthalonitrile	204	366
Isophthaloyl dichloride	6	216
Isopicramic acid	448	119
Isoprene	17	12
Isopropenyl acetylene	7	28
Isopropanolamine	67	297
1-Isopropenyl-1,4-cyclohexadiene	308	23
l-5-Isopropyl-2-methyl-1,3-cyclohexadiene	313	23
d-1-Isopropenyl-3-methylcyclohexane	301	22
l-1-Isopropenyl-3-methylcyclohexane	302	22
1-Isopropenyl-4-methylcyclohexane	300	22
cis-3-Isopropenyl-4-methylcyclohexene	298	22
1-Isopropenyl-3-methylcyclohexene	323	23
1-Isopropenyl-5-methylcyclohexene	320	23
l-3-Isopropenyl-1-methylcyclohexene	318	23
3-Isopropenyl-2-methylcyclohexene	303	22
4-Isopropenyl-3-methylcyclohexene	304	22
5-Isopropenyl-1-methylcyclohexene	317	23
Isopropenyl methyl ketone	7	161
(2-Isopropoxy)benzoic acid	330	431
(3-Isopropoxy)benzoic acid	308	431
(4-Isopropoxy)benzoic acid	418	432
2-Isopropoxyethanol	36	81
1-Isopropoxy-3-methyl-2-butanone	88	163
Isopropoxymethyl methyl ketone	49	162
Isopropyl acetate	17	250
Isopropyl acetylene	5	28
4-Isopropylacetophenone	210	168
2-Isopropylacrolein	25	145
Isopropyl alcohol	3	80
1-Isopropylallene	54	13
Isopropylamine	4	295
"	468	439
2-(Isopropylamino)ethylamine	416	439
N-Isopropylaniline	234	437
2-Isopropylaniline	153	437
3-Isopropylaniline	172	437
4-Isopropylaniline	135	299
2-Isopropylazulene	5	43
5-Isopropylazulene	10	43
6-Isopropylazulene	15	43
4-Isopropylbenzaldehyde	87	149
4-Isopropylbenzamide	236	237
Isopropylbenzene	7	35
1-Isopropylbenzimidazole	231	437
2-Isopropylbenzimidazole	254	438
Isopropyl benzoate	213	261
2-Isopropylbenzoic acid	226	431
4-Isopropylbenzoic acid	150	199
" "	355	432
4-Isopropylbenzonitrile	85	352
4-Isopropylbenzoyl chloride	22	214
α-Isopropylbenzyl alcohol	116	86
4-Isopropylbenzyl chloride	51	56
Isopropyl bromide	5	58
2-Isopropylbutanoic acid	24	192
Isopropyl *n*-butyrate	58	252
Isopropyl carbamate	78	233
Isopropyl carbonate	90	254
Isopropyl chloride	4	55
Isopropylcyclohexane	153	5
5-Isopropyl-1,3-cyclohexanedione	78	174
3-Isopropylcyclohexanone	76	170
4-Isopropylcyclohexanone	67	170
3-Isopropyl-2-cyclohexenone	58	170
l-6-Isopropyl-3-cyclohexenone	61	170
Isopropylcyclopentane	83	4
2-Isopropylcyclopentanone	119	165
Isopropyl ether	18	131
Isopropyl formate	7	250
3-Isopropylglutaric acid	345	432
4-Isopropylheptane	179	6
Isopropyl 2-hydroxybenzoate	20	94
Isopropylideneacetone	25	162
5-Isopropylidene-2-methyl-1,3-cyclohexadiene	321	23
1-Isopropylidene-2-methylcyclohexane	309	23
1-Isopropylidene-3-methylcyclohexane	310	23
1-Isopropylidene-4-methylcyclohexane	307	23
4-Isopropylidene-1-methylcyclohexane	325	24
3-Isopropylidene-6-methylcyclohexane	324	24
3-Isopropylidene-1-methylcyclopentane-1-carbonitrile	73	351
Isopropyl iodide	4	60
Isopropyl isobutyrate	47	252
Isopropyl isovalerate	76	253
Isopropyl *d,l*-lactate	118	255
Isopropyl levulinate	192	260
Isopropylmalonic acid	132	430
Isopropyl methoxymethyl ketone	56	162
Isopropylmethylacetic acid	24	190
5-Isopropyl-2-methylacetophenone	202	167
Isopropyl methyl acetylene	18	28
Isopropyl methylamine	8	295
2-Isopropyl-1-methylbenzene	22	36
3-Isopropyl-1-methylbenzene	17	35
4-Isopropyl-1-methylbenzene	21	36
2-Isopropyl-5-methylbenzenethiol	44	415
5-Isopropyl-2-methylbenzenethiol	45	415
2-Isopropyl-5-methyl-1,4-benzoquinone	2	181
2-Isopropyl-3-methyl-1-butene	127	16
d,l-Isopropyl methyl carbinol	12	80
1-Isopropyl-4-methyl-1,3-cyclohexadiene	311	23
1-Isopropyl-4-methyl-1,4-cyclohexadiene	322	23
2-Isopropyl-5-methyl-1,3-cyclohexadiene	312	23
1-5-Isopropyl-2-methyl-1,3-cyclohexadiene	313	23
5-Isopropyl-2-methyl-1,3-cyclohexadiene	314	23
1-Isopropyl-2-methylcyclohexane	236	7
l-1-Isopropyl-3-methylcyclohexane	228	6
d,l-1-Isopropyl-3-methylcyclohexane	214	6
d-1-Isopropyl-3-methylcyclohexane	219	6
cis-1-Isopropyl-4-methylcyclohexane	229	6
trans-1-Isopropyl-4-methylcyclohexane	232	7
trans-1-Isopropyl-4-methylcyclohexane	184	6
1-Isopropyl-2-methylcyclopentane	126	5
1-Isopropyl-3-methylcyclopentane	124	5
7-Isopropyl-1-methylfluorene	101	47
3-Isopropyl-2-methylhexane	196	6
2-Isopropyl-5-methylhydroquinone	347	114

	Compound No.	Page No.
Isopropyl methyl ketone	6	161
1-Isopropyl-7-methylnaphthalene	165	41
7-Isopropyl-1-methyl-9,10-phenanthraquinone	30	182
1-Isopropyl-7-methylphenanthrene	81	46
3-Isopropyl-1-methylphenanthrene	70	45
4-Isopropyl-1-methylphenanthrene	58	45
6-Isopropyl-1-methylphenanthrene	18	43
7-Isopropyl-1-methylphenanthrene	103	47
2-Isopropyl-5-methylphenol	44	98
5-Isopropyl-2-methylphenol	19	94
Isopropyl methyl sulfide	8	420
5-Isopropylnaphthanthracene	95	46
8-Isopropylnaphthanthracene	136	48
9-Isopropylnaphthanthracene	133	48
12-Isopropylnaphthanthracene	98	47
1-Isopropylnaphthalene	158	41
2-Isopropylnaphthalene	161	41
Isopropyl 2-naphthyl ether	22	138
Isopropyl 4-nitrophenyl sulfide	18	425
Isopropyl oxalate	160	258
Isopropyl *n*-pentanoate	98	254
2-Isopropyl-1-pentene	179	18
2-Isopropylphenanthrene	17	43
9-Isopropylphenanthrene	14	43
2-Isopropylphenol	7	94
4-Isopropylphenol	65	99
(4-Isopropylphenyl)acetic acid	365	432
d,l-Isopropyl phenyl carbinol	116	86
Isopropyl phenyl ketone	177	167
Isopropyl phenyl sulfide	48	421
Isopropyl phthalate	347	270
Isopropyl propionate	39	251
4-Isopropyl-1-propylbenzene	105	39
Isopropyl *n*-propyl ether	25	132
Isopropyl *n*-propyl ketone	34	162
Isopropyl propyl sulfide	20	420
2-Isopropylpyridine	237	437
3-Isopropylpyridine	232	437
4-Isopropylpyridine	246	438
Isopropyl salicylate	20	94
" "	262	264
Isopropyl sulfide	17	420
2-Isopropylthiophene	25	423
3-Isopropylthiophene	26	423
2-Isopropyltoluene	22	36
3-Isopropyltoluene	17	35
4-Isopropyltoluene	21	36
Isopropyl urethane	78	233
Isopropyl *n*-valerate	98	254
Isoquinoline	72	320
"	215	437
1-Isoquinoline-1-carboxaldehyde	38	155
1,4-Isoquinolinediol	573	126
D-Isorhamnose	29	330
trans(β)-Isosafrole	101	136
DL-Isoserine	69	287
L-Isoserine	33	285
Isovaleraldehyde	17	145
Isovaleramide	245	237
Isovaleranilide	162	235
Isovaleric acid	15	190
" "	432	432
Isovaleric anhydride	11	223
Isovalerone	101	164
Isovaleronitrile	22	346
Isovalerophenone	197	167
Isovaleryl bromide	6	218
Isovaleryl chloride	16	212
Isovanilline	54	434
Itaconic acid	254	203
" "	469	433
Itaconic acid diamide	406	242
Itaconic acid dianilide	403	242
Itaconic anhydride	26	225

J

Jasminaldehyde	9	150
Juglone	21	182

K

α-Ketobutyric acid	11	193
2-Ketocyclohexanecarboxylic acid	82	196
3-Ketocyclohexanecarboxylic acid	74	196
4-Ketocyclohexanecarboxylic acid	67	195
γ-Ketovaleric acid	18	193

L

Lactaldehyde	8	329
d,l-Lactamide	49	232
d,l-Lactanilide	22	231
d,l-Lactic acid	7	192
Lactic acid benzoate	138	198
" " "	261	431
Lactic aldehyde	8	329
d,l-Lactonitrile	54	349
Lactonitrile benzoate	98	353
Lactose	64	333
6-[β-Lactosido]-α-D-glucose	67	333
DL-Lanthionine	89	288
meso-Lanthionine	116	290
Lauraldehyde	18	153
Lauramide	160	235
Lauranilide	46	232
Laurent's acid	203	378
Lauric acid	29	194
Lauric anhydride	12	225
Laurolene	205	18
Laurone	91	175
Lauronitrile	101	353
Laurophenone	45	173
Lauroyl chloride	13	214
Lauryl alcohol	3	88
Lauryl bromide	29	58
Lauryl chloride	53	56
DL-Leucine	101	289
" "	78	429
L-Leucine	123	290
Leuco-malachite green	66	324
Levulinamide	152	234
Levulinanilide	124	234
Levulinic acid	16	172
" "	18	193
" "	407	432
Lignoceric acid	88	196
d-Limonene	316	23
d,l-Limonene	319	23
l-Linalool	103	85
l-Linalyl acetate	215	261
l-Linalyl alcohol	103	85
2,3-Lutidine	31	319
2,4-Lutidine	25	319
2,5-Lutidine	26	319
2,6-Lutidine	18	319
3,4-Lutidine	32	319
3,5-Lutidine	40	319
D-Lysine	57	429

	Compound No.	Page No.
DL-Lysine	129	290
L-Lysine	53	286
" "	208	429
α-D-Lyxose	13	329

M

L-Malamide	309	239
L-Malanilide	420	243
l-Malic acid	115	197
Maleamic acid	352	241
Maleic acid	175	200
" "	37	429
Maleic acid diamide	380	242
Maleic acid dianilide	396	242
Maleic acid monoamide	352	241
Maleic acid monoanilide	397	242
Maleic anhydride	21	225
Maleimide	83	233
Maleonitrile	19	357
Malonamic acid	6	231
" "	225	431
Malondiamide	345	241
Malonic acid	185	200
" "	123	430
Malonic acid diamide	345	241
Malonic acid dianilide	477	245
Malonic acid monoamide	6	231
" " "	225	431
Malonic acid monoanilide	232	237
Malononitrile	17	357
β-Maltose	43	332
d,l-Mandelamide	239	237
d,l-Mandelanilide	289	239
d,l-Mandelic acid	151	199
" "	196	430
D-Mandelonitrile	14	357
DL- Mandelonitrile	7	357
d-Mannitol	62	90
α-D-Mannoheptose	27	330
α-D-Mannose	23	330
β-D-Mannose	24	330
DL-Mannose	26	330
L-Mannose	25	330
Margaramide	149	234
Margaric acid	55	195
Margaric aldehyde	11	153
Margaric anhydride	25	225
Melezitose	38	331
β-Melibiose dihydrate	2	329
Menogene	324	24
Menogerene	321	23
1,5-*p*-Menthadiene	314	23
2,4-*p*-Menthadiene	312	23
d,l-2,8-*m*-Menthadiene	323	23
3,8-*m*-Menthadiene	320	23
3,8-*o*-Menthadiene	298	22
5,8-*o*-Menthadiene	304	22
6,8-*o*-Menthadiene	303	22
d-m-Menthane	219	6
l-m-Menthane	228	6
o-Menthane	236	7
p-Menthane	232	7
cis-p-Menthane	229	6
trans-p-Menthane	184	6
m-Menthene	310	23
o-Menthene	309	23
p-Menthene	307	23
d-m-8-Menthene	301	22
l-m-8-Menthene	302	22
p-8-Menthene	300	22
4(8)-*p*-Menthen-3-one	180	167
l-Menthol	20	88
l-Menthone	165	166
l-Menthyl acetate	232	262
L-Menthylamine	111	298
2-Mercaptoacetophenone	4	416
Mercaptobenzene	25	414
1-Mercaptonaphthalene	47	415
2-Mercaptonaphthalene	25	416
Mesaconic acid	329	207
" "	322	431
Mesaconic acid diamide	368	241
Mesaconic acid dianilide	391	242
Mesaconyl dichloride	28	214
Mesidine	142	299
Mesityl acetate	255	269
Mesitylacetic acid	261	203
Mesitylacetone	70	174
Mesitylene	11	35
Mesityleneamide	235	237
Mesitylene disulfonic acid	195	378
Mesitylenic acid	259	203
Mesityl oxide	25	162
Mesityl phenyl ketone	167	177
Metaldehyde	101	158
Metanilic acid	37	372
Methacrolein	10	144
Methacrylamide	180	235
Methacrylic acid	9	190
Methacrylonitrile	7	345
Methacrylyl chloride	7	212
Methallylacetone	66	163
Methallyl chloride	12	55
Methanal	1	144
Methane	1	3
Methane disulfonamide	395	407
Methane disulfonanilide	286	403
Methane disulfonic acid	179	377
Methane disulfonyl chloride	1	381
Methanesulfonamide	23	392
Methanesulfonanilide	32	393
Methanesulfonic acid	6	371
Methanethiol	1	413
Methanol	1	80
Methionic acid	179	377
DL-Methionine	87	288
L-Methionine	90	288
Methone	181	178
Methoxyacetaldehyde	16	145
Methoxyacetamide	103	233
Methoxyacetanilide	21	231
4-Methoxyacetanilide	211	236
Methoxyacetic acid	31	191
Methoxyacetonitrile	17	346
α-Methoxyacetophenone	25	169
2-Methoxyacetophenone	199	167
3-Methoxyacetophenone	200	167
4-Methoxyacetophenone	24	172
Methoxyacetyl chloride	14	212
2-Methoxyaniline	94	135
" "	134	299
" "	159	437
3-Methoxyaniline	102	136
" "	168	300
" "	139	437
4-Methoxyaniline	35	138
" "	67	304
" "	211	437
4-Methoxybenzalacetone	96	175
4-Methoxybenzalacetophenone	104	175
2-Methoxybenzaldehyde	15	153
3-Methoxybenzaldehyde	85	149

	Compound No.	Page No.
4-Methoxybenzaldehyde	89	149
2-Methoxybenzamide	218	236
2-Methoxybenzanilide	225	237
Methoxybenzene	56	133
4-Methoxybenzene-1,3-disulfonamide	416	408
4-Methoxybenzene-1,3-disulfonanilide	336	405
4-Methoxybenzene-1,3-disulfonic acid	191	378
4-Methoxybenzene-1,3-disulfonyl chloride	108	384
4-Methoxybenzil	82	174
2-Methoxybenzoic acid	114	197
" " "	296	431
3-Methoxybenzoic acid	297	431
4-Methoxybenzoic acid	291	204
" "	383	432
4-Methoxybenzoic anhydride	43	226
2-Methoxybenzonitrile	9	357
4-Methoxybenzonitrile	72	360
2-Methoxybenzophenone	29	173
4-Methoxybenzophenone	80	174
4-Methoxybenzoyl bromide	9	219
2-Methoxybenzoyl chloride	57	213
3-Methoxybenzoyl chloride	54	213
4-Methoxybenzoyl chloride	58	213
2-Methoxybenzyl alcohol	127	86
4-Methoxybenzyl alcohol	5	88
" " "	4	137
2-Methoxybenzylamine	343	438
3-Methoxybenzylamine	314	438
4-Methoxybenzylamine	327	438
2-Methoxybiphenyl	10	137
4-Methoxybiphenyl	51	139
1-Methoxy-2-butanone	29	162
1-Methoxy-3-butanone	14	161
4-Methoxychalcone	104	175
2-Methoxycinnamic acid	393	432
4-Methoxycinnamic acid	363	432
4-Methoxycinnamonitrile	74	360
4-Methoxycyclohexanone	54	170
2-Methoxyethanethiol	11	413
2-Methoxyethanol	20	81
2-(2-Methoxyethoxy)ethanol	96	85
β-Methoxyethyl acetate	78	253
2-Methoxyethylamine	336	438
β-Methoxyethyl benzoate	294	266
Methoxyethyl methyl ketone	14	161
1-Methoxyethyl *n*-propyl ketone	78	163
1-Methoxy-2-hexanone	106	164
1-Methoxy-3-hexanone	78	163
4-Methoxyhydrocinnamonitrile	103	354
3-Methoxyisobutyraldehyde	36	145
1-Methoxy-3-methyl-2-butanone	56	162
4-Methoxy-2-methyl-*n*-butyraldehyde	9	152
Methoxymethyl methyl ketone	13	161
3-Methoxy-2-methylolbenzoic acid	215	430
1-Methoxy-4-methyl-2-pentanone	96	164
2-Methoxy-3-methyl-2-pentanone	95	164
3-Methoxy-2-methyl-1-propanol	57	133
Methoxymethyl *n*-propyl ketone	72	163
2-Methoxy-1-naphthaldehyde	73	156
3-Methoxy-1-naphthaldehyde	52	155
4-Methoxy-1-naphthaldehyde	9	153
5-Methoxy-1-naphthaldehyde	56	155
1-Methoxynaphthalene	106	136
2-Methoxynaphthalene-1-sulfonamide	161	398
3-Methoxynaphthalene-2-sulfonamide	49	393
4-Methoxynaphthalene-1-sulfonamide	378	406
4-Methoxynaphthalene-2-sulfonamide	149	397
5-Methoxynaphthalene-1-sulfonamide	292	403
6-Methoxynaphthalene-1-sulfonamide	127	396
6-Methoxynaphthalene-2-sulfonamide	268	402
7-Methoxynaphthalene-2-sulfonamide	362	406
2-Methoxynaphthalene-1-sulfonanilide	304	403
3-Methoxynaphthalene-2-sulfonanilide	211	399
4-Methoxynaphthalene-1-sulfonanilide	159	397
4-Methoxynaphthalene-3-sulfonanilide	122	396
5-Methoxynaphthalene-1-sulfonanilide	150	397
6-Methoxynaphthalene-1-sulfonanilide	223	400
6-Methoxynaphthalene-2-sulfonanilide	58	394
7-Methoxynaphthalene-2-sulfonanilide	60	394
2-Methoxynaphthalene-1-sulfonyl chloride	188	387
3-Methoxynaphthalene-2-sulfonyl chloride	222	388
4-Methoxynaphthalene-1-sulfonyl chloride	146	385
4-Methoxynaphthalene-2-sulfonyl chloride	84	383
5-Methoxynaphthalene-1-sulfonyl chloride	184	387
6-Methoxynaphthalene-1-sulfonyl chloride	96	384
6-Methoxynaphthalene-2-sulfonyl chloride	122	384
7-Methoxynaphthalene-2-sulfonyl chloride	102	384
2-Methoxy-2-nitroaniline	121	306
2-Methoxy-4-nitroaniline	314	312
2-Methoxy-5-nitroaniline	249	310
3-Methoxy-5-nitroaniline	39	436
4-Methoxy-2-nitroaniline	287	311
4-Methoxy-3-nitroaniline	64	304
3-Methoxy-1-nitrobenzene	12	337
4-Methoxy-1-nitrobenzene	23	337
4-Methoxy-3-nitrobenzenesulfonamide	120	396
4-Methoxy-3-nitrobenzenesulfonic acid	46	372
4-Methoxy-3-nitrobenzenesulfonyl chloride	71	383
4-Methoxy-3-nitrobenzoic acid	300	205
2-Methoxy-4-nitrophenol	428	118
5-Methoxy-2-nitrophenol	22	434
1-Methoxy-2-pentanone	72	163
2-Methoxy-3-pentanone	36	162
2-Methoxyphenol	12	96
" "	9	137
" "	95	434
3-Methoxyphenol	21	95
" "	82	434
4-Methoxyphenol	48	99
" "	104	434
(2-Methoxyphenoxy)acetic acid	180	430
(3-Methoxyphenoxy)acetic acid	164	430
(4-Methoxyphenoxy)acetic acid	175	430
2-Methoxyphenyl acetate	261	264
(4-Methoxyphenyl)acetic acid	92	196
" " " "	359	432
4-Methoxyphenyl methyl carbinol	133	87
3-(2-Methoxyphenyl)propionic acid	439	432
3-(3-Methoxyphenyl)propionic acid	409	432
3-(4-Methoxyphenyl)propionic acid	421	432
3-(4-Methoxyphenyl)propionitrile	103	354
4-Methoxyphenyl sulfide	19	425
2-Methoxy-1-propanol	49	133
1-Methoxy-2-propanone	13	161
1-Methoxy-4-propenylbenzene	3	137
2-Methoxy-4-propenylphenol	26	95
2-Methoxy-5-propenylphenol	182	105
2-Methoxypropionic acid	11	192
3-Methoxypropionitrile	41	348
β-Methoxypropionyl chloride	26	212
1-Methoxy-2-*n*-propoxyethane	47	133
2-Methoxypyridine	80	436
3-Methoxypyridine	186	437
4-Methoxypyridine	262	438
2-Methoxyquinoline	83	436
4-Methoxyquinoline	260	438
6-Methoxyquinoline	112	321
"	193	437
7-Methoxyquinoline	59	140
8-Methoxyquinoline	27	138
"	26	323
2-Methoxytoluene	62	134

	Compound No.	Page No.
3-Methoxytoluene	66	134
4-Methoxytoluene	65	134
1-Methoxy-2,4,6-trinitrobenzene	36	338
N-Methyl acetanilide	123	234
Methyl acetate	4	250
Methylacetoacetate	108	164
" "	123	255
2-Methylacetoacetonitrile	35	347
2-Methylacetophenone	170	166
3-Methylacetophenone	176	166
4-Methylacetophenone	6	172
N-Methyl-2-acetotoluidide	17	231
N-Methyl-3-acetotoluidide	32	231
N-Methyl-4-acetotoluidide	58	232
N-Methylacetylanthranilic acid	311	206
Methyl acetylene	2	28
Methyl acrylate	12	250
2-Methylacrylic acid	411	432
α-Methylacrylonitrile	7	345
β-Methyladipic acid	89	196
D-N-Methyl-α-alanine	109	289
DL-N-Methyl-α-alanine	98	289
" "	66	429
N-Methyl-β-alanine	2	284
Methyl alcohol	1	80
Methylallene	11	12
2-Methylallyl sulfide	38	421
Methylamidine	470	439
Methylamine	1	295
"	422	439
L-Methylamine	111	298
2-(N-Methylamino)benzenesulfonamide	51	393
4-(N-Methylamino)benzenesulfonamide	338	405
2-(N-Methylamino)benzenesulfonic acid	14	371
4-(N-Methylamino)benzenesulfonic acid	158	376
Methyl-2-aminobenzoate	15	273
3-(Methylamino)benzoic acid	214	430
(2-Methylamino)ethylamine	367	439
1-(Methylamino)naphthalene	183	301
" "	109	436
2-(Methylamino)naphthalene	188	301
2-(Methylamino)-*n*-pentane	33	296
2-(Methylamino)phenol	184	105
4-(Methylamino)phenol	152	104
Methyl-*n*-amyl alcohol	41	82
N-Methylaniline	90	298
"	181	437
2-Methylaniline	94	298
"	156	437
3-Methylaniline	96	298
"	174	437
4-Methylaniline	34	303
"	195	437
N-Methylanilinonitrile	95	353
Methyl anisate	59	276
2-Methylanisole	62	134
3-Methylanisole	66	134
4-Methylanisole	65	134
1-Methylanthracene	85	46
9-Methylanthracene	80	46
Methylanthranilate	15	273
2-Methyl-9,10-anthraquinone	24	182
N-Methylaziridine	286	438
2-Methylazulene	23	43
6-Methylazulene	82	46
2-Methylbenzaldehyde	74	148
3-Methylbenzaldehyde	73	148
4-Methylbenzaldehyde	75	148
2-Methylbenzene-1,3-disulfonamide	443	409
2-Methylbenzene-1,4-disulfonamide	371	406
4-Methylbenzene-1,2-disulfonamide	410	407
4-Methylbenzene-1,3-disulfonamide	256	401
5-Methylbenzene-1,3-disulfonamide	349	405
2-Methylbenzene-1,3-disulfonanilide	168	398
2-Methylbenzene-1,4-disulfonanilide	225	400
4-Methylbenzene-1,2-disulfonanilide	272	402
4-Methylbenzene-1,3-disulfonanilide	267	402
5-Methylbenzene-1,3-disulfonanilide	137	397
2-Methylbenzene-1,3-disulfonic acid	204	378
2-Methylbenzene-1,4-disulfonic acid	168	377
4-Methylbenzene-1,2-disulfonic acid	188	377
4-Methylbenzene-2,4-disulfonic acid	132	375
5-Methylbenzene-1,3-disulfonic acid	162	377
2-Methylbenzene-1,3-disulfonyl chloride	113	384
2-Methylbenzene-1,4-disulfonyl chloride	144	385
4-Methylbenzene-1,2-disulfonyl chloride	166	386
4-Methylbenzene-1,3-disulfonyl chloride	44	382
5-Methylbenzene-1,3-disulfonyl chloride	125	385
2-Methylbenzenesulfonic acid	58	372
3-Methylbenzenesulfonic acid	10	371
4-Methylbenzenesulfonic acid	31	372
2-Methylbenzenesulfonyl chloride	73	383
3-Methylbenzenesulfonyl chloride	3	381
4-Methylbenzenesulfonyl chloride	75	383
4-Methylbenzhydrol	29	89
Methyl benzilate	110	278
1-Methylbenzimidazole	220	437
2-Methylbenzimidazole	252	438
4-Methylbenzimidazole	228	437
5-Methylbenzimidazole	235	437
Methyl benzoate	172	258
2-Methylbenzoic acid	125	198
"	269	431
3-Methylbenzoic acid	137	198
" "	339	432
4-Methylbenzoic acid	278	204
" "	360	432
2-Methylbenzoic anhydride	9	225
3-Methylbenzoic anhydride	29	225
4-Methylbenzoic anhydride	40	225
2-Methylbenzonitrile	64	350
3-Methylbenzonitrile	70	350
4-Methylbenzonitrile	13	357
4-Methylbenzophenone	74	174
2-Methyl-1,4-benzoquinone	6	181
Methyl 2-benzoylbenzoate	119	279
2-Methylbenzoyl bromide	5	219
3-Methylbenzoyl bromide	1	219
4-Methylbenzoyl bromide	8	219
4-Methylbenzoyl chloride	51	213
1-Methyl-3,4-benzphenanthrene	69	45
2-Methyl-3,4-benzphenanthrene	61	45
5-Methyl-3,4-benzphenanthrene	143	49
6-Methyl-3,4-benzphenanthrene	76	46
7-Methyl-3,4-benzphenanthrene	31	44
8-Methyl-3,4-benzphenanthrene	54	45
2-Methyl-1′,2′-benzpyrene	139	48
3-Methyl-1′,2′-benzpyrene	148	49
4-Methyl-1′,2′-benzpyrene	191	51
5-Methyl-1′,2′-benzpyrene	188	51
6-Methyl-1′,2′-benzpyrene	170	50
8-Methyl-1′,2′-benzpyrene	181	50
9-Methyl-1′,2′-benzpyrene	149	49
2-Methylbenzyl alcohol	14	88
3-Methylbenzyl alcohol	109	85
4-Methylbenzyl alcohol	32	89
N-Methylbenzylamine	331	438
2-Methylbenzylamine	104	298
"	315	438
3-Methylbenzylamine	101	298
"	320	438

	Compound No.	Page No.
4-Methylbenzylamine	105	298
"	322	438
2-Methylbenzyl chloride	44	56
3-Methylbenzyl chloride	43	56
4-Methylbenzyl chloride	41	56
4-Methylbenzyl sulfide	44	426
N-Methylbenzyl sulfonamide	42	393
Methyl bromide	1	58
Methyl bromoacetate	79	253
Methyl 2-bromobenzoate	267	264
Methyl 3-bromobenzoate	29	274
Methyl 4-bromobenzoate	121	279
2-Methyl-1,3-butadiene	17	12
3-Methyl-1,2-butadiene	22	12
3-Methylbutanal	17	145
d,l-2-Methylbutanamide	170	235
d,l-2-Methylbutananilide	163	235
2-Methylbutane	10	3
D,L-3-Methylbutane-1-sulfonanilide	4	392
D-2-Methyl-1-butanethiol	14	413
3-Methylbutanethiol	12	413
d,l-2-Methylbutanoic acid	14	190
3-Methylbutanoic acid	15	190
2-Methyl-1-butanol	23	81
2-Methyl-2-butanol	8	80
3-Methyl-1-butanol	26	81
d,l-3-Methyl-2-butanol	12	80
2-Methyl-3-butanone	6	161
2-Methyl-1-butenal	18	145
2-Methyl-2-butenal	31	145
3-Methyl-2-butenal	41	146
2-Methyl-1-butene	15	12
2-Methyl-2-butene	21	12
3-Methyl-1-butene	12	12
cis-2-Methyl-2-butenoic acid	59	195
trans-2-Methyl-2-butenoic acid	34	194
2-Methyl-1-buten-3-one	7	161
2-Methyl-3-butenyl phenyl ketone	53	170
3-Methyl-3-buten-1-yne	7	28
3-Methylbutyl acetate	75	253
D-2-Methyl-*n*-butylamine	29	296
3-Methylbutyl phenyl sulfide	56	421
3-Methyl-1-butyne	5	28
α-Methylbutyraldehyde	18	145
Methyl *n*-butyrate	31	251
2-Methylbutyric acid	440	432
2-Methylbutyronitrile	20	346
5-Methyl α-campholenonitrile	1	355
Methyl *n*-caprate	225	262
Methyl *n*-caproate	97	254
Methyl *n*-caprylate	163	258
Methyl carbamate	11	231
Methyl carbonate	18	250
3-Methylcatechol	84	101
4-Methylcatechol	76	100
2-Methylcatechol 2-methyl ether	92	135
Methyl cellosolve	20	81
Methyl cellosolve acetate	78	253
Methyl cellosolve benzoate	294	266
Methyl chloride	1	55
Methyl chloroacetate	61	252
Methyl 2-chlorobenzoate	250	263
Methyl 3-chlorobenzoate	242	263
" "	7	273
Methyl 2-chlorocinnamate	52	275
Methyl chloroformate	9	250
2-Methylchrysazin	23	182
1-Methylchrysene	197	51
2-Methylchrysene	193	51
3-Methylchrysene	168	50
4-Methylchrysene	154	49
5-Methylchrysene	121	48
6-Methylchrysene	162	50
2-Methylcinnamaldehyde	27	151
Methyl cinnamate	39	275
α-Methylcinnamic acid	81	196
trans-2-Methylcinnamic acid	392	432
trans-3-Methylcinnamic acid	380	432
trans-4-Methylcinnamic acid	399	432
3-Methycrotonaldehyde	41	146
Methyl crotonate	46	252
3-Methylcrotonic acid	466	433
2-Methylcrotononitrile	26	347
Methyl cyanoacetate	174	258
"	62	350
Methylcyclobutane	14	3
1-Methylcyclobutene	20	12
3-Methylcyclobutene	16	16
Methylcycloheptane	94	4
1-Methylcycloheptene	243	20
5-Methylcycloheptene	14	25
1-Methyl-1,4-cyclohexadiene	188	18
5-Methyl-1,3-cyclohexadiene	117	16
Methylcyclohexane	44	3
Methyl cyclohexanecarboxylate	144	257
cis-4-Methylcyclohexanecarboxylic acid	28	192
trans-4-Methylcyclohexanecarboxylic acid	134	198
cis-3-Methyl-1-cyclohexanethiol	24	414
trans-3-Methyl-1-cyclohexanethiol	26	414
cis-2-Methylcyclohexanol	58	83
trans-2-Methylcyclohexanol	60	83
trans-2-Methylcyclohexanol	2	88
cis-3-Methylcyclohexanol	65	83
trans-3-Methylcyclohexanol	68	83
cis-4-Methylcyclohexanol	66	83
trans-4-Methylcyclohexanol	67	83
2-Methylcyclohexanone	97	164
d-3-Methylcyclohexanone	104	164
d,l-3-Methylcyclohexanone	105	164
4-Methylcyclohexanone	112	164
1-Methylcyclohexene	158	17
3-Methylcyclohexene	126	16
4-Methylcyclohexene	125	16
3-Methylcyclohexyl-1,1-diacetic acid	81	170
3-Methylcyclohexyl-1,1-diacetic acid	387	432
4-Methylcyclohexyl-1,1-diacetic acid	388	432
2-Methylcyclohexyloxyacetic acid	266	431
cis-3-Methylcyclohexyloxy acetic acid	260	431
Methylcyclooctatetraene	15	25
Methylcyclopentane	26	3
2-Methylcyclopentanecarboxylic acid	26	192
2-Methylcyclopentanone	45	162
d-3-Methylcyclopentanone	50	162
d,l-3-Methylcyclopentanone	55	162
1-Methylcyclopentene	63	14
3-Methylcyclopentene	43	13
4-Methylcyclopentene	62	14
2-Methyl-3-cyclopentenone	90	163
3-Methylcyclopentyl-1,1-diacetic acid	248	431
1-Methyl-*trans*-decahydronaphthalene	260	7
9-Methyl-*cis*-decahydronaphthalene	253	7
9-Methyl-*trans*-decahydronaphthalene	251	7
Methyl *n*-decanoate	225	262
Methyl dibenzylacetate	45	275
Methyl 3,5-dinitrobenzoate	143	280
Methyl 3,5-dinitrosalicylate	156	281
Methyl diphenylacetate	84	277
2-Methyl-1,4-dithiane	4	425
Methyl enanthate	125	256
Methyleneaminoacetonitrile	77	324
Methylene bromide	1	65
Methylene chloride	1	63
Methylene cyanide	17	357

	Compound No.	Page No.
Methylene-di-2-naphthol	504	123
3,4-Methylenedioxybenzaldehyde	12	153
3,4-Methylenedioxychalcone	153	177
3,4-Methylenedioxypropiophenone	27	173
1,2-Methylenedioxy-4-propylbenzene	101	136
Methylenefluorene	28	44
Methylene iodide	1	67
Methylenesuccinic acid	254	203
Methylenesuccinic anhydride	26	225
endo-4,7-Methylene-4,7,8,9-tetrahydroindene	3	26
Methyl ethoxyacetate	92	254
Methyl ethylacetoacetate	153	257
2-Methylethylene sulfide	2	423
4-Methylfluorene	50	45
N-Methylformamide	3	230
N-Methylformanilide	8	230
Methyl formate	2	250
Methylfumaric acid	329	207
Methylfumaryl dichloride	28	214
2-Methylfuran	15	131
5-Methylfurfural	68	147
Methyl furoate	141	256
Methyl furoylacetate	6	272
Methyl β-(2-furyl)acrylate	18	274
Methyl gallate	506	123
" "	169	281
cis-α-Methylglutaconic anhydride	34	225
cis-β-Methylglutaconic anhydride	35	225
3-Methylglutaric acid	335	431
α-Methylglutaric anhydride	17	223
β-Methylglutaric anhydride	10	225
2-Methylglutaromononitrile	126	363
2-Methylglutaronitrile	97	353
β-Methylglyceraldehyde	11	328
N-Methylglycine	84	429
Methyl glycolate	96	254
Methyl glyoxal	103	171
α-Methylguanidoacetic acid	113	289
Methyl hendecylenate	285	265
2-Methylheptadecane	273	7
2-Methyl-2-heptadecene	337	24
2-Methyl-1,3-heptadiene	222	19
3-Methyl-1,5-heptadiene	173	17
3-Methyl-2,4-heptadiene	229	19
4-Methyl-2,4-heptadiene	227	19
6-Methyl-1,3-heptadiene	194	18
6-Methyl-2,4-heptadiene	185	18
2-Methylheptane	61	4
3-Methylheptane	67	4
4-Methylheptane	62	4
Methyl *n*-heptanoate	125	256
4-Methyl-1-heptanol	86	84
2-Methyl-4-heptanone	67	163
3-Methyl-2-heptanone	91	164
6-Methyl-2-heptanone	110	164
6-Methyl-3-heptanone	94	164
2-Methyl-1-heptene	202	18
2-Methyl-2-heptene	219	19
2-Methyl-3-heptene	170	17
3-Methyl-1-heptene	163	17
3-Methyl-2-heptene	212	19
3-Methyl-3-heptene	208	18
4-Methyl-1-heptene	175	18
4-Methyl-2-heptene	181	18
4-Methyl-3-heptene	206	18
5-Methyl-1-heptene	180	18
5-Methyl-2-heptene	200	18
5-Methyl-3-heptene	171	17
6-Methyl-1-heptene	216	19
6-Methyl-2-heptene	198	18
6-Methyl-3-heptene	176	18
3-Methyl-3-hepten-2-one	122	165
3-Methyl-3-hepten-5-one	17	169
4-Methyl-6-hepten-3-one	80	163
5-Methyl-3-heptyne	34	29
2-Methyl-1,3-hexadiene	142	17
2-Methyl-1,5-hexadiene	100	15
2-Methyl-2,4-hexadiene	141	17
3-Methyl-1,5-hexadiene	76	14
3-Methyl-2,4-hexadiene	143	17
4-Methyl-1,3-hexadiene	150	17
5-Methyl-1,2-hexadiene	111	16
5-Methyl-1,4-hexadiene	97	15
Methyl hexahydrobenzoate	144	257
5-Methylhexanal	45	146
2-Methylhexanamide	38	232
4-Methylhexanamide	108	233
2-Methylhexananilide	107	233
4-Methylhexananilide	45	232
2-Methylhexane	34	3
3-Methylhexane	37	3
3-Methyl-2,4-hexanedione	139	165
3-Methyl-2,5-hexanedione	92	170
Methyl *n*-hexanoate	97	254
2-Methylhexanoic acid	37	191
3-Methylhexanoic acid	17	192
4-Methylhexanoic acid	40	191
5-Methylhexanoic acid	35	191
2-Methyl-1-hexanol	55	83
d,l-4-Methyl-1-hexanol	57	83
2-Methyl-3-hexanone	34	162
3-Methyl-2-hexanone	38	162
4-Methyl-2-hexanone	48	162
4-Methyl-3-hexanone	35	162
5-Methyl-3-hexanone	31	162
2-Methylhexanonitrile	40	348
d,l-3-Methylhexanonitrile	44	348
d,l-4-Methylhexanonitrile	53	349
5-Methylhexanonitrile	51	349
2-Methyl-1-hexene	98	15
2-Methyl-2-hexene	108	16
2-Methyl-3-hexene	88	15
3-Methyl-1-hexene	83	15
3-Methyl-*trans*-2-hexene	105	16
3-Methyl-*cis*-3-hexene	107	16
3-Methyl-*trans*-3-hexene	103	15
4-Methyl-1-hexene	90	15
4-Methyl-*cis*-2-hexene	92	15
4-Methyl-*trans*-2-hexene	93	15
5-Methyl-1-hexene	86	15
5-Methyl-*cis*-2-hexene	96	15
5-Methyl-*trans*-2-hexene	87	15
5-Methyl-4-hexenoic acid	437	432
3-Methyl-1-hexen-5-one	39	162
5-Methyl-4-hexen-3-one	65	163
5-Methyl-5-hexen-2-one	66	163
Methyl hexyl acetylene	50	30
2-Methyl-3-hexyne	31	29
4-Methyl-2-hexyne	32	29
5-Methyl-2-hexyne	36	29
α-Methylhydrocinnamamide	159	235
Methyl hydrocinnamate	259	264
d,l-α-Methylhydrocinnamic acid	20	193
2-Methylhydroquinone	293	111
"	60	434
Methyl 2-hydroxybenzoate	12	94
Methyl 3-hydroxybenzoate	95	101
" "	97	278
Methyl 4-hydroxybenzoate	313	112
" "	157	281
" "	48	434
2-Methyl-3-hydroxybutyric acid	408	432
Methyl α-hydroxyisobutyrate	71	253

	Compound No.	Page No.
Methyl 3-hydroxy-2-naphthoate	109	278
Methyl 3-hydroxy-4-nitrobenzoate	17	434
4-Methyl-8 hydroxyquinoline	12	434
2-Methylimidazole	285	438
4-Methylimidazole	280	438
Methyliminodiacetic acid	355	208
Methyliminodiacetic acid diamide	339	240
Methyliminodiacetic acid monoamide	338	240
1-Methylindane	36	36
2-Methylindane	34	36
3-Methylindene	63	37
1-Methylindole	79	321
2-Methylindole	76	305
3-Methylindole	175	308
4-Methylindole	177	300
5-Methylindole	73	305
7-Methylindole	145	307
Methyl iodide	1	60
Methyl isobutylcarbinyl acetate	91	254
Methyl isobutyrate	19	250
Methyl isocrotonate	34	251
Methylisopropylacetaldehyde	27	145
Methyl isovalerate	42	251
Methyl *d,l*-lactate	82	253
Methyl laurate	314	268
Methyl levulinate	152	166
"	165	258
Methylmaleic acid	98	196
Methylmaleic anhydride	10	223
Methyl malonate	142	257
Methylmalonic acid	194	201
"	146	430
Methylmalonic acid diamide	457	244
Methylmalononitrile	11	357
Methyl *d,l*-mandelate	71	276
Methyl margarate	22	274
Methyl mercaptan	1	413
Methyl methacrylate	26	251
Methyl methoxyacetate	60	252
Methyl 2-methoxybenzoate	284	265
Methyl 3-methoxybenzoate	290	266
Methyl 4-methoxybenzoate	59	276
Methyl methylacetoacetate	131	256
Methyl 2-methylallyl sulfide	14	420
Methyl 2-methylbenzoate	208	261
Methyl 3-methylbenzoate	216	261
Methyl 2-methylbutyl sulfide	24	420
2-Methyl-6-methylene-2,7-octadiene	295	22
4-Methyl-2-methylolphenol	103	434
N-Methylmorpholine	278	438
Methyl myristate	2	273
1-Methylnaphthalene	146	40
2-Methylnaphthalene	12	43
2-Methyl-1,3-naphthalenediol	339	113
2-Methylnaphthalene-1-sulfonamide	64	394
4-Methylnaphthalene-1-sulfonamide	220	400
4-Methylnaphthalene-2-sulfonamide	108	396
5-Methylnaphthalene-1-sulfonamide	219	400
5-Methylnaphthalene-2-sulfonamide	266	402
6-Methylnaphthalene-2-sulfonamide	325	404
7-Methylnaphthalene-1-sulfonamide	298	403
7-Methylnaphthalene-2-sulfonamide	173	398
8-Methylnaphthalene-2-sulfonamide	54	394
4-Methylnaphthalene-1-sulfonanilide	157	397
5-Methylnaphthalene-2-sulfonanilide	430	408
7-Methylnaphthalene-1-sulfonanilide	171	398
2-Methylnaphthalene-1-sulfonic acid	18	371
4-Methylnaphthalene-1-sulfonic acid	97	374
4-Methylnaphthalene-2-sulfonic acid	39	372
5-Methylnaphthalene-1-sulfonic acid	96	374
5-Methylnaphthalene-2-sulfonic acid	128	375
6-Methylnaphthalene-2-sulfonic acid	151	376
7-Methylnaphthalene-1-sulfonic acid	142	376
2-Methylnaphthalene-1-sulfonyl chloride	103	384
4-Methylnaphthalene-1-sulfonyl chloride	99	384
4-Methylnaphthalene-2-sulfonyl chloride	200	387
5-Methylnaphthalene-2-sulfonyl chloride	185	387
6-Methylnaphthalene-2-sulfonyl chloride	141	385
7-Methylnaphthalene-1-sulfonyl chloride	133	385
7-Methylnaphthalene-2-sulfonyl chloride	64	383
8-Methylnaphthalene-2-sulfonyl chloride	114	384
2-Methylnaphthanthracene	151	49
3-Methylnaphthanthracene	163	50
4-Methylnaphthanthracene	184	51
5-Methylnaphthanthracene	157	49
6-Methylnaphthanthracene	134	48
7-Methylnaphthanthracene	141	48
8-Methylnaphthanthracene	159	49
9-Methylnaphthanthracene	153	49
10-Methylnaphthanthracene	176	50
11-Methylnaphthanthracene	120	47
12-Methylnaphthanthracene	138	48
Methyl 2-naphthoate	113	278
2-Methyl-1,4-naphthohydroquinone	447	119
1-Methyl-2-naphthol	231	108
2-Methyl-1-naphthol	75	100
4-Methyl-1-naphthol	140	103
4-Methyl-2-naphthol	129	103
5-Methyl-1-naphthol	187	106
5-Methyl-2-naphthol	205	106
7-Methyl-1-naphthol	230	108
2-Methyl-1,4-naphthoquinone	11	181
N-Methyl-N-(1-naphthyl)acetamide	87	233
1-Methyl-2-naphthylamine	53	304
2-Methyl-1-naphthylamine	9	303
3-Methyl-1-naphthylamine	54	304
3-Methyl-2-naphthylamine	304	312
4-Methyl-1-naphthylamine	55	304
4-Methyl-2-naphthylamine	105	306
5-Methyl-1-naphthylamine	124	306
5-Methyl-2-naphthylamine	86	305
7-Methyl-1-naphthylamine	68	304
8-Methyl-1-naphthylamine	101	306
d,l-Methyl 1-naphthyl carbinol	36	89
Methyl-1-naphthyl ether	106	136
Methyl 2-naphthyl ether	44	139
Methyl 1-naphthyl ketone	215	168
" " "	18	172
Methyl 2-naphthyl ketone	57	174
Methyl 2-naphthyl sulfide	23	425
Methylneopentylacetic acid	23	192
Methylneopentylglycolic acid	133	198
Methyl neopentyl ketone	21	161
Methyl nitrate	6	250
N-Methyl-4-nitroacetanilide	291	239
2-Methyl-4-nitroacetanilide	419	243
4-Methyl-2-nitroacetanilide	109	233
N-Methyl-3-nitroaniline	106	306
N-Methyl-4-nitroaniline	340	313
2-Methyl-3-nitroaniline	163	307
2-Methyl-4-nitroaniline	293	312
" " "	26	436
2-Methyl-5-nitroaniline	216	309
2-Methyl-6-nitroaniline	164	307
3-Methyl-4-nitroaniline	303	312
" "	31	436
4-Methyl-2-nitroaniline	245	310
4-Methyl-3-nitroaniline	126	306
" "	76	436
5-Methyl-2-nitrobenzene	43	338
2-Methyl-4-nitrobenzenesulfonamide	154	397
2-Methyl-5-nitrobenzenesulfonamide	254	401
3-Methyl-2-nitrobenzenesulfonamide	174	398
3-Methyl-4-nitrobenzenesulfonamide	84	395

	Compound No.	Page No.
4-Methyl-2-nitrobenzenesulfonamide	200	399
4-Methyl-3-nitrobenzenesulfonamide	114	396
2-Methyl-5-nitrobenzenesulfonanilide	124	396
2-Methyl-4-nitrobenzenesulfonic acid	61	373
2-Methyl-5-nitrobenzenesulfonic acid	121	375
2-Methyl-5-nitrobenzenesulfonic acid	116	375
3-Methyl-2-nitrobenzenesulfonic acid	67	373
3-Methyl-4-nitrobenzenesulfonic acid	26	371
4-Methyl-2-nitrobenzenesulfonic acid	85	373
4-Methyl-3-nitrobenzenesulfonic acid	42	372
2-Methyl-3-nitrobenzenesulfonyl chloride	145	385
2-Methyl-4-nitrobenzenesulfonyl chloride	161	386
2-Methyl-5-nitrobenzenesulfonyl chloride	32	381
3-Methyl-2-nitrobenzenesulfonyl chloride	55	382
3-Methly-4-nitrobenzenesulfonyl chloride	35	382
4-Methyl-3-nitrobenzenesulfonyl chloride	18	381
Methyl 3-nitrobenzoate	116	279
Methyl 4-nitrobenzoate	131	279
2-Methyl-4-nitrobenzoic acid	33	429
2-Methyl-3-nitrobenzonitrile	153	364
2-Methyl-2-nitrobutane	9	335
3-Methyl-1-nitrobutane	13	335
Methyl 2-nitrocinnamate	105	278
Methyl 3-nitrocinnamate	155	281
Methyl 4-nitrocinnamate	165	281
1-Methyl-2-nitronaphthalene	29	337
1-Methyl-4-nitronaphthalene	39	338
1-Methyl-8-nitronaphthalene	34	338
2-Methyl-1-nitronaphthalene	47	338
5-Methyl-1-nitronaphthalene	50	339
3-Methyl-2-nitro-1,4-naphthoquinone	84	340
2-Methy-3-nitrophenol	365	115
2-Methyl-4-nitrophenol	183	105
2-Methyl-5-nitrophenol	260	109
2-Methyl-6-nitrophenol	96	101
3-Methyl-2-nitrophenol	27	97
3-Methyl-4-nitrophenol	306	112
3-Methyl-6-nitrophenol	49	99
4-Methyl-2-nitrophenol	19	97
4-Methyl-3-nitrophenol	121	102
5-Methyl-2-nitrophenol	26	434
Methyl 2-nitrophenyl sulfide	36	425
Methyl 4-nitrophenyl sulfide	41	426
2-Methyl-1-nitropropane	8	335
2-Methyl-2-nitropropane	1	337
Methyl 3-nitrosalicylate	158	281
Methyl 5-nitrosalicylate	151	280
28-Methylnonacosane	62	9
2-Methylnonane	218	6
3-Methylnonane	224	6
4-Methylnonane	210	6
5-Methylnonane	209	6
Methyl *n*-nonyl carbinol	117	86
Methyl *n*-nonyl ketone	186	167
8-Methyl-4-nonyne	37	29
4-Methyl-3,5-octadiene	271	21
7-Methyl-2,4-octadiene	272	21
2-Methyloctanal	3	150
7-Methyloctanal	1	150
2-Methyloctane	128	5
3-Methyloctane	130	5
4-Methyloctane	125	5
Methyl *n*-octanoate	163	258
6-Methyloctanoic acid	15	192
7-Methyloctanoic acid	20	192
2-Methyl-4-octanone	102	164
4-Methyl-2-octanone	2	169
2-Methyl-4-octene	244	20
3-Methyl-2-octene	257	20
4-Methyl-2-octene	183	18
7-Methyl-3-octene	253	20
2-Methyl-3-octen-5-one	66	170
2-Methyl-3-octen-6-one	28	169
7-Methyl-1-octen-5-one	8	169
Methyl *n*-octyl carbinol	106	85
Methyl *n*-octyl ketone	166	166
2-Methylolphenol	92	434
3-Methylolphenol	87	434
4-Methylolphenol	86	434
Methyl orthoformate	33	251
Methyl palmitate	24	274
Methyl pelargonate	205	260
2-Methyl-1,3-pentadiene	64	14
2-Methyl-1,3-pentadiene	66	14
2-Methyl-1,4-pentadiene	35	13
2-Methyl-2,3-pentadiene	56	14
3-Methyl-1,2-pentadiene	74	14
3-Methyl-1,3-pentadiene	71	14
3-Methyl-1,4-pentadiene	33	13
4-Methyl-1,2-pentadiene	54	13
4-Methyl-1,3-pentadiene	67	14
2-Methylpentamethylene sulfide	24	423
3-Methylpentamethylene sulfide	27	423
4-Methylpentamethylene sulfide	30	423
d, l-2-Methylpentanamide	52	232
3-Methylpentanamide	199	236
d, l-2-Methylpentananilide	92	233
d, l-3-Methylpentananilide	70	232
4-Methylpentananilide	169	235
2-Methylpentane	21	3
3-Methylpentane	22	3
2-Methyl-2,4-pentanediol	99	85
Methyl *n*-pentanoate	57	252
d, l-2-Methylpentanoic acid	28	191
" " "	436	432
d, l-3-Methylpentanoic acid	29	191
" " "	446	432
4-Methylpentanoic acid	30	191
2-Methyl-1-pentanol	41	82
2-Methyl-2-pentanol	19	81
2-Methyl-3-pentanol	21	81
3-Methyl-1-pentanol	46	82
3-Methyl-2-pentanol	28	81
3-Methyl-3-pentanol	18	80
4-Methyl-1-pentanol	47	82
d, l-4-Methyl-2-pentanol	25	81
3-Methyl-2-pentanone	16	161
4-Methyl-2-pentanone	15	161
4-Methylpentanonitrile	38	348
4-Methylpentanoyl chloride	29	212
2-Methyl-2-pentenal-1	43	146
2-Methyl-1-pentene	39	13
2-Methyl-2-pentene	47	13
3-Methyl-1-pentene	32	13
3-Methyl-*cis*-2-pentene	55	13
3-Methyl-*trans*-2-pentene	48	13
4-Methyl-1-pentene	31	13
4-Methyl-*cis*-2-pentene	36	13
4-Methyl-*trans*-2-pentene	37	13
cis-3-Methyl-2-pentenoic acid	468	433
trans-3-Methyl-2-pentenoic acid	467	433
4-Methyl-2-pentenoic acid	438	432
4-Methyl-3-pentenoic acid	403	432
2-Methyl-1-penten-3-one	18	161
2-Methyl-1-penten-4-one	32	162
3-Methyl-1-penten-4-one	41	162
4-Methyl-3-penten-2-one	25	162
Methyl pentyl acetylene	48	30
1-Methyl-3-pentylbenzene	119	39
Methyl pentyl sulfide	28	420
3-Methyl-1-pentyne	16	28
4-Methyl-1-pentyne	15	28
4-Methyl-2-pentyne	18	28
Methyl phenacyl ketone	75	174

	Compound No.	Page No.
1-Methylphenanthrene	128	48
3-Methylphenanthrene	44	44
4-Methylphenanthrene	25	43
9-Methylphenanthrene	90	46
2-Methylphenol	11	96
"	109	435
3-Methylphenol	5	94
"	100	434
4-Methylphenol	17	97
"	108	435
Methyl phenoxyacetate	271	265
(2-Methylphenoxy) acetic acid	181	430
(4-Methylphenoxy) acetic acid	176	430
Methyl 3-phenoxypropyl ketone	49	173
Methyl phenylacetate	214	261
(4-Methylphenyl) acetic acid	361	432
d-2-Methyl-1-phenylbutane	50	37
d,l-2-Methyl-1-phenylbutane	58	37
2-Methyl-2-phenylbutane	43	37
3-Methyl-1-phenylbutane	60	37
3-Methyl-2-phenylbutane	35	36
3-Methyl-3-phenyl-2-butanone	65	170
3-Methyl-4-phenyl-2-butanone	16	169
2-Methyl-1-phenyl-1-butene	143	40
Methyl α-phenyl *n*-butyrate	114	278
3-Methyl-2-phenylbutyronitrile	88	352
d, l-Methyl phenyl carbinol	1	88
Methyl 4-phenylcyclohexyl ketone	72	170
Methyl phenyl ether	56	133
Methyl β-phenylethyl ketone	196	167
Methylphenylglycol aldehyde	20	150
2-Methyl-2-phenylhexane	121	39
3-Methyl-3-phenylhexane	123	39
α-Methyl-α-phenylhydrazine	138	299
4-Methylphenlhydrazine	91	305
Methyl phenyl ketone	160	166
2-Methyl-1-phenylpentane	104	39
2-Methyl-3-phenylpentane	93	38
3-Methyl-1-phenylpentane	115	39
3-Methyl-3-phenylpentane	82	38
2-Methyl-3-phenylpropionaldehyde	10	150
Methyl β-phenylpropionate	259	264
3-(2-Methylphenyl) propionic acid	413	432
3-(3-Methylphenyl) propionic acid	416	432
3-(4-Methylphenyl) propionic acid	417	432
Methyl phenyl sulfide	44	423
Methylphloroglucinol	531	124
Methyl phthalate	332	269
3-Methylphthalic anydride	50	226
4-Methylphthalic anhydride	38	225
1-Methylpiperidine	364	439
DL-3-Methylpiperidine	44	296
" "	458	439
DL-2-Methylpiperidine	41	296
" "	442	439
L-2-Methylpiperidine	40	296
Methyl piperonylate	65	276
Methyl pivalate	29	251
2-Methylpropane	5	3
2-Methylpropane-1-sulfonamide	1	392
2-Methylpropane-1-sulfonanilide	3	392
2-Methyl-1,2-prepanediol	79	84
2-Methyl-1-propanethiol	7	413
2-Methyl-2-propanethiol	4	413
2-Methyl-1-propanol	10	80
2-Methyl-2-propenal	10	144
2-Methylpropene	5	12
Methylpropionate	11	250
Methyl *n*-propylacetaldehyde	30	145
Methyl-*n*-propylacetic acid	28	191
Methyl propyl acetylene	24	29
1-Methyl-2-propylbenzene	31	36
1-Methyl-3-propylbenzene	24	36
1-Methyl-4-propylbenzene	27	36
Methyl *n*-propylcarbinyl acetate	65	252
1-Methyl-1-propylcyclohexane	238	7
1-Methyl-2-propylcyclohexane	241	7
1-Methyl-3-propylcyclohexane	204	6
1-Methyl-4-propylcyclohexane	240	7
3-Methvl-2-*n*-propylcyclopentanone	86	170
Methyl *n*-propyl ether	7	131
Methyl *n*-propyl ketone	10	161
Methyl *n*-propyl sulfide	9	420
2-Methyl-5-propylthiophene	44	424
4-Methylpurpuroxanthin	45	184
2-Methylpyrazine	16	319
1-Methylpyrazole	11	319
3-Methylpyrazole	106	298
"	101	436
4-Methylpyrazole	100	298
5-Methyl-2-pyrazoline	78	297
3-Methylpyrene	62	45
3-Methylpyridazine	114	298
2-Methylpyridine	13	319
"	240	437
3-Methylpyridine	19	319
"	227	437
4-Methylpyridine	20	319
"	247	438
N-Methyl-2-pyridone	86	321
N-Methyl-4-pyridone	59	324
Methyl 2-pyridyl ketone	144	165
" " "	50	320
Methyl 3-pyridyl ketone	68	320
" " "	175	166
Methyl-4-pyridyl ketone	167	166
"	66	320
DL-1-Methyl-2-(3-pyridyl)pyrrolidine	73	321
L-1-Methyl-2-(3-pyridyl)pyrrolidine	82	321
4-Methylpyrimidine	17	319
5-Methylpyrimidine	6	323
5-Methylpyrogallol	268	110
Methyl pyromucate	141	256
N-Methylpyrrolidine	3	319
"	385	439
2-Methylpyrrolidine	30	296
3-Methylpyrrolidine	31	296
1-Methyl-3-pyrroline	351	438
Methyl pyruvate	70	253
β-Methylquinoline	90	321
γ-Methylquinoline	95	321
2-Methylquinoline	80	321
"	230	437
3-Methylquinoline	90	321
4-Methylquinoline	95	321
"	205	437
5-Methylquinoline	94	321
"	166	437
6-Methylquinoline	91	321
"	201	437
7-Methylquinoline	13	323
"	208	437
8-Methylquinoline	81	321
"	183	437
2-Methylquinoxaline	78	321
2-Methylresorcinol	265	110
5-Methylresorcinol	217	107
5-Methylsalicylaldehyde	41	155
Methyl salicylate	12	94
" "	220	262
Methyl sebacate	42	275
Methyl stearate	43	275
Methyl styryl ketone	37	173

	Compound No.	Page No.
α-Methylstyryl phenyl ketone	220	168
Methylsuccinic acid	145	199
Methylsuccinic acid diamide	476	245
Methylsuccinic acid dianilide	428	243
DL-Methylsuccinic anhydride	7	225
Methyl succinonitrile	89	352
Methyl sulfate	150	257
Methyl sulfide	1	420
(Methylsulfonyl)acetic acid	89	429
3-(Methylsulfonyl)phenol	68	434
4-(Methylsulfonyl)phenol	31	434
DL-Methylterose	1	328
L-Methylterose	12	328
2-Methyl-3,4,5,6-tetrabromophenol	523	123
3-Methyl-2,4,5,6-tetrabromophenol	494	122
4-Methyl-2,3,5,6-tetrabromophenol	499	122
2-Methyl-4,5,6,7-tetrahydroindole	127	299
6-Methyl-1,2,3,4-tetrahydroisoquinoline	172	300
1-Methyl-1,2,3,4-tetrahydronaphthalene	112	39
2-Methyl-1,2,3,4-tetrahydronaphthalene	111	39
5-Methyl-1,2,3,4-tetrahydronaphthalene	131	40
6-Methyl-1,2,3,4-tetrahydronaphthalene	128	40
4-Methyl-5,6,7,8-tetrahydro-2-naphthol	222	107
3-Methyl-5,6,7,8-tetrahydroquinoline	8	322
4-Methyl-5,6,7,8-tetrahydroquinoline	7	322
7-Methyl-1,2,3,4-tetrahydroquinoline	176	300
1-Methyltetralin	112	39
2-Methyltetralin	111	39
5-Methyltetralin	131	40
6-Methyltetralin	128	40
2-Methyl-1-tetralone	84	170
4-Methyl-1-tetralone	87	170
2-Methyltetramethylene sulfide	13	423
3-Methyltetramethylene sulfide	18	423
2-Methylthiane	24	423
3-Methylthiane	27	423
4-Methylthiane	30	423
4-Methylthiazole-5-carboxaldehyde	65	156
Methyl 2-thienyl ketone	169	166
2-Methylthietane	7	423
2-Methylthiirane	2	423
3-(Methylthio)aniline	126	437
4-(Methylthio)aniline	146	437
4-(Methylthio)benzaldehyde	46	426
2-(Methylthio)ethylamine	328	438
2-Methylthiolane	13	423
3-Methylthiolane	18	423
2-Methylthiophene	8	423
3-Methylthiophene	10	423
3-Methyl-2-thiophenecarboxaldehyde	11	152
5-Methyl-2-thiophenecarboxaldehyde	10	152
3-(Methylthio)phenol	77	434
4-(Methylthio)phenol	78	434
2-(Methylthio)pyridine	106	436
3-(Methylthio)pyridine	152	437
4-(Methylthio)pyridine	241	437
Methyl thymyl ether	87	135
Methyl 2-toluate	208	261
Methyl 3-toluate	216	261
Methyl 4-toluate	30	274
N-Methyltoluene-2-sulfonamide	15	392
N-Methyltoluene-4-sulfonamide	19	392
N-Methyl-*o*-toluidine	103	298
N-Methyl-*p*-toluidine	109	298
Methyl 2-(4-toluyl)benzoate	86	277
α-Methyl-4-tolyl alcohol	110	85
Methyl 2-tolyl ether	62	134
Methyl 3-tolyl ether	66	134
Methyl 4-tolyl ether	65	134
Methyl 2-tolyl ketone	170	166
Methyl 3-tolyl ketone	176	166
Methyl 4-tolyl sulfide	49	421
2-Methyl-3,4,5-tribromophenol	153	104
2-Methyl-3,4,6-tribromophenol	162	104
3-Methyl-2,4,6-tribromophenol	131	103
4-Methyl-2,3,6-tribromophenol	198	106
2-Methyl-3,5,6-trichlorophenol	68	100
2-Methyl-4,5,6-trichlorophenol	114	102
3-Methyl-2,4,6-trichlorophenol	41	98
4-Methyl-2,3,5-trichlorophenol	80	100
1-Methyl-3,4,5-trihydroxybenzene	268	110
5-Methyl-1,2,3-trihydroxybenzene	268	110
5-Methyl-1,2,4-trihydroxybenzene	314	112
Methyl 3,4,5-trihydroxybenzoate	506	123
Methyl trimethylacetate	29	251
2-Methyltrimethylene sulfide	7	423
2-Methyl-3,4,5-trinitrophenol	197	106
3-Methyl-2,4,6-trinitrophenol	224	107
4-Methylumbelliferone	480	121
Methyl undecylenate	285	265
Methyl *n*-undecyl ketone	9	172
Methylurea	121	234
Methyl urethane	11	231
Methyl *n*-valerate	57	252
Methyl vinyl acetylene	14	28
Methyl vinyl carbinol	4	80
Methyl vinyl ketone	2	161
Methyl vinyl sulfide	3	420
Methyl 4-xenyl ketone	152	177
Michler's ketone	87	325
Morphol	345	114
Morpholine	48	296
"	296	438
Mucic acid	341	207
Mucic acid diamide	465	244
Mucic acid monoamide	407	242
Mucic acid monoanilide	506	246
Muconic acid	400	209
Muconic acid diamide	489	245
Mustard gas	52	421
Myrcene	295	22
Myricyl alcohol	46	89
Myristaldehyde	4	153
Myristamide	147	234
Myristanilide	61	232
Myristic acid	46	194
Myristic anhydride	19	225
Myristone	110	175
Myristoyl chloride	11	214
Myristyl alcohol	17	88

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1-Naphthaldehyde	7	153
2-Naphthaldehyde	50	155
Naphthalene	77	46
1-Naphthaleneacetic acid	177	200
2-Naphthaleneacetic acid	210	201
1,8-Naphthalenedicarboxylic anhydride	84	227
1,2-Naphthalenediol	64	99
1,3-Naphthalenediol	291	111
1,4-Naphthalenediol	490	122
1,5-Naphthalenediol	575	127
1,6-Naphthalenediol	330	113
1,7-Naphthalenediol	462	120
1,8-Naphthalenediol	343	114
2,3-Naphthalenediol	407	117
2,6-Naphthalenediol	535	124
2,7-Naphthalenediol	484	121
Naphthalene-1,3-disulfonamide	462	409
Naphthalene-1,4-disulfonamide	453	409
Naphthalene-1,5-disulfonamide	471	410

	Compound No.	Page No.
Naphthalene-1,6-disulfonamide	465	410
Naphthalene-1,7-disulfonamide	466	410
Naphthalene-2,6-disulfonamide	468	410
Naphthalene-2,7-disulfonamide	420	408
Naphthalene-1,4-disulfonanilide	227	400
Naphthalene-1,5-disulfonanilide	434	408
Naphthalene-1,3-disulfonic acid	216	378
Naphthalene-1,4-disulfonic acid	209	378
Naphthalene-1,5-disulfonic acid	223	379
Naphthalene-1,6-disulfonic acid	218	378
Naphthalene-1,7-disulfonic acid	219	379
Naphthalene-2,6-disulfonic acid	221	379
Naphthalene-2,7-disulfonic acid	193	378
Naphthalene-1,3-disulfonyl chloride	218	388
Naphthalene-1,4-disulfonyl chloride	249	389
Naphthalene-1,5-disulfonyl chloride	266	389
Naphthalene-1,6-disulfonyl chloride	206	387
Naphthalene-2,6-disulfonyl chloride	279	390
Naphthalene-2,7-disulfonyl chloride	248	389
1,5-Naphthalenedithiol	41	417
1,8-Naphthalenedithiol	37	417
2,7-Naphthalenedithiol	46	417
Naphthalene-1-sulfonamide	128	396
Naphthalene-2-sulfonamide	351	405
Naphthalene-1-sulfonanilide	47	393
Naphthalene-2-sulfonanilide	81	395
Naphthalene-1-sulfonic acid	49	372
Naphthalene-2-sulfonic acid	163	377
Naphthalene-1-sulfonyl chloride	74	383
Naphthalene-2-sulfonyl chloride	89	383
1,2,3,4-Naphthalenetetrol	555	126
1,2,5,8-Naphthalenetetrol	469	121
1,4,5,8-Naphthalenetetrol	485	121
1-Naphthalenethiol	47	415
2-Naphthalenethiol	25	416
1,2,4-Naphthalenetriol	388	116
1,2,6-Naphthalenetriol	482	121
1,2,7-Naphthalenetriol	498	122
1,3,6-Naphthalenetriol	175	105
1,4,6-Naphthalenetriol	335	113
1,6,7-Naphthalenetriol	459	120
2-Naphthamide	412	243
1-Naphthanilide	324	240
Naphthionic acid	154	376
1-Naphthoamide	434	243
β-Naphthohydroquinone	220	107
1,4-Naphthohydroquinone	461	120
"	71	434
1-Naphthoic acid	245	203
2-Naphthoic acid	288	204
" "	309	431
α-Naphthoic anhydride	65	226
β-Naphthoic anhydride	60	226
1-Naphthoic anhydride	65	226
2-Naphthoic anhydride	60	226
2-Naphthoin	157	177
α-Naphthol	169	105
" "	67	434
β-Naphthol	284	411
" "	80	434
1-Naphthol	169	105
"	67	434
2-Naphthol	284	111
"	80	434
1-Naphthonitrile	25	358
2-Naphthonitrile	78	360
α-Naphthoquinone	14	181
β-Naphthoquinone	19	182
1,2-Naphthoquinone	19	182
1,4-Naphthoquinone	14	181
1-Naphthoxyacetone	11	169
2-Naphthoxyacetone	105	175
1-Naphthoxyacetyl chloride	24	214
2-Naphthoxyacetyl chloride	11	216
1-Naphthoyl chloride	61	213
2-Naphthoyl chloride	7	216
3-(1-Naphthoyl)propionic acid	386	432
3-(2-Naphthoyl)propionic acid	462	433
1-Naphthylacetamide	379	242
N-(1-Naphthyl)acetamide	316	239
2-Naphthylacetamide	430	243
N-(2-Naphthyl)acetamide	240	237
N-(1-Naphthyl)-4-acetamidobenzenesulfonamide	347	405
N-(1-Naphthyl)acetanilide	302	239
1-Naphthyl acetate	58	276
2-Naphthyl acetate	99	278
(1-Naphthyl)acetic acid	177	200
" " "	329	431
(2-Naphthyl)acetic acid	210	201
" "	336	431
1-Naphthylacetonitrile	22	358
2-Naphthylacetonitrile	109	362
1-Naphthylacetyl chloride	29	214
1-Naphthylamine	51	304
2-Naphthylamine	232	310
N-(1-Naphthyl)-4-aminobenzenesulfonamide	301	403
2-Naphthylanilide	348	241
N-(1-Naphthyl)benzamide	319	240
N-(2-Naphthyl)benzamide	320	240
N-(1-Naphthyl)benzenesulfonamide	201	399
1-Naphthyl benzoate	78	277
2-Naphthyl benzoate	142	280
o-2-Naphthylbenzoic acid	308	205
N-(1-Naphthyl)benzylsulfonamide	181	398
N-(1-Naphthyl)-4-bromobenzenesulfonamide	244	401
N-(1-Naphthyl)-4-chlorobenzenesulfonamide	270	402
N-(1-Naphthyl)-4-chloronaphthalene-1-sulfonamide	169	398
N-(1-Naphthyl)ethanesulfonamide	13	392
1-(1-Naphthyl)ethanol	36	89
(1-Naphthyl)glycolic acid	112	197
2-Naphthylglyoxal	124	176
(1-Naphthyl)glyoxylic acid	141	198
N-(1-Naphthyl)methane sulfonamide	68	394
N-(1-Naphthyl)-3-methylbutane-1-sulfonamide	24	392
N-(1-Naphthyl)-2-methylpropanesulfonamide	38	393
1-Naphthyl 2-naphthyl sulfide	70	426
N-(1-Naphthyl)-3-nitrobenzenesulfonamide	184	398
1-Naphthyl phenyl amine	78	305
2-Naphthyl phenyl amine	218	309
1-Naphthyl phenyl ketone	100	175
1-Naphthyl phenyl sulfide	15	425
N-(1-Naphthyl)propane-1-sulfonamide	21	392
N-(1-Naphthyl)propane-2-sulfonamide	86	395
2-(1-Naphthyl)propionaldehyde	25	150
3-(1-Naphthyl)propionic acid	239	202
2-Naphthyl *n*-propyl ether	23	138
2-Naphthyl salicylate	178	105
" "	130	279
2-Naphthyl sulfide	71	426
N-(1-Naphthyl)toluene-4-sulfonamide	151	397
1-Naphthyl 4-tolyl amine	128	306
2-Naphthyl 4-tolyl amine	198	309
cis-Neobornylamine	362	438
Neonerolin	19	137
Neopentane	7	3
Neopentyl alcohol	28	89
Neopentyl benzene	32	36
Neopentyl bromide	13	58
Neopentyl chloride	14	55
Neopentyl cyanide	21	358
Neopentyl phenyl ketone	91	170
Neral	83	148
Nerolin	44	139

	Compound No.	Page No.
Nicotinaldehyde	15	152
Nicotinamide	214	236
Nicotinanilide	226	237
DL-Nicotine	73	321
L-Nicotine	82	321
Nicotinic acid	443	432
Nicotinic anhydride	53	226
Nicotinonitrile	54	359
Nicotinyl chloride	16	214
Ninhydrin	203	179
3-Nitroacenaphthene	103	341
5-Nitroacenaphthene	74	340
2-Nitroacetanilide	82	233
3-Nitroacetanilide	304	239
4-Nitroacetanilide	453	244
Nitroacetic acid	26	429
3-Nitroacetophenone	112	175
2-Nitroaniline	110	306
"	12	436
3-Nitroaniline	237	310
"	52	436
4-Nitroaniline	330	313
"	24	436
2-Nitroaniline-4-sulfonyl chloride	57	382
3-Nitroanisic acid	300	205
2-Nitro-*p*-anisidine	64	304
3-Nitro-*o*-anisidine	121	306
3-Nitro-*p*-anisidine	287	311
4-Nitro-*o*-anisidine	249	310
5-Nitro-*o*-anisidine	314	312
2-Nitroanisole	107	136
"	32	336
3-Nitroanisole	21	138
"	12	337
4-Nitroanisole	34	138
"	23	337
9-Nitroanthracene	100	341
1-Nitroanthraquinone	130	342
2-Nitroanthraquinone	121	342
2-Nitroazobenzene	38	338
3-Nitroazobenzene	68	339
4-Nitroazobenzene	94	340
2-Nitroazoxybenzene	19	337
4-Nitroazoxybenzene	104	341
2-Nitrobenzaldehyde	22	154
3-Nitrobenzaldehyde	44	155
4-Nitrobenzaldehyde	92	158
2-Nitrobenzamide	362	241
3-Nitrobenzamide	263	238
4-Nitrobenzamide	429	243
2-Nitrobenzamide-4-sulfonamide	376	406
2-Nitrobenzanilide	300	239
3-Nitrobenzanilide	294	239
4-Nitrobenzanilide	449	244
Nitrobenzene	21	335
5-Nitrobenzene-1,3-disulfonamide	419	408
5-Nitrobenzene-1,3-disulfonic acid	194	378
5-Nitrobenzene-1,3-disulfonyl chloride	142	385
2-Nitrobenzenesulfonamide	288	403
3-Nitrobenzenesulfonamide	185	398
4-Nitrobenzenesulfonamide	228	400
2-Nitrobenzenesulfonanilide	52	394
3-Nitrobenzenesulfonanilide	69	394
4-Nitrobenzenesulfonanilide	204	399
2-Nitrobenzenesulfonic acid	137	376
3-Nitrobenzenesulfonic acid	77	373
4-Nitrobenzenesulfonic acid	98	374
2-Nitrobenzenesulfonyl chloride	76	383
3-Nitrobenzenesulfonyl chloride	66	383
4-Nitrobenzenesulfonyl chloride	95	384
2-Nitrobenzoic acid	218	202
" "	67	429
3-Nitrobenzoic acid	204	201
" "	200	430
4-Nitrobenzoic acid	373	208
2-Nitrobenzoic acid-4-sulfonamide	280	402
2-Nitrobenzoic anhydride	61	226
3-Nitrobenzoic anhydride	69	226
4-Nitrobenzoic anhydride	73	226
2-Nitrobenzonitrile	153	364
3-Nitrobenzonitrile	164	364
4-Nitrobenzonitrile	193	365
3-Nitrobenzoyl bromide	1	220
4-Nitrobenzoyl bromide	5	220
3-Nitrobenzoyl carbinol	51	89
4-Nitrobenzoyl carbinol	55	90
2-Nitrobenzoyl chloride	27	214
3-Nitrobenzoyl chloride	60	213
4-Nitrobenzoyl chloride	15	216
2-Nitrobenzyl alcohol	43	89
3-Nitrobenzyl alcohol	8	88
4-Nitrobenzyl alcohol	52	90
2-Nitrobenzyl bromide	4	59
3-Nitrobenzyl bromide	6	59
4-Nitrobenzyl bromide	8	59
4-Nitrobenzyl chloride	7	57
4-Nitrobenzyl cyanide	161	364
4-Nitrobenzyl phenyl sulfide	47	426
4-Nitrobenzyl sulfide	73	427
3-Nitrobenzylsulfonamide	162	398
4-Nitrobenzylsulfonamide	320	404
4-Nitrobenzylsulfonanilide	361	406
3-Nitrobenzylsulfonic acid	63	373
4-Nitrobenzylsulfonic acid	149	376
3-Nitrobenzylsulfonyl chloride	152	386
2-Nitrobiphenyl	9	337
3-Nitrobiphenyl	32	338
4-Nitrobiphenyl	78	340
4′-Nitrobiphenyl-4-sulfonamide	384	407
4′-Nitrobiphenyl-4-sulfonic acid	173	377
4′-Nitrobiphenyl-4-sulfonyl chloride	265	389
1-Nitrobutane	11	335
DL-2-Nitrobutane	7	335
tert-Nitrobutane	1	337
3-Nitrocatechol	148	104
'	19	434
4-Nitrocatechol	460	120
2-Nitrocinnamamide	390	242
3-Nitrocinnamamide	417	243
4-Nitrocinnamamide	439	243
trans-2-Nitrocinnamic acid	371	208
" ' "	307	431
trans-3-Nitrocinnamic acid	317	206
" " "	303	431
trans-4-Nitrocinnamic acid	398	209
" ' "	293	431
trans-2-Nitrocinnamoyl chloride	13	216
trans-4-Nitrocinnamoyl chloride	28	216
2-Nitro-*m*-cresol	27	97
2-Nitro-*p*-cresol	19	97
3-Nitro-*o*-cresol	365	115
3-Nitro-*p*-cresol	121	102
4-Nitro-*m*-cresol	306	112
4-Nitro-*o*-cresol	183	105
5-Nitro-*o*-cresol	260	109
6-Nitro-*m*-cresol	49	99
6-Nitro-*o*-cresol	96	101
Nitrocyclohexane	19	335
2-Nitro-*p*-cymene	31	336
2-Nitrodiphenyl sulfide	49	426
3-Nitrodiphenyl sulfide	16	425
4-Nitrodiphenyl sulfide	29	425
2-Nitrodiphenylamine-4-sulfonamide	170	398
4-Nitrodiphenylamine-2-sulfonamide	208	399

	Compound No.	Page No.
2-Nitrodiphenylamine-4-sulfonanilide	155	397
4-Nitrodiphenylamine-2-sulfonanilide	177	398
4-Nitrodiphenylamine-2-sulfonic acid	88	374
2-Nitrodiphenylamine-4-sulfonic acid	65	373
4-Nitrodiphenylamine-2-sulfonyl chloride	155	386
3-Nitrodurene	77	340
Nitroethane	3	335
Nitroethylene	1	335
2-Nitrofluorene	106	341
9-Nitrofluorene	118	342
1-Nitroheptane	17	335
2-Nitroheptane	18	335
1-Nitrohexane	16	335
2-Nitrohexane	15	335
2-Nitrohydroquinone	29	434
4-Nitroindane	16	337
5-Nitroindane	14	337
2-Nitroindane	96	341
1-Nitroisobutene	12	335
1-Nitroisobutylene	12	335
4-Nitromesidine	120	306
Nitromesitylene	17	337
Nitromethane	2	335
3-Nitro-N-methylaniline	106	306
1-Nitronaphthalene	27	337
2-Nitronaphthalene	44	338
4-Nitronaphthalene-2,7-disulfonamide	459	409
4-Nitronaphthalene-2,7-disulfonic acid	213	378
4-Nitronaphthalene-2,7-disulfonyl chloride	227	388
1-Nitronaphthalene-2-sulfonamide	344	405
4-Nitronaphthalene-1-sulfonamide	264	402
4-Nitronaphthalene-2-sulfonamide	374	406
5-Nitronaphthalene-1-sulfonamide	402	407
5-Nitronaphthalene-2-sulfonamide	246	401
6-Nitronaphthalene-1-sulfonamide	370	406
7-Nitronaphthalene-1-sulfonamide	446	409
8-Nitronaphthalene-1-sulfonamide	275	402
8-Nitronaphthalene-2-sulfonamide	386	407
1-Nitronaphthalene-2-sulfonanilide	318	404
5-Nitronaphthalene-1-sulfonanilide	63	394
8-Nitronaphthalene-1-sulfonanilide	226	400
8-Nitronaphthalene-2-sulfonanilide	206	399
1-Nitronaphthalene-2-sulfonic acid	160	376
4-Nitronaphthalene-1-sulfonic acid	126	375
5-Nitronaphthalene-1-sulfonic acid	183	377
5-Nitronaphthalene-2-sulfonic acid	108	374
7-Nitronaphthalene-1-sulfonic acid	207	378
8-Nitronaphthalene-1-sulfonic acid	131	375
8-Nitronaphthalene-2-sulfonic acid	166	377
1-Nitronaphthalene-2-sulfonyl chloride	189	387
4-Nitronaphthalene-1-sulfonyl chloride	149	385
4-Nitronaphthalene-2-sulfonyl chloride	224	388
5-Nitronaphthalene-1-sulfonyl chloride	174	386
5-Nitronaphthalene-2-sulfonyl chloride	203	387
6-Nitronaphthalene-1-sulfonyl chloride	204	387
7-Nitronaphthalene-1-sulfonyl chloride	263	389
8-Nitronaphthalene-1-sulfonyl chloride	254	389
8-Nitronaphthalene-2-sulfonyl chloride	260	389
4-Nitro-1-naphthalenethiol	24	416
1-Nitro-2-naphthol	199	106
2-Nitro-1-naphthol	302	111
4-Nitro-1-naphthol	421	118
4-Nitro-2-naphthol	272	110
5-Nitro-1-naphthol	451	119
5-Nitro-2-naphthol	364	115
6-Nitro-1-naphthol	471	121
8-Nitro-1-naphthol	311	112
8-Nitro-2-naphthol	351	114
1-Nitro-2-naphthonitrile	183	365
4-Nitro-1-naphthonitrile	179	365
5-Nitro-1-naphthonitrile	223	367
5-Nitro-2-naphthonitrile	213	366
8-Nitro-2-naphthonitrile	189	365
3-Nitro-1,2-naphthoquinone	107	341
1-Nitro-2-naphthylamine	276	311
2-Nitro-1-naphthylamine	322	313
4-Nitro-1-naphthylamine	412	316
5-Nitro-1-naphthylamine	252	310
5-Nitro-2-naphthylamine	323	313
8-Nitro-1-naphthylamine	185	308
8-Nitro-2-naphthylamine	201	309
1-Nitrooctane	20	335
1-Nitropentane	14	335
DL-2-Nitropentane	10	335
3-Nitrophenacyl alcohol	51	89
4-Nitrophenacyl alcohol	55	90
2-Nitrophenanthrene	70	339
3-Nitrophenanthrene	112	341
4-Nitrophenanthrene	48	338
9-Nitrophenanthrene	79	340
2-Nitrophenanthrenequinone	135	342
3-Nitrophenanthrenequinone	136	342
4-Nitrophenanthrenequinone	116	342
3-Nitro-*p*-phenetidine	235	310
2-Nitrophenetole	34	336
3-Nitrophenetole	17	137
	8	337
4-Nitrophenetole	30	338
2-Nitrophenol	34	98
	24	434
3-Nitrophenol	185	105
	42	434
4-Nitrophenol	242	108
	23	434
(3-Nitrophenoxy)acetic acid	133	430
(4-Nitrophenoxy)acetic acid	128	430
3-Nitrophenylacetamide	164	235
4-Nitrophenylacetamide	422	243
4-Nitrophenylacetanilide	423	243
(2-Nitrophenyl)acetic acid	207	201
	287	431
(3-Nitrophenyl)acetic acid	157	199
	278	431
(4-Nitrophenyl)acetic acid	229	202
	259	431
(4-Nitrophenyl)acetonitrile	161	364
4-Nitrophenylacetyl chloride	10	216
β-(2-Nitrophenyl)acrylonitrile	120	362
2-Nitro-*p*-phenylenediamine	307	312
4-Nitro-*m*-phenylenediamine	361	314
4-Nitro-*o*-phenylenediamine	415	316
2-Nitrophenylhydrazine	158	307
3-Nitrophenylhydrazine	170	308
4-Nitrophenylhydrazine	352	314
2-Nitro-5-phenylphenol	20	434
2-Nitrophenyl phenylsulfide	49	426
3-Nitrophenyl phenyl sulfide	16	425
4-Nitrophenyl phenyl sulfide	29	425
3-(2-Nitrophenyl)propionic acid	391	432
3-(4-Nitrophenyl)propionic acid	384	432
2-Nitrophenyl sulfide	65	426
3-Nitrophenyl sulfide	75	427
4-Nitrophenyl 4-tolyl sulfide	51	426
4-Nitrophthalamide	426	243
4-Nitrophthalanilide	408	243
3-Nitrophthalic acid	346	207
4-Nitrophthalic acid	253	203
3-Nitrophthalic acid diamide	432	243
3-Nitrophthalic acid dianilide	484	245
3-Nitrophthalic anhydride	70	226
4-Nitrophthalic anhydride	51	226

	Compound No.	Page No.
3-Nitrophthalimide	455	244
3-Nitrophthaloyl chloride	16	216
1-Nitropropane	6	335
2-Nitropropane	4	335
3-Nitropropene	5	335
3-Nitropropylene	5	335
3-Nitropyridine	17	323
"	20	436
5-Nitroquinoline	39	323
"	66	436
6-Nitroquinoline	81	324
	67	436
7-Nitroquinoline	78	324
"	49	436
8-Nitroquinoline	56	436
2-Nitroresorcinol	143	103
4-Nitroresorcinol	280	110
5-Nitroresorcinol	397	116
3-Nitrosalicylamide	296	239
3-Nitrosalicylamide (hydrate)	267	238
5-Nitrosalicylamide	474	245
5-Nitrosalicylanilide	473	245
3-Nitrosalicylic acid	374	115
"	166	199
5-Nitrosalicylic acid	358	208
4-Nitroso-N,N-dimethylaniline	50	324
β-Nitrostyrene	28	337
3-Nitro-1,2,4,5-tetramethylbenzene	77	340
2-Nitrothiophenol	19	416
3-Nitrothiophenol	22	416
4-Nitrothiophenol	23	416
2-Nitrotoluene	22	335
3-Nitrotoluene	26	336
4-Nitrotoluene	21	337
3-Nitrotoluene-α-sulfonamide	162	398
4-Nitrotoluene-α-sulfonamide	320	404
4-Nitrotoluene-α-sulfonanilide	361	406
2-Nitro-*p*-toluidine	126	306
3-Nitro-*o*-toluidine	164	307
3-Nitro-*p*-toluidine	245	310
4-Nitro-*o*-toluidine	216	309
5-Nitro-*o*-toluidine	293	312
6-Nitro-*m*-toluidine	303	312
6-Nitro-*o*-toluidine	163	307
2-Nitro-3-tolunitrile	106	362
2-Nitro-4-tolunitrile	148	363
3-Nitro-2-tolunitrile	152	364
3-Nitro-4-tolunitrile	136	363
4-Nitro-2-tolunitrile	145	363
4-Nitro-3-tolunitrile	123	362
5-Nitro-3-tolunitrile	143	363
6-Nitro-2-tolunitrile	86	361
6-Nitro-3-tolunitrile	102	362
1-Nitro-2,4,6-tribromobenzene	89	340
2-Nitro-3,4,6-tribromophenol	301	111
2-Nitro-4,5,6-tribromophenol	287	111
3-Nitro-2,4,6-tribromophenol	156	104
1-Nitro-2,3,6-trimethylbenzene	3	337
3-Nitro-2,4,6-trimethylphenol	57	434
2-Nitro-*m*-xylene	24	336
2-Nitro-*p*-xylene	27	336
3-Nitro-*o*-xylene	30	336
4-Nitro-*m*-xylene	29	336
4-Nitro-*o*-xylene	4	337
5-Nitro-*m*-4-xylidine	123	306
5-Nitro-*p*-2-xylidine	325	313
n-Nonacosane	45	8
Nonacosylcyclohexane	56	9
Nonacosylcyclopentane	44	8
1-Nonacosyne	16	31
n-Nonadecane	11	8
1-Nonadecanol	34	89
10-Nonadecanol	46	89
2-Nonadecanone	61	174
Nonadecanonitrile	37	358
1-Nonadecene	1	26
Nonadecylcyclohexane	22	8
Nonadecylcyclopentane	13	8
1-Nonadecyne	5	31
1,8-Nonadiene	255	20
2,7-Nonadiene	280	21
1,8-Nonadiyne	51	30
2,7-Nonadiyne	56	30
Nonanal	67	147
n-Nonane	144	5
1-Nonanethiol	43	415
n-Nonanoic acid	48	191
	459	432
1-Nonanol	107	85
d,l-2-Nonanol	102	85
5-Nonanol	97	85
2-Nonanone	150	166
3-Nonanone	142	165
5-Nonanone	140	165
Nonanonitrile	76	351
n-Nonanoyl chloride	45	213
Nonantriacontane	74	9
1-Nonatriacontene	22	26
1-Nonatriacontyne	26	31
2-Nonenal	16	150
1-Nonene	268	21
2-Nonene	275	21
3-Nonene	269	21
4-Nonene	260	20
n-Nonylacetylene	57	30
n-Nonyl alcohol	107	85
n-Nonylamine	95	298
	419	439
n-Nonylbenzene	166	41
n-Nonyl bromide	27	58
n-Nonyl chloride	46	56
n-Nonylcyclohexane	270	7
n-Nonylcyclopentane	266	7
n-Nonyl iodide	20	60
n-Nonyl mercaptan	43	415
1-Nonylnaphthalene	184	42
2-Nonylnaphthalene	185	42
1-Nonyne	47	30
2-Nonyne	50	30
3-Nonyne	48	30
4-Nonyne	46	29
Nopinane	140	5
Nopinene	291	22
Norbornane	77	9
Norbricyclene	33	8
DL-Norleucine	106	289
"	79	429
L-(+)-Norleucine	111	289
DL-Norvaline	112	289
L-(+)-Norvaline	120	290
NW-acid	14	380

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	Compound No.	Page No.
Octachloronaphthalene	33	72
n-Octacosane	42	8
Octacosylcyclohexane	53	9
Octacosylcyclopentane	41	8
1-Octacosyne	15	31
Octadecanal	14	153
n-Octadecane	8	8
n-Octadecanoic acid	70	195
n-Octadecanoic anhydride	28	225

	Compound No.	Page No.
1-Octadecanol	33	89
Octadecanonitrile	33	358
1-Octadecene	338	24
cis-Octa-9-decen-1-ol	134	87
trans-Octa-9-decen-ol	15	88
cis-Octadecenyl alcohol	134	87
n-Octadecyl acetate	27	274
Octadecylcyclohexane	18	8
Octadecylcyclopentane	10	8
Octadecyl sulfide	39	426
1-Octadecyne	3	31
2-Octadecyne	4	31
2,4-Octadiene	234	19
2,6-Octadiyne	2	31
Octanal	60	147
n-Octanamide	161	235
n-Octane	82	4
Octane-1,8-dicarboxylic acid	183	200
Octanedioic acid	215	202
Octanedioic anhydride (dimer)	22	225
1-Octanethiol	36	414
2-Octanethiol	30	414
n-Octanoic acid	47	191
" "	456	432
n-Octanoic anhydride	18	223
1-Octanol	98	85
d,l-2-Octanol	80	84
2-Octanone	114	164
4-Octanone	107	164
Octanonitrile	66	350
n-Octanoyl chloride	40	213
Octatriacontane	72	9
1-Octatriacontene	21	26
1-Octatriacontyne	25	31
Octatrienal	37	155
4-Octenal	12	152
1-Octene	209	18
cis-2-Octene	221	19
trans-2-Octene	220	19
cis-3-Octene	217	19
trans-3-Octene	218	19
cis-4-Octene	213	19
trans-4-Octene	210	19
n-Octyl acetate	194	260
sec-Octyl acetate	162	258
n-Octylacetylene	52	30
n-Octyl alcohol	98	85
n-Octylamine	77	297
"	421	439
n-Octylbenzene	156	41
n-Octyl bromide	24	58
n-Octyl *n*-butyrate	268	264
n-Octyl *n*-caproate	325	269
n-Octyl *n*-caprylate	348	270
n-Octyl chloride	39	56
n-Octylcyclohexane	267	7
n-Octylcylopentane	263	7
n-Octyl *n*-enanthate	338	270
n-Octyl formate	170	258
n-Octyl *n*-heptanoate	338	270
n-Octyl *n*-hexanoate	325	269
n-Octyl iodide	21	60
n-Octyl mercaptan	36	414
sec-Octyl mercaptan	30	414
1-Octylnaphthalene	182	42
2-Octylnaphthalene	183	42
n-Octyl *n*-octanoate	348	270
n-Octyl *n*-pentanoate	306	267
n-Octyl propionate	234	262
n-Octyl sulfide	30	425
2-*n*-Octylthiophene	54	424
n-Octyl *n*-valerate	306	267
1-Octyne	42	29
2-Octyne	45	29
3-Octyne	44	29
4-Octyne	43	29
2-Octynoic acid	14	192
3-Octyn-2-one	14	169
2-Octynonitrile	60	349
Oleamide	41	232
Oleanilide	2	231
trans-Oleic acid	31	194
" " "	4	192
Oleic anhydride	1	225
Oleyl alcohol	134	87
Oleyl chloride	3	214
Orcinol	217	107
DL-Ornithine	127	290
" "	38	429
L-Ornithine	8	284
Orthanilic acid	54	372
Oxalic acid	116	197
" "	10	429
Oxalic acid diamide	513	247
Oxalic acid dianilide	497	246
Oxaloacetic acid	102	429
Oxalyl chloride	2	212
Oxalyl dibromide	1	218
Oxamic acid	334	207
Oxanilic acid	224	202
Oxime	110	102
2-Oxobutanoic acid	11	193
2-Oxocyclohexane-carboxylic acid	82	196
3-Oxocyclohexane-carboxylic acid	74	196
4-Oxocyclohexane-carboxylic acid	67	195
2-Oxopropionaldehyde	103	171
α-Oxopropionic acid	11	190

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	Compound No.	Page No.
Palmitaldehyde	6	153
Palmitamide	142	234
Palmitanilide	74	232
Palmitic acid	58	195
Palmitic anhydride	24	225
Palmitoyl chloride	10	214
Paraisobutyraldehyde	48	155
Paraldehyde	34	145
Pararosaniline	429	317
Pararosaniline base	65	90
Pelargonaldehyde	67	147
Pelargonamide	113	233
Pelargonanilide	19	231
Pelargonic acid	48	191
" "	459	432
Pelargonyl chloride	45	213
Pentabromophenol	560	126
Pentachlorobenzaldehyde	126	160
Pentachlorobenzene	24	71
Pentachloroethane	21	63
Pentachlorophenol	488	122
n-Pentacosane	29	8
1-Pentacosene	8	26
Pentacosylcyclohexane	43	8
Pentacosylcyclopentane	30	8
1-Pentacosyne	12	31
Pentadecanal	5	153
Pentadecanamide	125	234
Pentadecananilide	48	232
n-Pentadecane	268	7
n-Pentadecanoic acid	44	194
1-Pentadecanol	21	88
8-Pentadecanone	36	173
Pentadecanonitrile	8	357

	Compound No.	Page No.
1-Pentadecene	334	24
7-Pentadecene	16	25
Pentadecylamine	18	303
Pentadecylcyclohexane	9	8
Pentadecylcyclopentane	1	8
n-Pentadecylic acid	44	194
1-Pentadecyne	63	30
1,2-Pentadiene	29	13
1-*cis*-3-Pentadiene	27	12
1-*trans*-3-Pentadiene	26	12
1,3-Pentadiene	24	12
1,4-Pentadiene	13	12
2,3-Pentadiene	30	13
2,4-Pentadienonitrile	23	346
1,3-Pentadiyne	20	28
Pentaerythritol	69	90
Pentaerythritol tetraacetate	123	279
Pentahydrocyclohexane	68	90
Pentamethylaniline	339	313
Pentamethylbenzene	32	44
Pentamethylbenzoic acid	335	207
Pentamethylenediamine	76	297
Pentamethyleneglycol	124	86
2,2,3,3,4-Pentamethylpentane	215	6
2,2,3,4,4-Pentamethylpentane	173	5
Pentamethylphenol	297	111
1,2,2,4,4-Pentamethylpiperidine	465	439
Pentamethylene sulfide	3	425
Pentanal	20	145
n-Pentanamide	146	234
n-Pentananilide	28	231
n-Pentane	13	3
Pentane-1,1-dicarboxylic acid	118	197
1,5-Pentanediol	124	86
2,4-Pentanedione	44	162
1,5-Pentanedithiol	42	415
1-Pentanethiol	18	413
2-Pentanethiol	10	413
n-Pentanoic acid	20	190
" " "	450	432
n-Pentanoic anhydride	13	223
1-Pentanol	32	81
d,l-2-Pentanol	15	80
3-Pentanol	13	80
2-Pentanone	10	161
3-Pentanone	9	161
n-Pentanoyl bromide	2	219
n-Pentanoyl chloride	22	212
Pentatriacontane	65	9
1-Pentatriacontene	18	26
Pentatriacontylcyclohexane	73	9
Pentatriacontylcyclopentane	64	9
1-Pentatriacontyne	22	31
2-Pentenal	35	145
1-Pentene	14	12
cis-2-Pentene	19	12
trans-2-Pentene	18	12
2-Pentenoic acid	422	432
3-Pentenoic acid	99	429
4-Pentenoic acid	22	190
" " "	414	432
4-Pentenonitrile	28	347
1-Penten-3-one	11	161
1-Penten-3-yne	14	28
1-Penten-4-yne	10	28
cis-3-Penten-1-yne	11	28
trans-3-Penten-1-yne	12	28
n-Pentyl acetate	94	254
n-Pentylacetylene	35	29
n-Pentylamine	417	439
n-Pentylbenzene	81	38
n-Pentyl bromide	17	58
DL-2-Pentyl bromide	14	58
3-Pentyl bromide	15	58
n-Pentyl *n*-butyrate	146	257
3-Pentyl chloride	20	55
n-Pentyl chloride	22	55
2-*n*-Pentylcinnamaldehyde	9	150
n-Pentylcyclohexane	249	7
n-Pentylcyclopentane	242	7
n-Pentyl *n*-heptanoate	277	265
n-Pentyl *n*-hexanoate	226	262
n-Pentyl iodide	15	60
2-Pentyl iodide	12	60
3-Pentyl iodide	13	60
sec-*n*-Pentylmalonic acid	50	194
1-Pentylnaphthalene	173	42
2-Pentylnaphthalene	174	42
n-Pentyl *n*-octanoate	302	267
n-Pentyl *n*-Pentanoate	183	259
4-*n*-Pentylphenol	4	96
n-Pentyl phenyl ketone	3	172
n-Pentyl propionate	120	255
2-Pentylpyridine	245	438
n-Pentylstearate	25	274
3-Pentyltoluene	119	39
1-Pentyne	9	28
2-Pentyne	13	28
2-Pentynoic acid	42	194
Peonol	45	99
Perchloroethylene	14	63
Perfluoro-*n*-butyric anhydride	3	223
Perfluoro-*n*-caproic anhydride	6	223
Perfluorocyclohexane	3	62
Perfluorocyclopentane	1	62
Perfluoro-*n*-decane	8	62
Perfluoro-*n*-hendecane	9	62
Perfluoro-*n*-heptane	6	62
Perfluoro-*n*-hexane	4	62
Perfluoro-*n*-hexanoic anhydride	6	223
Perfluoro-2-methylpentane	5	62
Perfluoro-*n*-nonane	7	62
Perfluoropropionic anhydride	2	223
Perfluoro-*n*-undecane	9	62
Peri acid	4	380
Perylene	201	51
Phenacetin	242	237
Phenacridone	204	179
Phenacyl acetate	60	276
Phenacyl alcohol	47	89
" "	150	177
Phenacyl bromide	51	173
Phenacyl chloride	68	174
Phenacyl phenyl ketone	111	175
1-Phenanthraldehyde	96	158
2-Phenanthraldehyde	47	155
3-Phenanthraldehyde	69	156
9-Phenanthraldehyde	89	158
9,10-Phenanthraquinone	34	183
Phenanthrene	104	47
Phenanthrene-2-carboxylic acid chloride	24	216
Phenanthrene-3-carboxylic acid chloride	27	216
Phenanthrene-9-carboxylic acid chloride	25	216
1,2-Phenanthrenediol	463	120
1,9-Phenanthrenediol	477	121
2,5-Phenanthrenediol	467	120
2,6-Phenanthrenediol	561	126
2,7-Phenanthrenediol	576	127
2,8-Phenanthrenediol	513	123
3,6-Phenanthrenediol	548	125
3,8-Phenanthrenediol	570	126
9,10-Phenanthrenediol	371	115
Phenanthrene-2-sulfonamide	438	409
Phenanthrene-3-sulfonamide	273	402

	Compound No.	Page No.
Phenanthrene-9-sulfonamide	290	403
Phenanthrene-2-sulfonanilide	156	397
Phenanthrene-2-sulfonic acid	200	378
Phenanthrene-3-sulfonic acid	129	375
Phenanthrene-9-sulfonic acid	138	376
Phenanthrene-2-sulfonyl chloride	243	389
Phenanthrene-3-sulfonyl chloride	169	386
Phenanthrene-9-sulfonyl chloride	205	387
3,4,5-Phenanthrenetriol	372	115
Phenanthridine	158	437
Phenanthrindene	118	47
1-Phenanthroic acid	360	208
2-Phenanthroic acid	388	209
3-Phenanthroic acid	394	209
9-Phenanthroic acid	383	209
1-Phenanthrol	393	116
2-Phenanthrol	440	119
3-Phenanthrol	282	111
4-Phenanthrol	236	108
9-Phenanthrol	396	116
3-Phenanthrylacetic acid	276	204
9-Phenanthrylacetonitrile	129	363
9-Phenanthrylmethylamine	215	309
2-Phenethyl alcohol	113	85
Phenethylamine	349	438
2-(Phenethylamino)ethylamine	325	438
o-Phenetidine	141	299
m-Phenetidine	163	300
p-Phenetidine	164	300
Phenetole	63	134
Phenetrol	413	117
4-Phenetylurea	353	241
Phenol	28	97
"	96	434
Phenol-2,4-disulfonamide	412	408
Phenol-2,4-disulfonanilide	324	404
Phenol-2,4-disulfonic acid	190	378
Phenol-2,4-disulfonyl chloride	115	384
Phenolphthalein	577	127
Phenol-*o*-sulfonanilide	70	394
Phenol-*o*-sulfonic acid	3	380
Phenoxyacetaldehyde	79	148
Phenoxyacetamide	122	234
Phenoxyacetanilide	112	233
Phenoxyacetic acid	110	197
"	171	430
Phenoxyacetone	189	167
Phenoxyacetonitrile	81	351
α-Phenoxyacetophenone	98	175
Phenoxyacetyl chloride	50	213
2-Phenoxybenzaldehyde	31	151
2-Phenoxybenzoic acid	207	430
3-Phenoxybenzoic acid	271	431
4-Phenoxybutanoic acid	10	192
1-Phenoxy-2-butanone	10	169
α-Phenoxybutyryl chloride	14	214
γ-Phenoxybutyryl chloride	4	214
Phenoxyethanal	79	148
2-Phenoxyethanol	122	86
Phenoxymethyl phenyl ketone	98	175
Phenoxymethyl *n*-propyl ketone	13	169
1-Phenoxy-2-pentanone	13	169
5-Phenoxy-2-pentanone	49	173
2-Phenoxyphenol	216	107
1-Phenoxy-2-propanone	189	167
2-Phenoxypropionic acid	146	199
3-Phenoxypropionic acid	108	197
α-Phenoxypropionyl chloride	18	214
Phenylacetaldehyde	70	147
"	8	153
Phenylacetamide	310	239
Phenylacetanilide	183	235
Phenyl acetate	168	258
Phenylacetic acid	77	196
"	347	432
Phenylacetic anhydride	30	225
Phenylacetone	5	172
Phenylacetonitrile	80	351
4-Phenylacetophenone	152	177
Phenylacetyl bromide	7	219
Phenylacetyl chloride	44	213
Phenylacetyl fluoride	8	211
1-Phenylacrylic acid	130	198
DL-α-Phenylalanine	76	287
DL-β-Phenylalanine	78	288
	55	429
L-Phenylalanine	92	288
4-Phenylanisole	51	139
4-Phenylbenzaldehyde	51	155
4-Phenylbenzenesulfonyl chloride	178	386
Phenyl benzoate	95	277
2-Phenylbenzoic acid	140	198
"	202	430
4-Phenylbenzoic acid	349	207
4-Phenylbenzoyl chloride	26	216
α-Phenylbenzyl cyanide	95	361
1-Phenyl-1,3 butanedione	75	174
d,l-α-Phenylbutanoic acid	26	193
1-Phenyl-2-butanone	182	167
3-Phenyl-2-butanone	41	169
4-Phenyl-2-butanone	196	167
2-Phenyl-*cis*-2-butene	52	37
4-Phenyl-3-buten-2-one	37	173
α-Phenylbutyramide	65	232
γ-Phenylbutyramide	60	232
4-Phenylbutyric acid	430	432
γ-Phenylbutyric acid	43	194
γ-Phenylbutyryl chloride	5	214
Phenyl carbamate	10	231
4-Phenylcatechol	357	114
2-Phenylcinnamaldehyde	80	157
3-Phenylcinnamaldehyde	20	154
Phenyl cinnamate	103	278
β-Phenylcinnamonitrile	49	359
2-Phenylcrotononitrile	77	351
Phenylcyanoacetic acid	117	362
2-Phenylcyclohexanone	81	174
3-Phenylcyclohexanone	214	168
4-Phenylcyclohexanone	106	175
2-Phenylcyclopentanone	22	172
1-Phenyldecane	172	42
ω-Phenyldibenzofulvene	67	45
2-Phenyl-1,3-dithiane	40	426
1-Phenyldodecane	178	42
m-Phenylenediamine	84	305
"	190	437
o-Phenylenediamine	196	309
"	176	437
p-Phenylenediamine	318	313
2-Phenylenedithiol	8	416
3-Phenylenedithiol	6	416
4-Phenylenedithiol	31	417
Phenylethanal	70	147
2-Phenylethane-1-sulfonamide	61	394
2-Phenylethane-1-sulfonanilide	18	392
2-Phenylethane-1-sulfonic acid	16	371
2-Phenylethane-1-sulfonyl chloride	13	381
1-Phenylethanethiol	13	413
2-Phenylethanethiol	35	414
2-Phenylethanol	113	85
Phenyl ether	7	137
β-Phenylethyl acetate	243	263

	Compound No.	Page No.
1-Phenylethyl alcohol	1	88
DL-α-Phenylethylamine	83	297
β-Phenylethylamine	92	298
α-Phenylethyl bromide	25	58
β-Phenylethyl bromide	26	58
d,l-Phenylethyl carbinol	111	85
α-Phenylethyl chloride	42	56
β-Phenylethyl chloride	40	56
2-Phenylethyl cinnamate	56	275
Phenyl ethyl ether	63	134
2-Phenylethyl sulfide	53	426
9-Phenylfluorene	150	49
β-Phenylglutaconic anhydride	77	226
β-Phenylglutaric anhydride	45	226
N-Phenylglycine	6	284
Phenylglyoxal	28	151
Phenylglyoxal hydrate	77	157
Phenylglyoxylic acid	85	174
2-Phenylheptane	130	40
3-Phenylheptane	125	39
1-Phenyl-1-hepten-3-one	25	172
4-Phenylhexahydroacetophenone	72	170
2-Phenylhexane	103	39
d,l-3-Phenylhexane	98	39
1-Phenyl-1-hexen-5-one	29	169
1-Phenyl-4-hexen-1-one	26	169
3-Phenyl-1-hexen-5-one	30	169
3-Phenyl-2-hexen-5-one	63	170
3-Phenyl-3-hexen-5-one	42	169
Phenylhydrazine	160	300
Phenyl 2-hydroxybenzoate	30	97
2-Phenylimidazole	258	438
1-Phenylisobutylamine	113	298
1-Phenylisopropylamine	91	298
DL-2-Phenylisopropylamine	98	298
Phenyl isopropyl ether	68	134
1-Phenylisoquinoline	61	324
d,l-2-Phenyllactic acid	68	195
N-Phenylmaleimide	75	232
Phenylmalonic acid	231	202
" "	104	430
Phenylmalononitrile	85	361
Phenylmalonyl dichloride	36	215
Phenylmethanethiol	32	414
2-Phenylnaphthalene	107	47
2-Phenylnaphthalene-1,2′-dicarboxylic acid	318	206
4-Phenyl-1-naphthol	338	113
N-Phenyl-1-naphthylamine	78	305
Phenylnitromethane	25	336
1-Phenylnonane	166	41
1-Phenyloctane	156	41
2-Phenylpentane	46	37
3-Phenylpentane	41	37
3-Phenyl-2,4-pentanedione	69	174
5-Phenylpentanoic acid	52	195
3-Phenyl-2-pentanone	71	170
4-Phenyl-2-pentanone	31	169
5-Phenyl-2-pentanone	27	169
5-Phenyl-3-pentanone	201	167
4-Phenylphenacyl bromide	156	177
4-Phenylphenacyl chloride	158	177
2-Phenylphenol	51	99
"	98	434
3-Phenylphenol	117	102
"	81	434
4-Phenylphenol	431	118
"	76	434
2-Phenyl-2-phenoxyethanol	48	139
1-Phenyl-2-phenoxymethanol	40	138
N-Phenylphthalimide	440	243
Phenyl phthalate	108	278
3-Phenylpropanol	123	86
Phenylpropargyl aldehyde	13	152
3-Phenylpropenal	90	149
Phenylpropiolamide	117	233
Phenylpropiolic acid	191	200
2-Phenylpropionaldehyde	14	152
α-Phenylpropionamide	77	233
β-Phenylpropionamide	140	234
Phenylpropiolanilide	213	236
β-Phenylpropionanilide	104	233
Phenyl propionate	5	273
β-Phenylpropionic acid	38	194
2-Phenylpropionic acid	50	191
3-Phenylpropionic acid	412	432
2-Phenylpropionitrile	79	351
3-Phenylpropionitrile	93	353
Phenylpropiolyl chloride	12	214
3-Phenylpropionaldehyde	81	148
β-Phenylpropionyl chloride	48	213
1-Phenyl-*n*-propyl alcohol	111	85
1-Phenylpropylamine	107	298
2-Phenylpropylamine	108	298
3-Phenylpropylamine	126	299
Phenyl *n*-propyl ether	74	134
Phenyl-*n*-propylglycolic acid	101	197
Phenyl *n*-propyl ketone	191	167
Phenyl propyl sulfide	53	421
3-Phenylpropyl sulfide	42	426
2-Phenylpyridine	97	321
Phenyl 2-pyridyl ketone	217	168
Phenylpyruvic acid	234	202
2-Phenyl-4-quinolinonitrile	187	365
Phenyl salicylate	30	97
"	46	275
Phenyl stearate	70	276
Phenyl styryl ketone	66	174
α-*d,l*-Phenylsuccinamide	314	239
β-*d,l*-Phenylsuccinamide	269	238
d,l-Phenylsuccinic acid	260	203
d,l-Phenylsuccinic acid diamide	450	244
d,l-Phenylsuccinic acid dianilide	468	244
α-*d,l*-Phenylsuccinic acid monoanilide	357	241
β-*d,l*-Phenylsuccinic acid monoanilide	346	241
DL-Phenylsuccinic anhydride	18	225
N-Phenylsuccinimide	307	239
Phenyl sulfide	61	422
Phenyl 2-thienyl ketone	60	174
Phenyl 4-tolyl carbinol	29	89
Phenyl 4-tolyl ketone	74	174
Phenyl 2-tolyl sulfide	65	422
Phenyl 3-tolyl sulfide	64	422
Phenyl 4-tolyl sulfide	67	422
1-Phenyltridecane	181	42
1-Phenylundecane	175	42
Phenyl *n*-undecyl ketone	45	173
Phenylurea	273	238
Phenyl urethane	10	231
2-Phenylvaleronitrile	91	352
Phloracetophenone	200	179
"	545	125
Phloroglucinaldehyde	17	152
Phloroglucinol	255	109
"	541	125
"	45	434
Phloroglucinol triacetate	139	280
Phloroglucinol trimethyl ether	31	138
Phorone	8	172
Phthalaldehyde	39	155
Phthalaldehydic acid	86	157
Phthalamic acid	282	238
" "	244	431

	Compound No.	Page No.
Phthalic acid	321	206
" "	134	430
Phthalic acid diamide	464	244
Phthalic acid dianilide	496	246
Phthalic acid monoamide	282	238
" " "	244	431
Phthalic acid mononitrile	299	205
Phthalic acid 4-sulfonamide	287	403
Phthalic acid 4-sulfonyl chloride	259	389
Phthalic anhydride	58	226
Phthalimide	482	245
α-Phthalonamide	373	241
β-Phthalonamide	303	239
Phthalonic acid	219	202
Phthalonic acid dianilide	443	244
Phthalonic acid monoanilide	363	241
Phthalonitrile	188	365
Phthaloyl dibromide	6	220
Phthaloyl dichloride	59	213
Phthaloyl difluoride	7	211
Picene	202	51
α-Picolene	13	319
β-Picolene	19	319
γ-Picolene	20	319
Picolinic acid	198	201
Picolinonitrile	12	357
Picramic acid	444	119
" "	380	315
Picramide	404	242
"	405	316
Picric acid	281	110
" "	87	340
" "	1	434
Picryl chloride	51	339
Pimelic acid	124	198
" "	385	432
Pimelic acid diamide	356	241
Pimelic acid dianilide	305	239
Pimelic acid monoanilide	157	235
Pinacol	19	88
Pinacolone	12	161
d,l-Pinacolyl alcohol	16	80
Pinacolyl chloride	25	55
d,α-Pinane	213	6
d,l-Pinane	206	6
l-β-Pinane	223	6
α-Pinene	287	22
β-Pinene	291	22
Pinosylvyn	392	116
Piperazine	202	309
"	347	438
Piperic acid	344	207
Piperidine	34	296
"	459	439
N-Piperidinoacetonitrile	2	357
Piperonal	12	153
Piperonalacetone	143	176
Piperonalacetophenone	153	177
Piperonyl alcohol	31	89
Piperonylamide	336	240
Piperonylic acid	357	208
Piperylene	24	12
Pivalaldehyde	12	144
Pivalamide	306	239
Pivalanilide	215	236
Pivalic acid	19	193
Pivalic anhydride	8	223
Pivalophenone	181	167
Pivalyl chloride	10	212
Prehnilene	77	38
Primeverose	63	333

	Compound No.	Page No.
DL-Proline	36	285
L-Proline	50	286
Propanal	4	144
Propanal cyanohydrin	3	355
Propane	3	3
1,3-Propanedicarboxylic acid	107	197
Propanedioic acid	185	200
d,l-1,2-Propanediol	91	84
1,3-Propanediol	108	85
Propane-1,1-disulfonamide	195	399
Propane-1,3-disulfonamide	194	399
Propane-1,1-disulfonic acid	83	373
Propane-1,3-disulfonic acid	82	373
Propane-1,3-disulfonyl chloride	29	381
1,3-Propanedithiol	28	414
Propane-1-sulfonamide	6	392
Propane-2-sulfonamide	10	392
Propane-2-sulfonanilide	20	392
Propane-1-sulfonic acid	1	371
Propane-2-sulfonic acid	3	371
1-Propanethiol	5	413
2-Propanethiol	3	413
Propane-1,2,3-tricarboxylic acid	258	203
Propanoic acid	6	190
" "	452	432
1-Propanol	6	80
2-Propanol	3	80
2-Propanone	1	161
Propargyl aldehyde	7	144
Propene	2	12
2-Propene-1-thiol	8	413
2-Propen-1-ol	5	80
cis-Propenyl acetylene	11	28
trans-Propenyl acetylene	12	28
trans-Propenylbenzene	19	36
Propiolamide	27	231
Propiolanilide	68	232
Propiolic acid	7	190
Propionaldehyde	4	144
Propionamide	55	232
Propionanilide	141	234
Propionic acid	6	190
" "	452	432
n-Propionic anhydride	5	223
Propionitrile	8	345
Propionyl bromide	3	218
Propionyl chloride	5	212
1-Propionylcyclohexene	77	170
Propionyl fluoride	2	211
N-Propionylglycine	241	431
Propionyl iodide	2	221
2-Propionylphenanthrene	134	176
3-Propionylphenanthrene	64	174
9-Propionylphenanthrene	65	174
4-Propionylphenol	370	115
6-Propionyltetralin	85	170
Propiophenone	174	166
Propiopiperone	27	173
n-Propoxyacetaldehyde	32	145
n-Propoxybenzene	74	134
2-Propoxybenzoic acid	331	431
3-Propoxybenzoic acid	324	431
4-Propoxybenzoic acid	433	432
2-*n*-Propoxyethanol	44	82
1-Propoxy-2-propanone	49	162
N-Propylacetanilide	7	231
2-*n*-Propylacetanilide	135	234
4-*n*-Propylacetanilide	66	232
n-Propyl acetate	30	251
Propyl acetylene	9	28
N-Propylalanine	64	429

	Compound No.	Page No.
n-Propyl alcohol	6	80
n-Propylallene	65	14
n-Propylamine	7	295
" "	429	439
2-(Propylamino) ethylamine	386	439
N-*n*-Propylaniline	128	299
" " "	177	437
2-*n*-Propylaniline	129	299
" " "	147	437
4-*n*-Propylaniline	136	299
n-Propylbenzene	8	35
n-Propyl benzoate	240	263
d,l- -Propylbenzyl alcohol	23	88
N-Propylbenzylamine	334	438
n-Propyl bromide	7	58
n-Propyl *n*-butyrate	77	253
n-Propyl *n*-caproate	149	257
n-Propyl *n*-caprylate	229	262
n-Propyl carbamate	24	231
n-Propyl carbonate	119	255
3-Propylcatechol	97	101
4-Propylcatechol	63	99
n-Propyl chloride	7	55
n-Propyl chloroformate	41	251
n-Propylcyclohexane	165	5
2-*n*-Propylcyclohexanone	156	166
3-*n*-Propylcyclohexanone	46	169
4-*n*-Propylcyclohexanone	168	166
3-*n*-Propyl-2-cyclohexenone	51	169
Propylcyclooctatetraene	17	25
n-Propylcyclopentane	88	4
2-Propylcyclopentanone	137	165
3-Propylcyclopentanone	145	165
n-Propyl *n*-enanthate	189	259
Propylene	2	12
1,2-Propylenediamine	361	438
1,3-Propylenediamine	50	296
" " "	382	439
α-Propylene glycol	91	84
Propylene oxide	5	131
1,2,3-Propylenetricarboxylic acid trichloride	37	215
n-Propyl ether	30	132
N-Propylformanilide	10	230
n-Propyl formate	13	250
n-Propyl 2-furoate	197	260
3-*n*-Propylglutaric acid	346	432
N-Propylglycine	85	429
4-Propylheptane	191	6
n-Propyl *n*-heptanoate	189	259
n-Propyl *n*-hexanoate	149	257
3-Propyl-3-hexen-2-one	32	169
2-Prophylhydroquinone	159	104
n-Propyl 4-hydroxybenzoate	132	279
n-Propyl iodide	5	60
n-Propyl isobutyrate	68	252
n-Propyl isovalerate	102	254
n-Propyl levulinate	217	261
n-Propylmalonic acid	140	430
n-Propylmalononitrile	69	350
n-Propyl mercaptan	5	413
sec-Propyl mercaptan	3	413
1-Propylnaphthalene	163	41
2-Propylnaphthalene	162	41
n-Propyl nitrate	37	251
n-Propyl *n*-octanoate	229	262
n-Propyl oxalate	204	260
n-Propyl *n*-pentanoate	114	255
2-*n*-Propyl-1-pentene	199	18
1-Propyl phenanthrene	9	43
2-Propyl phenanthrene	11	43
9-Propyl phenanthrene	42	44
2-*n*-Propylphenol	13	94
3-*n*-Propylphenol	5	96
4-*n*-Propylphenol	2	96
1-*n*-Propylpiperidine	389	439
n-Propyl propionate	49	252
3-Propylpropiophenone	24	169
2-*n*-Propylpyridine	243	438
n-Propyl 2-pyridyl ketone	173	166
n-Propyl 3-pyridyl ketone	206	168
n-Propyl 4-pyridyl ketone	190	167
n-Propyl pyromucate	197	260
5-Propylresorcinol	135	103
n-Propyl salicylate	260	264
n-Propyl sulfide	26	420
2-Propylthiophene	29	423
3-Propylthiophene	34	424
m-Propyltoluene	24	36
o-Propyltoluene	31	36
p-Propyltoluene	27	36
2-Propyl-1,3,5-trimethylbenzene	116	39
5-Propyl-1,2,4-trimethylbenzene	40	127
n-Propylurethane	24	231
n-Propyl *n*-valerate	114	255
Propynal	7	144
Propyne	2	28
Protocatechualdehyde	117	159
Protocatechualdehyde diethyl ether	92	149
Protocatechuamide	451	244
Protocatechuanilide	329	240
Protocatechuic acid	319	206
Pseudocumene	14	35
Pseudocumenol	98	101
Pseudocumenyl acetate	38	275
Pseudocumidine	103	306
Pseudopinene	291	22
Pulegan	124	5
Pulegone	180	167
Pulenene	248	20
Putrescine	66	297
Pyrazine	18	436
Pyrazole	53	436
Pyrene	152	49
Pyrene-3-carboxaldehyde	107	159
1,6-Pyrenediol	568	126
3,8-Pyrenediol	591	127
Pyridazine	43	436
Pyridine	7	319
"	206	437
2-Pyridinecarbonitrile	12	357
3-Pyridinecarboxaldehyde	15	152
2-Pyridinecarboxylic acid	198	201
3-Pyridinecarboxylic acid	370	208
4-Pyridinecarboxylic acid	406	210
3-Pyridinecarboxylic anhydride	53	226
Pyridine-3,4-dicarboxylic acid	389	209
2, 5-Pyridinediol	572	126
Pyridine-3-sulfonamide	46	393
Pyridine-3-sulfonanilide	116	396
Pyridine-3-sulfonic acid	12	371
Pyridine-3-sulfonyl chloride	231	388
α-Pyridone	215	107
"	68	324
β-Pyridone	112	307
γ-Pyridone	115	373
3-Pyridylacetone	60	170
3-Pyridylacrylic acid	361	208
Pyrimidine	1	323
"	29	436
Pyrocatechol	207	107
Pyrocatechol dibenzoate	124	279
Pyrocatechol monomethyl ether	9	137
Pyrogallol	317	112
"	59	434

	Compound No.	Page No.
Pyrogallol triacetate	167	281
Pyrogallol trimethyl ether	29	138
Pyromucic acid	184	200
γ-Pyrone-2,6-dicarboxylic acid	391	209
Pyrotartaric acid	145	199
Pyrrole	11	436
2-Pyrrolecarboxaldehyde	25	154
Pyrrolidine	24	295
"	466	439
Pyruvamide	198	236
Pyruvanilide	133	234
Pyruvic acid	11	190
" "	97	429
Pyruvic aldehyde	103	171

Q

Quadricycleane	40	3
Quadricyclo (2.2.1.$0^{2,6}$ $0^{3,5}$) heptane	40	3
d-Quercitol	68	90
Quinacetophenone	197	179
Quinaldine	80	321
Quinazoline	98	436
Quinhydrone	187	178
Quinizarin	33	183
Quinoline	71	320
"	178	437
Quinoline-2-carboxaldehyde	60	156
Quinoline-4-carboxaldehyde	29	154
Quinoline-6-carboxaldehyde	66	156
Quinoline-8-carboxaldehyde	79	157
Quinoline-3-carboxylic acid	395	209
Quinoline-4-carboxylic acid	385	209
2,3-Quinolinediol	574	126
Quinoline-6-sulfonamide	281	402
Quinoline-8-sulfonamide	242	401
Quinoline-6-sulfonic acid	135	376
Quinoline-8-sulfonic acid	106	374
Quinoline-6-sulfonyl chloride	119	384
Quinoline-8-sulfonyl chloride	199	387
2-Quinolinoacetonitrile	62	359
Quinone	12	181
Quinoxaline	5	323
"	16	436
Quinuclidine	82	324
"	441	439

R

R-Acid	16	380
Raffinose	14	330
Resacetophenone	362	115
"	175	178
Resodiacetophenone	478	121
Resorcinol	226	108
"	74	434
Resorcinol diacetate	329	269
Resorcinol dibenzoate	149	280
Resorcinol diethyl ether	98	136
Resorcinol dimethyl ether	89	135
Resorcinol monoacetate	29	95
" "	331	269
Resorcinol monoethyl ether	24	97
Resorcinol monomethyl ether	21	95
β-Resorcylaldehyde	110	159
β-Resorcylaldehyde dimethyl ether	59	156
β-Resorcylamide	469	245
β-Resorcylanilide	208	236
β-Resorcylic acid	338	207
α-Resorcylic aldehyde	118	159
Retene	103	47
Retenequinone	30	182
Retene-6-sulfonamide	331	405
Retene-6-sulfonic acid	156	376
Retene-6-sulfonyl chloride	235	388
6-Retenol	409	117
α-L-Rhamnohexose	58	333
D-Rhamnose	13	328
α-L-Rhamnose	9	329
β-L-Rhamnose	15	330
D-Rhodeose	33	331
DL-Rhodeose	44	332
L-Rhodeose	34	331
d-Rhodinal	76	148
D-Ribose	3	329
L-Ribose	4	331
Rufol	578	127

S

Saccharin	466	244
Salicylaldehyde	4	94
'	71	148
"	21	434
Salicylaldehyde ethyl ether	3	153
Salicylaldehyde methyl ether	15	153
Salicylaldehyde triacetate	141	280
Salicylamide	261	238
"	41	434
Salicylanilide	248	237
Salicylic acid	400	117
' "	244	203
" '	116	430
Salicylic acid ethyl ether	5	193
Salicylic acid methyl ether	114	197
Salicyloyl chloride	1	216
Saligenin	49	89
"	146	103
Saligenin-2-methyl ether	127	86
Salol	30	97
"	46	275
Santene	250	20
Sarcosine	43	286
Sebacic acid	183	200
Sebacic acid diamide	446	244
Sebacic acid dianilide	433	243
Sebacic acid monoamide	343	240
Sebacic acid monoanilide	194	236
Sebacic anhydride (dimer)	27	225
Sebaconitrile	19	356
Sebacoyl dichloride	33	214
Semicarbazide	97	233
DL-Serine	70	287
"	62	429
L-Serine	56	286
d-Silversterene	315	23
β-Sitosterol	57	90
Skatole	175	308
Sodium 3-hydroxybenzenephosphonate	105	434
Sodium 4-hydroxybenzenephosphonate	89	434
Sodium 3-hydroxybenzenesulfonate	66	434
Sodium 4-hydroxybenzenesulfonate	58	434
Sodium 3-hydroxybenzoate	94	434
Sodium 4-hydroxybenzoate	73	434
Sorbaldehyde	5	152
d-Sorbitol	50	89
D-Sorbose	51	332
DL-Sorbose	45	332
L-Sorbose	50	332
Spiropentane	16	3
Stachyose	54	332
Stearaldehyde	14	153
Stearamide	158	235

	Compound No.	Page No.
Stearanilide	94	233
Stearic acid	70	195
Stearic anhydride	28	225
Stearoyl chloride	2	216
Stearyl alcohol	33	89
trans-Stilbene	131	48
Stilbene-2-carboxaldehyde	72	156
2,2-Stilbenediol	172	105
3,5-Stilbenediol	392	116
4,4' Stilbenediol	583	127
4-Styrenesulfonic acid	33	372
Suberane	68	4
Suberene	187	18
Suberic acid	215	202
" "	395	432
Suberic anhydride (dimer)	22	225
Suberic acid diamide	456	244
Suberic acid dianilide	395	242
Suberic acid monoamide	210	236
Suberic acid monoanilide	216	236
Suberonitrile	20	356
Succinaldehyde	59	147
Succinamic acid	312	239
" "	398	432
Succinic acid	294	205
" "	310	431
Succinic acid diamide	498	246
Succinic acid dianilide	480	245
Succinic acid monoamide	312	239
" " "	398	432
Succinic acid monoanilide	279	238
Succinic anhydride	52	226
Succinimide	205	236
Succinonitrile	67	360
Succinyl dibromide	12	219
Succinyl dichloride	38	212
Sucrose	55	332
Sulfadimethylpyrimidine	308	404
Sulfaguanidine	269	402
Sulfamethazine	308	404
Sulfanilic acid	70	373
Sulfanilylguanidine	269	402
Sulfapyridine	278	402
Sulfathiazole	319	404
2-Sulfobenzoic acid	139	376
3-Sulfobenzoic acid	84	373
4-Sulfobenzoic acid	184	377
4-Sulfophthalic acid	136	376
Sylvan	15	131
Syringetin	584	127

T

D-Tagatose	16	330
D-Talose	21	330
d-Tartaric acid	263	203
" "	141	430
d, l-Tartaric acid	326	206
meso-Tartaric acid	203	201
" " "	177	430
D-Tartaric acid diamide	418	243
meso-Tartaric acid diamide	401	242
D-Tartaric acid dianilide	500	246
D, L-Tartaric acid monoamide	478	245
D-Tartaric acid monoanilide	375	242
D, L-Tartaric acid monoanilide	486	245
Tartronic acid	240	202
Taurine	110	289
Terephthalaldehyde	103	158
Terephthalic acid	404	210
" "	210	430
Terephthalic acid dianilide	510	247
Terephthalic acid monoanilide	485	245
Terephthalic acid mononitrile	348	207
Terephthalonitrile	229	367
Terephthaloyl dichloride	19	216
α-Terpinene	311	23
γ-Terpinene	322	23
d, l-α-Terpineol	114	85
Terpinolene	325	24
1,2,3,4,5,6,7,8-Tetrabenzanthracene	203	51
2,3,4,6-Tetrabromoaniline	248	310
1,2,4,5-Tetrabromobenzene	9	74
2,3,4,6-Tetrabromobenzenesulfonamide	423	408
2,3,4,6-Tetrabromobenzenesulfonic acid	196	378
2,3,4,6-Tetrabromobenzenesulfonyl chloride	137	385
Tetrabromocatechol	492	122
2,4,5,6-Tetrabromo-*m*-cresol	494	122
3,4,5,6-Tetrabromo-*o*-cresol	523	123
2,3,5,6-Tetrabromo-*p*-cresol	499	122
1,1,2,2-Tetrabromoethane	19	65
2,3,4,5-Tetrabromophenol	285	111
Tetrabromophthalic anhydride	85	227
2,3,4,5-Tetrachlorobenzaldehyde	93	158
2,3,4,6-Tetrachlorobenzaldehyde	85	157
1,2,3,4-Tetrachlorobenzene	6	71
1,2,3,5-Tetrachlorobenzene	10	71
1,2,4,5-Tetrachlorobenzene	29	71
2,3,4,5-Tetrachlorobenzonitrile	107	362
2,3,5,6-Tetrachloro-1,4-benzoquinone	53	184
1,1,2,2-Tetrachloroethane	19	63
1,1,2,2-Tetrachloroethylene	14	63
2,3,5,6-Tetrachlorohydroquinone	565	126
4,6,7,8-Tetrachloronaphthalene-2-sulfonamide	401	407
4,6,7,8-Tetrachloronaphthalene-2-sulfonyl chloride	264	389
2,3,4,6-Tetrachlorophenol	93	101
Tetrachlorophthalic anhydride	83	227
1,2,3,4-Tetrachlorotetralin	32	72
5,6,7,8-Tetrachlorotetralin	31	72
Tetracontane	76	9
1-Tetracontene	23	26
1-Tetracontyne	27	31
n-Tetracosane	26	8
Tetracosanoic acid	88	196
1-Tetracosene	7	26
Tetracosylcyclohexane	39	8
Tetracosylcyclopentane	27	8
1-Tetracosyne	11	31
Tetracyanoethylene	222	367
Tetradecanal	4	153
n-Tetradecane	265	7
1,14-Tetradecanedicarboxylic acid	168	199
n-Tetradecanoic acid	46	194
n-Tetradecanoic anhydride	19	225
1-Tetradecanol	17	88
2-Tetradecanone	17	172
Tetradecanonitrile	4	357
1-Tetradecene	332	24
n-Tetradecylacetylene	64	30
n-Tetradecyl bromide	30	58
n-Tetradecylcyclohexane	6	8
n-Tetradecylcyclopentane	278	7
n-Tetradecyl sulfide	25	425
1-Tetradecyne	62	30
Tetraethylene glycol dimethyl ether	105	136
Tetraethyl pyromellitate	74	276
Tetraethyl silicate	113	255
1,2,3,4-Tetrahydroanthracene	108	47
1,2,3,4-Tetrahydroanthranol	221	107
Tetrahydrofuran	16	131
Tetrahydrofurfural	44	146
α-Tetrahydrofurfuryl acetate	164	258

	Compound No.	Page No.
Tetrahydrofurfuryl alcohol	78	84
" "	67	134
α-Tetrahydrofurfuryl benzoate	346	270
α-Tetrahydrofurfuryl propionate	180	259
1,2,3,4-Tetrahydroisoquinoline	146	299
Tetrahydromesitylene	256	20
bz-Tetrahydro-6-methoxyquinoline	25	138
1,2,3,4-Tetrahydro-2-naphthaldehyde	24	150
1,2,3,4-Tetrahydronaphthalene	88	38
cis-Tetrahydronaphthalene-2,3-dicarboxylic acid	279	431
trans-Tetrahydronaphthalene-2,3-dicarboxylic acid	286	431
1,2,3,4-Tetrahydro-2-naphthoic acid	106	197
d,l-1,2,3,4-Tetrahydro-2-naphthol	25	95
5,6,7,8-Tetrahydro-1-naphthol	88	101
5,6,7,8-Tetrahydro-2-naphthol	66	100
5,6,7,8-Tetrahydro-2-naphthylamine	22	303
1,2,3,4-Tetrahydrophenanthrene-9-carboxaldehyde	108	159
Tetrahydropyran	29	132
1,2,3,4-Tetrahydroquinoline	165	300
Tetrahydrosylvan	21	132
2,3,4,5-Tetrahydroxyadipic acid	274	204
1,2,3,4-Tetrahydroxybenzene	413	117
1,2,3,5-Tetrahydroxybenzene	430	118
1,2,4,5-Tetrahydroxybenzene	536	124
2,3,4,2′-Tetrahydroxybenzophenone	182	178
2,5,2′,6′-Tetrahydroxybenzophenone	196	179
3,4,3′,4′-Tetrahydroxybenzophenone	202	179
d,l-1,2,3,4-Tetrahydroxybutane	41	89
1,2,3,4-Tetrahydroxynaphthalene	555	126
1,2,5,8-Tetrahydroxynaphthalene	469	121
1,4,5,8-Tetrahydroxynaphthalene	485	121
Tetraiodophthalic anhydride	86	227
Tetralin	88	38
Tetralin-6-sulfonamide	88	395
Tetralin-6-sulfonanilide	144	397
Tetralin-6-sulfonyl chloride	54	382
1-Tetralone	90	170
2-Tetralone	75	170
Tetramethylallene	89	15
N,N,2,4-Tetramethylaniline	59	320
N,N,2,5-Tetramethylaniline	58	320
N,N,2,6-Tetramethylaniline	56	320
2,3,5,6-Tetramethylaniline	144	437
2,3,5,6-Tetramethylbenzaldehyde	2	153
1,2,3,4-Tetramethylbenzene	77	38
1,2,3,5-Tetramethylbenzene	59	37
1,2,4,5-Tetramethylbenzene	73	46
2,2,3,3-Tetramethylbutane	78	9
1,1,3,3-Tetramethylcyclohexane	154	5
1,1,3,4-Tetramethylcyclohexane	174	5
cis-1,1,3,5-Tetramethylcyclohexane	147	5
trans-1,1,3,5-Tetramethylcyclohexane	163	5
cis-1,2,3,5-Tetramethylcyclohexane	230	6
trans-1,2,3,5-Tetramethylcyclohexane	193	6
cis-1,2,4,5-Tetramethylcyclohexane	237	7
trans-1,2,4,5-Tetramethylcyclohexane	216	6
2,2,6,6-Tetramethylcyclohexanone	138	165
d,1,2,2,3-Tetramethylcyclopentane-1-carboxylic acid	129	198
2,2,5,5-Tetramethylcyclopentanone	77	163
1,2,3,3-Tetramethylcyclopentene	237	19
1,2,2,3-Tetramethyl-3-cyclopentene-1-acetonitrile	1	355
1,2,2,3-Tetramethylcyclopentene-1-carbonitrile	93	361
Tetramethylenediamine	66	297
Tetramethylene glycol	119	86
Tetramethylene sulfide	12	423
Tetramethylethylene glycol	19	88
2,2,3,3-Tetramethylhexane	183	6
2,2,3,4-Tetramethylhexane	155	5
2,2,3,5-Tetramethylhexane	139	5
2,2,4,4-Tetramethylhexane	152	5
2,2,4,5-Tetramethylhexane	136	5
2,2,5,5-Tetramethylhexane	107	4
2,3,3,4-Tetramethylhexane	207	6
2,3,3,5-Tetramethylhexane	151	5
2,3,4,4-Tetramethylhexane	194	6
2,3,4,5-Tetramethylhexane	186	6
3,3,4,4-Tetramethylhexane	234	7
2,2,5,5-Tetramethyl-3-hexyne	40	29
Tetramethylhydroquinone	119	435
1,2,4,8-Tetramethylnaphthalene	36	44
1,2,5,6-Tetramethylnaphthalene	122	48
1,3,6,8-Tetramethylnaphthalene	78	46
1,4,5,7-Tetramethylnaphthalene	35	44
1,4,5,8-Tetramethylnaphthalene	137	48
1,4,6,7-Tetramethylnaphthalene	51	45
2,2,3,3-Tetramethylpentane	114	4
2,2,3,4-Tetramethylpentane	92	4
2,2,4,4-Tetramethylpentane	76	4
2,3,3,4-Tetramethylpentane	121	5
3,3,4,4-Tetramethylpentanoic acid	66	195
2,2,4,4-Tetramethyl-3-pentanone	74	163
2,3,4,6-Tetramethylphenol	122	102
2,3,5,6-Tetramethylphenol	257	109
1,2,2,4-Tetramethylpiperidine	374	439
1,2,2,6-Tetramethylpiperidine	430	439
2,2,6,6-Tetramethylpiperidine	455	439
2,2,6,6-Tetramethyl-4-piperidone	20	172
2,3,4,5-Tetramethylpyridine	70	320
2,3,5,6-Tetramethylpyridine	289	438
Tetramethyl pyromellitate	162	281
2,4,5,8-Tetramethylquinoline	23	323
Tetramethylsuccinic acid	205	430
2,3,4,5-Tetramethylthiophene	49	424
Tetratriacontane	61	9
1-Tetratriacontene	17	26
Tetratriacontylcyclohexane	71	9
Tetratriacontylcyclopentane	60	9
1-Tetratriacontyne	21	31
Tetrolic acid	110	430
2-Thenoic acid	173	200
3-Thenoic acid	196	201
7-Thiabicycloheptane	45	424
Thiacyclobutane	5	423
Thiacycloheptane	41	424
Thiacyclohexane	3	425
Thiacyclopentane	12	423
Thiacyclopropane	1	423
2-Thianaphthenecarboxylic acid	367	208
3-Thianaphthenecarboxylic acid	272	204
Thiane	3	425
Thiazole	51	436
2-Thienylacetic acid	75	196
α-Thienylacetone	78	170
α-Thienylglyoxylic acid	96	196
1-(α-Thienyl)-2-propanone	78	170
Thiepane	41	424
Thietane	5	423
Thiirane	1	423
Thioacetamide	150	234
Thioacetanilide	42	232
Thioacetic acid	1	190
Thioacetic anhydride	30	420
Thiobenzoic anhydride	20	425
Thiocarvacrol	45	415
Thiocatechol	40	415
2-Thiocresol	31	414
3-Thiocresol	33	414

	Compound No.	Page No.
4-Thiocresol	11	416
Thiohydroquinone	9	416
Thiolane	12	423
Thiophane	12	423
Thiophene	3	423
Thiophene-2-acetonitrile	9	355
Thiophene-2-carbonitrile	59	349
Thiophene-3-carbonitrile	52	349
2-Thiophenecarboxaldehyde	72	148
2-Thiophenecarboxylic acid	173	200
3-Thiophenecarboxylic acid	196	201
Thiophene-2,3-dicarbonitrile	29	347
2-Thiophenethiol	27	414
Thiophenol	25	414
Thioresorcinol	1	416
Thiothymol	44	415
Thiourea	382	242
1,4-Thioxane	23	423
DL-Threonine	73	287
D-Threose	17	330
B-Thujone	159	166
Thymol	44	98
Thymoquinol	347	114
Thymoquinone	2	181
Thymyl acetate	272	265
Thymyl benzoate	31	274
DL-Thyroxine	58	286
Tiglamide	43	232
Tiglanilide	44	232
Tiglic acid	59	195
" "	461	433
T.N.T.	46	338
Tolane	47	44
m-Tolidine	221	309
o-Tolidine	290	312
4-Tolil	133	176
2-Tolualdehyde	74	148
3-Tolualdehyde	73	148
4-Tolualdehyde	75	148
2-Toluamide	255	238
3-Toluamide	98	233
4-Toluamide	317	240
2-Toluanilide	202	236
3-Toluanilide	206	236
4-Toluanilide	270	238
Toluene	2	35
2-*p*-Tolueneazo-*p*-cresol	235	108
Toluene-2,4-disulfonamide	256	401
Toluene-3,4-disulfonamide	272	402
Toluene-2,4-disulfonyl chloride	44	382
Toluene-α-sulfonamide	37	393
Toluene-2-sulfonamide	148	397
Toluene-3-sulfonamide	39	393
Toluene-4-sulfonamide	95	395
Toluene-α-sulfonanilide	34	393
Toluene-2-sulfonanilide	90	395
Toluene-3-sulfonanilide	26	392
Toluene-4-sulfonanilide	35	393
Toluene-2-sulfonic acid	58	372
Toluene-3-sulfonic acid	10	371
Toluene-4-sulfonic acid	31	372
Toluene-2-sulfonyl chloride	73	383
Toluene-3-sulfonyl chloride	3	381
Toluene-4-sulfonyl chloride	75	383
2-Toluenethiol	31	414
3-Toluenethiol	33	414
4-Toluenethiol	11	416
Toluhydroquinone	60	434
2-Toluic acid	125	198
3-Toluic acid	137	198
4-Toluic acid	278	204
4-Toluic acid-2-sulfonamide	250	401
4-Toluic acid-2-sulfonyl chloride	56	382
m-Toluic anhydride	29	225
o-Toluic anhydride	9	225
p-Toluic anhydride	40	225
m-Toluidine	96	298
o-Toluidine	94	298
p-Toluidine	34	303
2-Tolunitrile	64	350
3-Tolunitrile	70	350
4-Tolunitrile	13	357
p-Toluquinone	6	181
2-(4-Toluyl)benzamide	361	241
4-Toluyl chloride	51	213
2-Tolyl acetate	187	259
3-Tolyl acetate	200	260
4-Tolyl acetate	203	260
(2-Tolyl)acetic acid	95	196
(4-Tolyl)acetic acid	103	197
(2-Tolyl)acetonitrile	86	352
(3-Tolyl)acetonitrile	83	352
(4-Tolyl)acetonitrile	84	352
2-Tolyl benzoate	350	271
3-Tolyl benzoate	76	277
4-Tolyl benzoate	101	278
2-Tolyl carbinol	14	88
3-Tolyl carbinol	109	85
4-Tolyl carbinol	32	89
p-Tolylhydrazine	91	305
2-Tolyl sulfide	35	425
3-Tolyl sulfide	60	421
4-Tolyl sulfide	31	425
3-Tolyl 4-tolyl sulfide	6	425
2-Tolylurea	409	243
3-Tolylurea	259	238
4-Tolylurea	384	242
Transbrassidamide	85	233
Transbrassidanilide	50	232
α,α-Trehalose	62	333
1,2,4-Triacetoxybenzene	133	279
1,3,5-Triacetoxybenzene	139	280
n-Triacontane	49	3
Triacontanol	48	89
1-Triacontene	13	26
Triacontylcyclohexane	59	9
Triacontylcyclopentane	47	9
1-Triacontyne	17	31
Triallylamine	295	438
1,2,3-Triaminopropane	88	298
"	335	438
4,4',4''-Triaminotriphenyl carbinol	65	90
"	429	317
4,4',4''-Triaminotriphenylmethane	424	317
Tri-*n*-amylamine	89	321
1,3-Triazine	281	438
d,l,α-Triazobutyric acid	3	193
α-Triazoisobutyric acid	9	193
2-Triazoisovaleric acid	6	192
1,2,4-Triazole	46	436
d,l-2-Triazopropionic acid	8	192
Tribenzylamine	56	324
Tribromoacetamide	193	236
Tribromoacetic acid	176	200
" "	5	429
1,1,1-Tribromoacetone	211	168
3,4,5-Tribromoacetophenone	164	177
2,4,6-Tribromoaniline	264	311
3,4,5-Tribromoaniline	267	311
1,3,5-Tribromobenzene	7	74
2,4,6-Tribromobenzenesulfonamide	385	407
2,4,6-Tribromobenzenesulfonanilide	363	406
2,4,6-Tribromobenzenesulfonic acid	172	377
2,4,6-Tribromobenzenesulfonyl chloride	65	383

	Compound No.	Page No.
1,1,1-Tribromo-*tert*-butyl alcohol	63	90
3,4,5-Tribromocatechol	349	114
2,3,6-Tribomo-*p*-cresol	198	106
2,4,6-Tribromo-*m*-cresol	131	103
3,4,5-Tribromo-*o*-cresol	153	104
3,4,6-Tribromo-*o*-cresol	162	104
2,2,2-Tribromoethanal	63	147
1,1,2-Tribromoethane	15	65
2,2,2-Tribromoethanol	45	89
2,4,5-Tribromophenetol	45	139
2,4,6-Tribromophenetol	42	138
2,3,4-Tribromophenol	176	105
2,4,5-Tribromophenol	150	104
2,4,6-Tribromophenol	171	105
Tribromophloroglucinol	384	116
1,2,3-Tribromopropane	17	65
2,4,6-Tribromoresorcinol	234	108
Tri-*n*-butylamine	64	320
" "	355	438
Tricarballylic acid	258	203
Trichloroacetaldehyde	19	145
Trichloroacetamide	256	238
Trichloroacetanilide	99	233
2,4,6-Trichloroacetanilide	276	238
Trichloroacetic acid	47	194
" "	3	429
Trichloroacetonitrile	6	345
Trichloroacetyl bromide	7	218
Trichloroacetyl chloride	18	212
Trichloroacetyl fluoride	4	211
Trichloroacetyl iodide	4	222
Trichloroacrylic acid	8	429
Trichloroacrylonitrile	6	357
2,4,6-Trichloroaniline	125	306
2,4,6-Trichloroanisole	37	138
2,3,4-Trichlorobenzaldehyde	78	157
2,3,5-Trichlorobenzaldehyde	40	155
2,3,6-Trichlorobenzaldehyde	74	157
2,4,5-Trichlorobenzaldehyde	98	159
2,4,6-Trichlorobenzaldehyde	46	155
3,4,5-Trichlorobenzaldehyde	76	157
1,2,3-Trichlorobenzene	11	71
1,2,4-Trichlorobenzene	25	70
1,3,5-Trichlorobenzene	17	71
2,3,4-Trichlorobenzenesulfonamide	382	406
2,4,6-Trichlorobenzenesulfonamide	339	405
2,3,4-Trichlorobenzenesulfonyl chloride	67	381
2,4,6-Trichlorobenzenesulfonyl chloride	17	381
4,4,4-Trichloro-*n*-butylamine	356	438
2,2,3-Trichloro-*n*-butyraldehyde	58	147
2,2,4-Trichloro-*n*-butyraldehyde	16	152
2,3,5-Trichloro-*p*-cresol	80	100
2,4,6-Trichloro-*m*-cresol	41	98
3,5,6-Trichloro-*o*-cresol	68	100
4,5,6-Trichloro-*o*-cresol	114	102
Trichloroethanal	19	145
1,1,1-Trichloroethane	7	63
1,1,2-Trichloroethane	13	63
Trichloroethanol	45	82
2,2,2-Trichloroethylamine	218	437
1,1,2-Trichloroethylene	10	63
Trichlorohydroquinone	327	113
1,1,1-Trichloroisopropanol	24	88
3,3,3-Trichlorolactic acid	165	199
Trichlorolactamide	96	233
Trichlorolactanilide	325	240
5,6,7-Trichloronaphthalene-1-sulfonamide	433	408
5,6,8-Trichloronaphthalene-2-sulfonamide	400	407
6,7,8-Trichloronaphthalene-2-sulfonamide	424	408
5,6,7-Trichloronaphthalene-1-sulfonyl chloride	211	388
5,6,8-Trichloronaphthalene-2-sulfonyl chloride	247	389
6,7,8-Trichloronaphthalene-2-sulfonyl chloride	245	389
1,3,4-Trichloro-2-naphthol	415	117
1,4,5-Trichloro-2-naphthol	395	116
2,3,4-Trichloro-1-naphthol	439	119
5,5,5-Trichloro-*n*-pentylamine	366	439
2,4,6-Trichlorophenetole	26	138
2,3,4-Trichlorophenol	136	103
2,3,5-Trichlorophenol	67	100
2,3,6-Trichlorophenol	60	99
2,4,5-Trichlorophenol	87	101
2,4,6-Trichlorophenol	91	101
3,4,5-Trichlorophenol	193	106
Trichlorophloroglucinol	329	113
1,2,3-Trichloropropane	20	63
3,3,3-Trichloro-*n*-propylamine	341	438
2,3,4-Trichlorotoluene	5	71
2,3,5-Trichlorotoluene	8	71
2,4,5-Trichlorotoluene	23	71
2,4,6-Trichlorotoluene	2	71
3,4,5-Trichlorotoluene	7	71
n-Tricosane	23	8
12-Tricosanone	91	175
1-Tricosene	6	26
Tricosylcyclohexane	36	8
Tricosylcyclopentane	25	8
1-Tricosyne	10	31
Tricresyl phosphate	358	271
Tricyanomethane	66	360
Tricyclo(2,2,1,$0^{2,6}$)heptane	33	8
Tridecanal	7	150
Tridecanamide	116	233
Tridecananilide	53	232
n-Tridecane	261	7
n-Tridecanoic acid	28	194
n-Tridecanoic anhydride	17	225
1-Tridecanol	12	88
2-Tridecanone	9	172
7-Tridecanone	14	172
1-Tridecene	331	24
Tridecyl acetylene	63	30
n-Tridecyl aldehyde	7	150
Tridecylbenzene	181	42
Tridecylcyclohexane	3	8
Tridecylcyclopentane	276	7
Tridecylic acid	28	194
1-Tridecyne	61	30
Triethyl aconitate	322	268
Triethylamine	4	319
"	435	439
1,2,4-Triethylbenzene	109	39
1,3,5-Triethylbenzene	110	39
2,4,6-Triethylbenzoic acid	139	198
Triethyl carbinol	37	82
Triethyl citrate	340	270
Triethylene bromohydrin	73	84
Triethylene glycol	130	86
Triethylene glycol diacetate	193	260
Triethylene glycol dimethyl ether	88	135
Triethyl orthoformate	85	253
1,4,5-Triethylpyrazole	42	320
2,4,5-Triethylpyridine	34	319
Triethylsuccinic acid	115	430
Triethyl trimesate	159	281
Trifluoroacetaldehyde	2	144
Trifluoroacetic acid	2	429
Trifluoroacetic anhydride	1	223
Trifluoroacrylic acid	27	429
4,4,4-Trifluorobutyric acid	306	431
4,4,4-Trifluorocrotonic acid	166	430
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