

**G2461**

**Second Semester BSc Degree examination may 2019**  
**Complementary Course II for Botany/Zoology/Microbiology**  
**CH1231.3/CH1231.4/ CH1231.7 – Inorganic& Bio inorganic Chemistry**  
**(2017 Admission onwards) Max Marks :80**

<b>Q. No</b>	<b>Section A</b> <b>Answer All questions, Each question carries 1 mark</b>	<b>Marks</b>
1	What are fluxional molecules? For metal complexes with higher coordination number, there are a number of intermediate structures, and interconversion between them is often rapid at room temperature. These type of molecules <b>(Not mentioned in the syllabus, give full mark if attempted )</b>	1
2	Define co-ordination number. Total number of atoms of the ligands that can coordinate to the central metal ion.	1
3	Which is the stable isotope obtained as the end species in (4n+1) series Bi 209	1
4	What are the limitations of using organomercuric compounds Neurotoxicity. Methylmercury produced by microbial activity from organo mercuric compounds, tend to bioaccumulate within fish tissues and then enters the aquatic food chain.	1
5	What is ionization isomerism Ionization isomerism occurs when a ligand and a counter ion in one compound exchange places. An example is $[\text{PtCl}_2(\text{NH}_3)_4]\text{Br}_2$ and $[\text{PtBr}_2(\text{NH}_3)_4]\text{Cl}_2$ .	1
6	Define photosynthesis Photosynthesis is the process by which plants use the energy from sunlight to produce glucose from carbon dioxide and water.	1
7	Name one organo mercuric compound which is used as fungicide Phenyl mercuric acetate/methylmercury dicyanamide/any other	1
8	What is meant by nutritional anemia Type of anemia due to nutritional disorders like malnutrition	1
9	What type of complexes are obtained if the central metal has $d^2sp^3$ hybridisation? Inner sphere / Low spin /	1
10	Define hapticity The number of atoms in the ligand which are directly coordinated to the metal.	1
	<b>Section B</b> <b>Answer any eight questions Each question carries 2 marks</b>	
11	What is transmetallation method of synthesis of organo metallic compounds	1+1

	Synthesis by metal displacement, one metal atom takes the place of another, it is called transmetallation Any example of the form $M' + MR \longrightarrow M'R$	
12	What is the role of cytochromes in biological systems? Bioredox agents in all aerobic organisms, redox intermediates in electron transfer, involved in the release of energy by oxidizing glucose with dioxygen in the mitochondria of living cells.	1+1
13	Define coordination isomerism? Give one example Coordination isomerism arises when there are different complex ions that can form from the same molecular formula, as in $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$ .	1+1
14	Give one example of artificial transmutation The conversion of one element into another by artificial means, i.e., by means of bombarding with some fundamental particles, is known as artificial transmutation. ${}_7N^{14} + {}_2He^4 \longrightarrow {}_8O^{17} + {}_1H^1$	1+1
15	Discuss any one method of synthesis of ferrocene 1. Cyclopentadienyl magnesium bromide (CpMgBr) is reacted with iron (II) chloride 2. $FeCl_2 + 2NaCp$	2
16	What are high spin complexes Coordination complexes exhibiting paramagnetic behavior + any one example	1+1
17	Discuss any one use of coordination compounds in the qualitative analysis. Ni-DMG/any familiar color reactions given by metal ions with number of ligands	2
18	Complete the following nuclear reactions ${}^{24}_{12}Mg + \dots = {}^{27}_{14}Si + {}^1_0n$ ${}^{10}_5B + {}^4_2He = \dots + {}^1_0n$ Ans: ${}^4_2He$ , ${}^{13}_7N$	1+1
19	What are Grignard reagents? Give any two examples Alkyl Magnesium Halides (1) Any 2 examples (1)	2
20	What is Bohr effect? Binding of oxygen in hemoglobin depends on the pH of the medium, and the ability to add oxygen decreases as the pH of the medium increases. This relationship is related to the fact that $CO_2$ and $H^+$ affect the cooperativity, and the concentrations of these species are pH dependent. Because this behavior was discovered by Christian Bohr, it is referred to as the Bohr effect.	2
21	Define a chelate ligand and a chelate complex. Chelate ligands are multidentate ligands that binds to the metal atom through more than one atom. The stable ring complex formed by chelate ligands with metals is called chelate complex.	1+1
22	What are metal sandwich compounds? Give one example	1+1

	Derivatives of transition metals in which two organic ring systems are bonded symmetrically to the metal atom. Eg: Ferrocene, iron is sandwiched between two cyclopentadienyl rings	
	<b>Section C</b> <b>Answer any six questions, each question carries 4marks</b>	
23	Briefly discuss any two synthesis each of organo metallic compounds containing zinc and mercury? $C_2H_5I + Zn \longrightarrow C_2H_5-ZnI$ : $2C_2H_5ZnI \longrightarrow C_2H_5-Zn-C_2H_5 + ZnI_2$ $RMgX + HgX \longrightarrow RHgX + MgX_2$ $2RMgX + HgX_2 \longrightarrow R_2Hg + 2 MgX_2$ $RH + HgX_2 \longrightarrow RHgX + HgX$	2+2
24	What are the basic postulates of VB theory of metal complexes. 1.The central metal atom or ion makes available a number of empty atomic orbitals equal to its coordination number. 2.These vacant orbitals hybridize together to form hybrid orbitals 3. The ligands have atleast one $\sigma$ orbital containing a lone pair of electrons. 4. Vacant hybrid orbitals of the metal atom overlap with the filled $\sigma$ orbitals of the ligands to form L-M $\sigma$ bond	4×1
25	Briefly discuss the function of myoglobin. In vertebrates, when hemoglobin releases oxygen to the muscle tissue, myoglobin picks it up and stores it until it is needed. In oxymyoglobin M-O bond is stronger and oxygen is stored in this form in tissues. However, the bond is reversible and Oxygen is readily released during the oxidation of glucose. With explanation	4
26	Explain the term nitrogen fixation. Conversion of molecular dinitrogen into nitrogen compounds is known as nitrogen fixation. Explanation: lightening, Biological nitrogen fixation, any relevant equation (1+1+1)	1 3
27	The skeleton of a pre historic animal shows $1/5^{th}$ C14 radioactivity of that of a living animal. Calculate the age of skeleton ( $t_{1/2} = 5270$ years). Remaining C-14 = 0.2 Number of Half-lives elapsed = $(1/2)^n = 0.2$ $n \log 0.5 = \log 0.2$ $n = 2.32$ Age of skeleton = $2.32 \times 5270 = 12,226.4$ yr	4

28	Distinguish between nuclear fission and fusion			
	Sl. No.	Fission		Fusion
	1.	The process in which heavy nucleus is broken into tiny nuclei, is called as nuclear fission.		Nuclear fusion is defined as the reaction wherein lighter atoms come together and form a heavy nucleus.
	2.	Fission reaction does not normally occur in nature.		Fusion occurs in stars, such as the sun.
	3.	Fission produces many highly radioactive particles.		Few radioactive particles are produced by fusion reaction
	4.	Takes little energy to split two atoms in a fission reaction.		Extremely high energy is required to bring two or more protons close enough that nuclear forces overcome their electrostatic repulsion.
	5.	The energy released by fission is a million times greater than that released in chemical reactions; but lower than the energy released by nuclear fusion.		The energy released by fusion is three to four times greater than the energy released by fission.
6.	Uncontrollable	Controllable		
Any 4 points 4 Marks.				
29	<p>Discuss the preparation and use of organo silicon compounds. Organosilicon compounds can be prepared from metallic silicon and silicon halides.</p> <ul style="list-style-type: none"> <li>Chlorotrimethylsilane is prepared by the reaction of methylmagnesium iodide with silicon chloride.</li> </ul> $\text{SiCl}_4 + 3\text{MeMgI} \longrightarrow \text{Me}_3\text{SiCl}$ <p>Applications in medicine, bioactive organic compounds like testosterone, Sila-Pharmaca: Any 3 applications of 3 compounds</p>		1 3	
30	<p>Explain optical isomerism in metal complexes with a suitable example.</p> <p>For metal complex structures that do not possess a plane of symmetry, the mirror images are not superimposable, known as chiral structures, such molecules rotate a beam of polarized light and are said to be optically active.</p> $\text{Co(en)}_3, \text{Co(en)}_2\text{Cl}_2$		2+2	
31	<p>What are the limitations of valence bond theory of metal complexes. It cannot tell us why certain ligands are associated with the formation of high- (or low-) spin complexes. i.e., Complexes with same d electronic configurations may adopt different hybridisation and hence geometry. Could not quantitatively connect between spectra and magnetic moment. Could not explain the square planar complexes of d9 system. Importance of ligand is not properly accounted. Could not explain reaction rates and mechanism</p>		Explain any 4 limitations	

