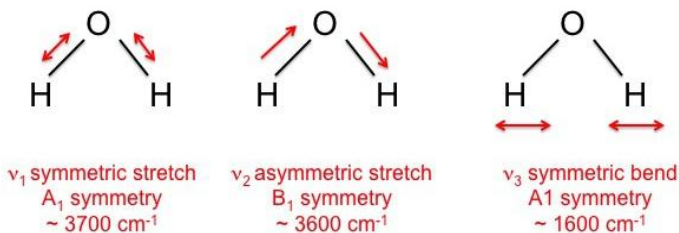


Second Semester BSc Degree examination may 2019
Complementary Course II for Botany/Zoology/Microbiology
CH1231.3/CH1231.4/ CH1231.7 – Inorganic& Bio inorganic Chemistry
(2013-2016 Admissions) Max Marks :80

Q.No	Section A Answer All questions, Each question carries 1 mark	Marks
1	Hardness due to ----- is called temporary hardness Bicarbonates of Ca ²⁺ or Mg ²⁺ (any one)	1
2	Give one example of primary pollutant CO, CO ₂ , NO, NO ₂ , SO ₂ , Hydrocarbons, Particulate Matter (one Correct answer)	1
3	Analysis of nitrogen oxide can be done by..... Photomultipliers/Light emission studies (any correct answer)	1
4	Write the IUPAC Name of [Co(NH ₃) ₆]Cl ₃ hexaamminecobalt(III) chloride	1
5	Give an example of linkage isomerism [Co(NH ₃) ₅ NO ₂] ²⁺ and [Co(NH ₃) ₅ ONO] ²⁺ Any Correct example	1
6	The complex having a ring structure is called Chelate	1
7	During fixation of carbon, carbon dioxide is converted into Glucose	1
8	----- is a complex of Mg ²⁺ with porphyrin Chlorophyll	1
9	The energy of oscillating molecule in its lowest vibrational level is called Zero point energy	1
10	Write the expression to calculate the force constant of a molecule $v = \frac{1}{2\pi} \sqrt{k/\mu}$ where k is the force constant	1
	Section B Answer any eight questions Each question carries 2 marks	
11	How is water purified for drinking purpose? Pretreatment: filtration, hardness removing, chlorination Sedimentation, Disinfection Or active carbon filtration and boiling or reverse osmosis etc Any correct answer give 2 marks.	2
12	What is acid rain? What are its consequences? The sulfur oxides and nitrogen oxides from high-temperature combustion are readily dissolved in water droplets in the atmosphere and returned to the earth as acid rain. (1) Acid rain has damaged forests and lakes globally, as well as attacking building materials and artistic works. Studies of the damage to limestone statues and building materials show an accelerating rate of destruction,	1+1

	with many carvings and sculptures becoming completely unrecognizable over a relatively short time. (Any 2 Consequences 1 Mark)	
13	[CoCl ₄] ²⁻ is blue while [Co(H ₂ O) ₆] ²⁺ is pink, why? Explanation based on the energy gap for tetrahedral and octahedral splitting	2
14	The d ⁶ ions tends to form low spin complexes even with comparatively weak field ligand explain. Large CFSE. Explanation	2
15	Explain carbon cycle. Carbon Cycle; Fixation of C = CO ₂ to glucose, Glucose to CO ₂ process	2
16	Sketch the normal modes of vibrations of H₂O.  <p>ν_1 symmetric stretch A₁ symmetry ~ 3700 cm⁻¹</p> <p>ν_2 asymmetric stretch B₁ symmetry ~ 3600 cm⁻¹</p> <p>ν_3 symmetric bend A₁ symmetry ~ 1600 cm⁻¹</p>	2
17	What is isotopic effect? The differences brought about by isotopic substitution in the physical and chemical properties of atoms and molecules are called isotope effects. Or explanations based on spectroscopy	2
18	Which of the following are micro wave active : O₂,N₂,HCl and why? HCl, permanent dipole moment	1+1
19	Explain ionization isomerism in coordination compounds with a suitable example. Explanation with example like [Cr(NH ₃) ₄ ClBr]NO ₂ and [Cr(NH ₃) ₄ ClNO ₂]Br	2
20	How fertilizers and pesticides cause soil pollutions? By repetitive use of fertilizers- (NH ₄) ₂ SO ₄ - NH ₄ ⁺ is used by crops but SO ₄ ²⁻ accumulates-makes soil acidic, Na/KNO ₃ - NO ₃ ⁻ are used up by crops- Na/K ⁺ -soil basic	2
21	What is cation exchange resins? Explain their action on hard water. Calcium (Ca ²⁺) and magnesium (Mg ²⁺) ions that cause water hardness can be removed by cation exchange resins. As hard water passes through a softener, the calcium and magnesium exchanges with sodium ions in the resin. Sodium ions are held loosely and are replaced easily by calcium and magnesium ions.	2
22	Discuss on any four limitations of valence bond theory. 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.	4 × $\frac{1}{2}$ = 2

	<p>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>	
	<p>Section C Answer any six questions, each question carries 4marks</p>	
23	<p>What is meant by green house effect? Illustrate it with an example.</p> <p>In this effect, a polyatomic molecule like CO₂ in the atmosphere permits the passage of visible light but, because of its vibrational infrared absorptions, it blocks the immediate radiation of heat from the Earth. Explanation 2Mark</p>	2+2
24	<p>Write a note on the splitting of d orbital energies in octahedral and tetrahedral fields.</p> <p>Splitting Diagram octahedral 2 Marks + tetrahedral 2 marks</p> <p>Specify the orbitals in t_{2g} and e_g in each case with their corresponding stabilization</p>	4
25	<p>Write a short note on biochemistry of iron.</p> <p>Explanation based on Oxygen Transport-heme protein-hemoglobin-myoglobin-affinity</p>	4
26	<p>Discuss on the mechanism of respiration.</p> <p>In oxygen transport, the gas is absorbed in lung tissue and transported by heme to muscle tissue, where it is transferred to myoglobin. Some oxygen is stored in myoglobin and released during exertion to oxidize glucose. After transferring an oxygen molecule to myoglobin, hemoglobin attaches a molecule of carbon dioxide and transports it to the lungs, from which it is exhaled. The oxygen transport occurs through the arterial network, and carbon dioxide is transported through the veins.</p>	4
27	<p>Discuss the effects of fluorocarbons on ozone layer.</p> $\text{CCl}_2\text{F}_2 + h\nu \longrightarrow \text{Cl}\cdot + \cdot\text{CClF}_2 \quad (\text{This requires ultraviolet radiation with } \lambda \approx 200 \text{ nm.})$ $\cdot\text{Cl} + \text{O}_3 \longrightarrow \text{ClO}\cdot + \text{O}_2 \quad (\text{These two reactions remove O}_3 \text{ and oxygen atoms without reducing the number of chlorine atoms, Cl}\cdot.)$ $\text{ClO}\cdot + \text{O}\cdot \longrightarrow \text{Cl}\cdot + \text{O}_2$ <p>Explanation with equation 2+2</p>	
28	<p>How is water purified by reverse osmosis?</p>	

	Principle Reverse osmosis (2)- Pressure- Experimental description(2)	
29	Write a note on pure rotational spectra. Polar molecules having a permanent dipole moment- Rigid Rotor model, Moment of Inertia, $B(J+1)$, Constant B, Selection rule, $2B$, Bond length Isotopic effect, atomic mass. (relevant 4 points with explanation)	4
30	Explain the applications of coordination compounds in qualitative analysis. Ni-DMG/any familiar color reactions given by metal ions with number of ligands like Schiff base ligands, thiocyanate complex of Fe(III), Al^{3+} 8-hydroxy quinoline, etc 4 points 4 Marks	
31	Write a note on nitrogen fixation cycle. Conversion of molecular dinitrogen into nitrogen compounds is known as nitrogen fixation. (1Mark) Explanation: lightning, Biological nitrogen fixation, any relevant equation (1+1+1)	
	Section D Answer any two questions, Each question carries 15marks	
32	Give an account of crystal field theory. Explain the formation of low spin and high spin complexes with the help of crystal field theory. Important features-(5) Splitting of d Orbitals in octahedral and tetrahedral field-(5)- Formation of Low spin and high Spin Explanation (5)	5+5+5
33	Discuss the principles underlying infrared spectroscopy. Vibrational spectroscopy is used to characterize compounds in terms of the strength, stiffness, and number of bonds that are present. It is also used to detect the presence of known compounds (fingerprinting), to monitor changes in the concentration of a species during a reaction, to determine the components of an unknown compound (such as the presence of CO ligands), to determine a likely structure for a compound, and to measure properties of bonds (their force constants). Molecules-spring-Harmonic oscillator- $E_v = \left(v + \frac{1}{2}\right) h\omega$, where $\omega = \sqrt{k/\mu}$, terms explanation, Number of vibrational degrees of freedom-IR Active molecules- IR active vibrations of any molecules- v values-selection rules-fundamental vibrations-overtone (15 points 15 marks)	
34	What are cytochromes? Discuss their importance in biological systems. Fe porphyrin group-Cytochromes use the Fe^{3+}/Fe^{2+} couple and are generally six-coordinate, with two stable axial bonds to amino acid donors, and the Fe is usually low spin in both oxidation states-different cytochromes- the capability of cytochromes for fast electron transfer-Structure description -7.5 Marks + Biological importance -7.5 marks	

35	<p>What are pollutants? How are they classified? What are the sources of important air pollutants?</p> <p>Pollutanat: The contamination of air, water and soil with the substances which have adverse effect on human beings, animals and plants is called pollution and these substances whose presence in air , water and soil makes them polluted, are called pollutants. (2 Marks)</p> <p>Classification with explanation: Gaseous, Liquid, soild and pollutants without weight(heat, radiation etc)-5 Marks</p> <p>Sources of air pollutants: CO, CO₂, Oxides of N, Oxides of S, O₃, Dust, smoke</p> <p style="text-align: center;">OR</p> <p>Sources of air pollution like burning of coal, gases from internal combustion engines, chemical industries, smoking, dust, radioactive waste materials</p> <p>Any 5 points with explanation -8 marks</p>	
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