[This question paper contains 8 printed pages.]

Your Roll No......

Sr. No. of Question Paper : 1107 **A**

Unique Paper Code : 32171601

Name of the Paper : Inorganic Chemistry IV: Organometallic Chemistry and Bio-inorganic Chemistry

Name of the Course : **B.Sc. (Hons.) Chemistry**

Semester : VI

Duration : 3 hours 30 minutes Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **six** questions out of nine.
3. **All** questions carry equal marks **(12.5)**.

1. (i) What are Metalloenzymes and Metal Activated Enzymes? Give the name and the mechanism of action of the enzyme transporting CO_2 from the tissues to the lungs.

P.T.O.

(ii) What are interfering anions? How do they interfere in the cation analysis? Why do they interfere only after the second group cation analysis and not before?

(iii) Predict whether the following compounds obey EAN rule or not.

(a) $[Fe(CO)_2(\eta^5\text{-}C_5H_5)(\eta^1\text{-}C_5H_5)]$

(b) $[Fe(CO)_2(NO)_2]$ (5,5,2.5)

2. (i) The Heam group in Haemoglobin cannot function as an oxygen carrier in the absence of the globin chain. Explain. Give the Hill's equation for the oxygenation of Haemoglobin.

(ii) What is Zeise's salt? Discuss the bonding in Zeise's salt on the basis of Dewar-Chatt-Duncanson model and IR studies. How is M-C bonding in Zeise's salt different from that in metal carbonyl complexes?

(iii) Explain the steps involved in the identification of NO_2^- and NO_3^- ions when present together in a salt mixture. (5,5,2.5)

3. (i) A mixture of anions gives brown vapours with concentrated H_2SO_4, which are intensified on adding copper turnings. A rod dipped in ammonia solution gives white dense fumes when brought near the mouth of the test tube. The sodium carbonate extract gives a white precipitate with silver nitrate after acidification, which is completely soluble in ammonium hydroxide solution. Explain with reactions how will you confirm the anions present.

(ii) How are organometallic compounds classified on the basis of type of bonding? Explain giving examples.

(iii) State what special features of Zn(II) make it an excellent biocatalyst? (5,5,2.5)

4. (i) State how does cis-platin block cell proliferation? Explain.

(ii) What is Bohr Effect? Draw the oxygen saturation curves for haemoglobin and myoglobin. Why do their shapes differ?

P.T.O.

(iii) What is meant by the term hapticity? Give an example where the same ligand can show varying hapticity. (5,5,2.5)

5. (i) Give examples of metal containing biomolecules which perform the following functions. (Give the name of the metal and the biomolecule which contains the metal)

(a) Oxygen storage

(b) Metal storage

(c) Electron carrier

(d) Photoredox

(e) Prevention of disease

(ii) Ferrocene on acetylation with excess of reagent shows heteroannular substitution while on alkylation with excess of reagent shows homoannular substitution. Give reason.

(iii) Which alkaline earth metal is also involved in the sodium - potassium pump? What is the source of energy for this pump? (5,5,2.5)

6. (i) Explain the functioning and mechanism of action of the enzymes: Carbonic anhydrase and Carboxypeptidase A?

(ii) Define the following terms with reference to Catalysis :

(a) Catalytic cycle

(b) Tolman catalytic loop

(c) Lifetime of a catalyst

(d) Turnover number

(e) Poison

(iii) How will you detect potassium ion in presence of ammonium ions? (5,5,2.5)

7. (i) Name the metal with oxidation state involved in following biomolecules.

(a) Ferritin

(b) Vitamin B12

(c) Haemoglobin

(d) Chlorophyll

(e) Transferrin

(ii) What is Zieglar Natta Catalyst? Explain the active form of this catalyst which is involved in the oligomerization of olefin.

(iii) Write the formulae and draw the structures of two organometallic compounds having multicentre bonding. What is the reason of their multicentre bonding? (5,5,2.5)

8. (i) An unknown salt A, when heated with NaOH solution, produced a pungent smelling gas B. B turned red litmus blue and gave dense white fumes of C when a glass rod dipped in HCl was held at the mouth of the test tube. A, on heating with concentrated sulphuric acid, gave a mixture of two odourless gases D and E. D burnt with a blue flame while E turned lime water milky. An aqueous solution of A gave a white precipitate with calcium chloride solution, the acid

extract of which discharged the colour of acidified potassium permanganate solution. Identify A, B, C, D and E giving the reactions involved.

(ii) What do you mean by reductive carbonylation? Give a suitable example for this. The symmetric CO stretching frequencies in isoelectronic series of $[V(CO)_6]^-$, $Cr(CO)_6$ and $[Mn(CO)_6]^+$ are 1860 cm^{-1}, 2000 cm^{-1} and 2090 cm^{-1} respectively. Explain these observations.

(iii) In what form iron is stored in the human body? How is it taken from the storage site for the incorporation into haemoglobin? (5,5,2.5)

9. (i) Both carbon and oxygen have one lone pair of electron but in metal carbonyls, bonding is through carbon and not through oxygen. Explain with help of Molecular orbital diagram.

(ii) Write the toxic effects of Pb(II). Give the reasons for its toxicity. How it can be treated?

P.T.O.

(iii) What is Wilkinson's catalyst. Explain its structure and oxidation state of the central metal ion. (5,5,2.5)