SET – A

Unique Paper Code : 32171601
Name of Course : B.Sc. (H) Chemistry
Semester : VI
Name of the Paper : Inorganic Chemistry IV: Organometallic Chemistry
Duration : 2 hours
Maximum Marks : 75 Marks

Instructions for the Candidates

Attempt **Four** questions in all. **Question No.1** is compulsory.
All questions carry equal marks.

1. **(a)** Answer the following very short type questions:

1) A precipitate of AgCl is soluble in _____due to the formation of soluble_____ complex.
2) A 'percentage saturation versus partial pressure of O_2' curve for Myoglobin is _____in shape.
3) Give examples of two interfering anions in qualitative analysis of cations.
4) Give an example of a biomolecule in which the metal ion has a photoredox role. Name the metal ion.
5) Give the composition of the brown ring obtained in the ferrous sulphate test for nitrate ions.
6) _____ and _____ react to form synthetic gasoline by Fischer-Tropsch process.

(6 x 1)

(b) Answer the following short answer type questions (any three):

1) Name an element which has good crustal abundance but only a marginal role in the biosystem. Give reason.
2) Predict the 3d metal atom "M" in a stable organometallic compound $[M\ (\eta^3: C_5H_5)\ (CO)_5]$.
3) Two different structures of $Co_2(CO)_8$ are consistent with 18 electron rule. Draw these structures.
4) Calculate the valence electron count for $(CH_3)Mn(CO)_5$ and the number of metal-metal bonds in $Co_4(CO)_{12}$.

(3 x 2)

(c) Answer the following questions:

1) Draw the structure of methyl lithium. What are the coordination numbers of Li and C in this compound?

2) Mention any two features that a chelating agent should possess to be used in medicine. Give an example of such a drug.

(3, 3.75)

2. (a) Explain the bonding in metal carbonyls with the help of a Molecular Orbital Diagram of CO. Why is carbon monoxide called a **Π**-acceptor ligand?

(6)

(b) Why does the haem subunit in haemoglobin adopt a domed shape in deoxygenated haemoglobin? How does it aid in the transportation of oxygen from lungs to the tissues?

(6)

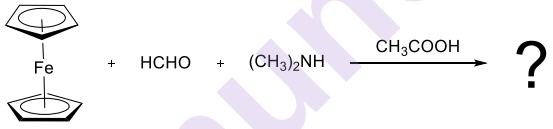
(c) Answer the following:

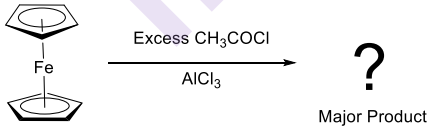
(1). Can we replace yellow ammonium sulphide with sodium sulphide to separate Group IIA and Group IIB cations? Justify your answer.

(2). Why do Pb(II) ions sometimes precipitate in Group I as well as Group II in qualitative mixture analysis for cations? (3,3.75)

3. (1) Give one method of preparation of metal carbonyls with equation.

(2) Complete the following reactions:





(6)

(b) Define Therapeutic Index. Why is cisplatin a preferred anti -cancer drug in contrast to transplatin. Explain giving the mechanism of action.

(6)

(c) Arrange the following:

(1). In increasing order of their ease of oxidation giving reason.

Cl^-,Br^- and I^-

(2). In increasing order of the IR vibrational stretching frequency of CO (ν_{C-O}) giving reason.
$[Mo(CO)_3(PF_3)_3]$, $[Mo(CO)_3(PCl_3)_3]$, $[Mo(CO)_3(PPh_3)_3]$

(3,3.75)

4. The CO stretching frequency in IR spectra of the compounds are as follows: $[Mn(CO)_6]^+$ 2090 cm-1, $Cr(CO)_6$ 2000 cm-1, $[V(CO)_6]^-$ 1860 cm-1, $[Ti(CO)_6]^{2-}$ 1750 cm^{-1}.The value for CO (g) is 2143 cm^{-1}. Interpret the variation in stretching frequencies.

(6)

(b) A metal 'M' is capable of existing in two oxidation states +III and +V. An aqueous solution of its salt in the lower oxidation state gives white precipitate on addition of concentrated ammonia, which however disappears on adding hydrochloric acid. 'X', a compound of 'M' in the higher oxidation state is used for detection of Mn(II). Identify 'M' and 'X' and give the reactions.

(6)

(c) What is the function of the enzyme Carboxypeptidase A? Give the coordination number and geometry about the metal center in this enzyme. Describe the interactions which help to keep the substrate in place in the enzyme's pocket.

(6.75)

5. Differentiate between active and passive transport of ions. How do channels discriminate between different ions?

(6)

(b) Explain the use of the following reagents (any two) in the identification of ions in qualitative mixture analysis along with the chemical reactions

(1). Sodium bismuthate
(2). Zirconyl nitrate
(3). Dimethylglyoxime

(6)

(c) Write the formula of Zeise's salt and draw its structure. The C-C bond length of ethene increases to 137.5 pm from 133.7 pm in Zeise's salt. Explain the variation in C-C bond length. What is the expected change in the C-C stretching frequency?

(6.75)

6. What is the common ion effect? Discuss the concept as applicable to the precipitation of group II and group IV cations in qualitative analysis.

(6)

(b) What is Wilkinson's catalyst used for? Draw the cycle and describe each step of the catalytic cycle.

(6)

(c) (1) Why do cells have different extracellular and intracellular concentrations of metal ions?

(3)

(2) Draw the dose-response curve for an essential element and a toxic element. Explain.

Or

What effect does a change in pH have on the percentage saturation curves of Haemoglobin. Depict graphically and explain.

(3.75)