

Unique Paper Code : 32171601

Name of Course : B.Sc. (H) Chemistry

Semester : VI

Name of the Paper : Inorganic Chemistry IV: Organometallic Chemistry

Duration : 3 hours

Maximum Marks : 75 Marks

**Instructions for the Candidates**

Attempt **four** questions in all. **Question No.1 is compulsory.**

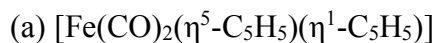
All questions carry equal marks.

**Q1. (a) Answer the following very short type questions.**

- (i) The rhodium complex used as Wilkinson's catalyst has the formula ..... and contains rhodium in oxidation state .....
- (ii) Write the formula of the canary yellow precipitate obtained in the confirmatory test of phosphate ion.
- (iii) Explain "hapticity" with the help of an example.
- (iv) Define "Turnover number" of a Catalyst.
- (v) A.....pH helps in releasing oxygen from oxygenated haemoglobin in the tissues.
- (vi) Define Active transport. (1 × 6)

**(b) Answer the following short answer type questions:**

- (i) The V-C bond lengths in  $[\text{V}(\text{CO})_6]$  and  $[\text{V}(\text{CO})_6]^-$  are 200 pm and 193 pm, respectively. Explain.
- (ii) Define and give an example each of an essential and a non-essential element.
- (iii) Predict whether the following compounds obey EAN rule or not.



(2 × 3)

**(c)** Answer the following :

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

(ii) What do you mean by homogeneous and heterogeneous catalysis? Out of these two, which one is preferred and why? **(3, 3.75)**

**Q2. (a)** 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 ? **(6)**

**(b)** Give the complete cycle describing each step to outline the working of the Ziegler-Natta catalyst for the polymerization of ethene. **(6)**

**(c)** What are Metalloenzymes and Metal Activated Enzymes? Give the name and the mechanism of action of the enzyme transporting CO<sub>2</sub> from the tissues to the lungs. **(6.75)**

**Q3. (a)** Give the use of the following reagents in the identification of ions along with the chemistry involved:

(i) Potassium hexacyanoferrate(II)

(ii) Dimethylglyoxime

(iii) Sodium Bismuthate

**(6)**

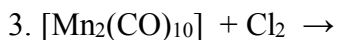
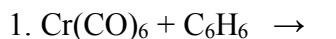
**(b)** The Heam group in Haemoglobin cannot function as an oxygen carrier in the absence of the globin chain. Explain. Give the Hill's equation for the oxygenation of Haemoglobin.

**(6)**

**(c)** CO does not bind to Lewis acids like BF<sub>3</sub> or AlCl<sub>3</sub>; yet it binds to transition metals in low oxidation states. Explain with reference to MO diagram of carbon monoxide.

**(6.75)**

**Q4. (a)** (i) Predict the products of the following reactions:



(ii) Arrange the following in the increasing order of CO stretching frequencies in the IR spectrum. Explain the order.



**(3, 3)**

**(b)** Define toxic elements. Give the sources, symptoms associated with and antidotes for Cadmium poisoning.

**(6)**

**(c)** (i) The hydrochloric acid solution of a salt of metal M gives white turbidity when diluted with water. A compound of M is used in the confirmatory test of a Group IV metal ion. Identify M and explain the reactions mentioned with equations.

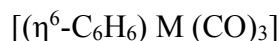
(ii) Explain the steps involved in the identification of  $\text{NO}_2^-$  and  $\text{NO}_3^-$  when present together in a salt mixture.

**(3, 3.75)**

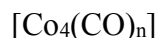
**Q5. (a)** How is iron transported and stored in the human body ? Where is it stored? **(6)**

**(b)** Using 18 electron rule as a guide, identify/find:

(i) the 3d metal in



(ii) the probable number of carbonyl ligands in



(iii) the number of Fe-Fe bonds in  $[\text{Fe}_3(\text{CO})_{12}]$  **(6)**

**(c)** (i)  $\text{Mn}^{2+}$  ions are not precipitated as MnS on passing  $\text{H}_2\text{S}$  gas in group II but precipitate as MnS on passing  $\text{H}_2\text{S}$  gas in Group IV of qualitative analysis. Explain.

(ii) A mixture of anions gives brown vapours with concentrated  $\text{H}_2\text{SO}_4$ , 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.

**(3, 3.75)**

**Q6. (a)** Ferrocene shows both similarities as well as differences from benzene. Illustrate with examples. **(6)**

**(b)** What are interfering anions ? How do they interfere in the cation analysis. Why do they interfere only after the second group of the cations analysis scheme and not before? **(6)**

**(c)** Why does only *cisplatin* and not *transplatin*, act as an anti cancer drug. Give its mechanism of action. **(6.75)**