[This question paper contains 8 printed pages.]

Your Roll No.....

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Sr. No. of Question Paper : 1056

Unique Paper Code : 2172013501

Name of the Paper : DSC: Inorganic Chemistry V – Basics of Organometallic Chemistry

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

Semester : V

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

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

1. (a) Define the following with suitable example :

(i) Organometallic compounds and its application

(ii) Hapticity. Give examples of ligands with hapticities of 3, 4 and 5.

(b) What is meant by Synergic effect? How does it account for the formation of carbonyl complexes of transition metals in low oxidation states?

(c) Explain hydroformylation? Mention in detail the mechanism for the catalytic cycle of conversion of alkenes to aldehyde. (5,5,5)

2. (a) How are organometallic compounds classified on the bases of type of bonding. Explain giving example.

(b) (i) The V-C bond lengths in $[V(CO)_6]$ and $[V(CO)_6]^-$ are 200pm and 193pm respectively. Explain.

(ii) Give reason and arrange in order of Shortest C-O bond - Ni $(CO)_4$, $[Co(CO)_4]^-$, $[Fe(CO)_4]^{2-}$.

(c) Explain in details the Wacker Oxidation process for conversion of ethene to acetaldehyde. (5,5,5)

3. (a) The cyclopentadienyl rings in ferrocene have aromatic character but cyclopentadiene itself has no such character. Explain. Give two reactions of ferrocene which show it is more reactive than benzene.

(b) Give one method of preparation of Fischer Carbene. Differentiate between Fischer and Schrock Carbene (at least three).

(c) What is Ziegler Natta catalyst? Explain the active form of this catalyst which is involved in the polymerization of alkenes. (5,5,5)

4. (a) Give any two methods of preparation of Metal Carbonyls. What happens when $Fe(CO)_5$ react with :

(i) Bromine

(ii) PR_3 in presence of sunlight.

(b) Discuss in detail the Monsanto process for the production of acetic acid from methanol.

(c) Using the 18-electron rule as a guide, find the number of metal-metal bonds in $Fe_3(CO)_{12}$, and the charge on the species $[Co(CO)_4]^x$. (5,5,5)

5. (a) (i) Give reasons $Fe(CO)_5$ is known while $Fe(CO)_6$ is not.

(ii) Explain the structure and hybridization in Potassium risoxalatoferrate(III).

(b) Give a possible mechanism of conversion of synthesis gas to synthetic gasoline by Fischer Tropsch method.

(c) Which of the following are organometallic compounds and why :

(i) $(C_2H_5)_2Zn$

(ii) $Ti(OEt)_4$

(iii) CH_3MgBr

(iv) $(\eta^6\text{-}C_6H_6)(PPh_3)_2Cr$

(v) LiBr (5,5,5)

6. (a) Draw and explain the structure of the following metal carbonyls using VBT.

(i) $Co_2(CO)_8$

(ii) $Cr(CO)_6$

(b) Draw and explain the structure and bonding of metal with alkyl and allyl group.

(c) (i) Explain why direct nitration of ferrocene is not possible? How can you get nitro derivative of ferrocene?

(ii) Explain the following term used in a catalytic process: Catalyst Poison, Catalyst Promotor.

(5,5,5)

7. (a) Give any three methods of synthesis of metal alkene complexes. What happens when a metal alkene complex $[CpW(CO)_3(\pi\text{-}C_2H_4)]^+$ reacts with triphenylphosphine.

(b) Explain the following :

(i) Migratory insertion of Carbonyl.

(ii) The Carbonyls of 4d metals are less stable than the corresponding carbonyl of 3d metals.

(c) What is Wilkinson's Catalyst? Explain its structure and how it is an effective homogenous catalyst for hydrogenation of alkenes. (5,5,5)

8. (a) Give two methods of synthesis of ferrocene and how does it react with the following :

(i) Butyl Lithium,

(ii) Formaldehyde and secondary amine.

(b) Predict whether the following obey the EAN rule :

(i) $[Mn(\pi C_2H_4)(CO)_5]^+$

(ii) $Mn_2(CO)_{10}$

(iii) $[Fe(CO)_4]^{2-}$

(iv) $[Cr(CO)_3(NO)_2]$

(v) $[Co(\pi\text{-}C_3H_5)(CO)_3]$

*Calculate considering ligand (NO) as linear and bent both.

(c) How to synthesized Zeise's salt? Discuss the bonding in Zeise's salt on the basis of Dewar-Chatt-Duncanson model. — (5,5,5)