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CHS 554

**IV Semester M.Sc. Examination, September/October 2022
(CBCS) (2016 – 17 Syllabus) (Freshers and Repeaters)
CHEMISTRY
Organometallic Chemistry**

Time : 3 Hours

Max. Marks : 70

Note : i) Answer Part – A and **any four** questions from Part – B.
ii) Figures to the **right** indicate marks.

PART – A

1. Answer **all** the following sub-divisions. **(9×2=18)**
- Narrate the invention of first organometallic compound.
 - Write the structure of $[\eta^1 - (C_6H_5) Mn \eta^6 - (C_6H_6)]Cl_2$ and comment on its stability.
 - What are agostic bonds ? How are they different from the other bonds ?
 - Discuss the structure of cyclooctatetraene complexes and mention its properties.
 - Name the following complexes
 - $[IrCl(CO)(PPh_3)_3]$
 - $[CoCl_2(C_2H_2)_2(CO)_2]$.
 - Why does back donation of electrons alter the C-C bond length in alkene complexes ?
 - What properties of $AlCl_3$ and $TiCl_4$ in the Ziegler-Natta compound make it a polymerisation catalyst ?
 - Mention the advantages of water-gas shift reaction.
 - Differentiate hydrocyanation reactions from the hydrogenation reactions.

PART – B

Answer **any four full** questions. **(4×13=52)**

2. a) Discuss the structure and bonding in transition metal alkyl compounds with suitable example.
- b) By providing suitable experimental evidences, explain the structure and bonding in $K[PtCl_3(C_2H_4)]$.
- c) How does metal hydrides synthesised ? Give their applications. **(5+5+3=13)**

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3. a) Explain how Pd(II) complexes with $16e^-$ are stable.
- b) Discuss the classification of organometallic compounds based on hapticity.
- c) Determine the total number of electrons in the following complexes and comment on their stability. **(4+5+4=13)**
- i) $[\eta^1-(C_5H_5)Fe \eta^6-(C_6H_6)]Cl_3$ ii) $[\eta^3-(C_3H_4)Mn(CO)_4]^{2+}$.
4. a) Give one preparation of metal butadiene. Discuss the structure.
- b) What are fluxional molecules ? Explain the fluxionality isomerism in dienyl complexes.
- c) Discuss the structure and bonding in metallocycles. **(5+5+3=13)**
5. a) Based on concepts of molecular orbital theory, explain the structure of ferrocene.
- b) How does metal allyl complexes prepared ? Explain the structure and bonding.
- c) Discuss the structure and reactivity of isolobal compounds. **(5+5+3=13)**
6. a) Discuss the catalytic cycle for hydroformylation reaction.
- b) Explain the mechanism of hydrogenation of olefins using Wilkinson's catalyst.
- c) Explain the Fischer-Tropsch reaction. **(5+4+4=13)**
7. a) Explain the Wacker process. How do regeneration of the original catalyst be done ?
- b) Describe the mechanism of the Monsanto acetic acid process.
- c) Write differences between homogeneous and heterogeneous catalysis. **(5+4+4=13)**
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