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3 (Sem-6/CBCS) CHE HC 1

2023

**CHEMISTRY**

(Honours Core)

Paper : CHE-HC-6016

**(Inorganic Chemistry-IV)**

Full Marks : 60

Time : Three hours

**The figures in the margin indicate full marks for the questions.**

1. Answer the following:  $1 \times 7 = 7$

(a) What are fluxional organometallic compounds?

(b) The most suitable route to prepare the *trans*- isomer of  $[PtCl_2(NH_3)(PPh_3)]$  is :

(i)  $[PtCl_4]^{2-}$  with  $PPh_3$  followed by reaction with  $NH_3$

(ii)  $[PtCl_4]^{2-}$  with  $NH_3$  followed by reaction with  $PPh_3$

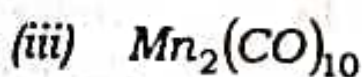
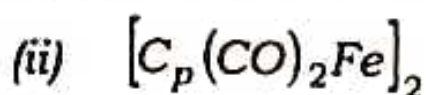
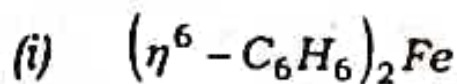
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- (iii)  $[P(NH_3)_4]^{2+}$  with  $HCl$  followed by reaction with  $PPh_3$
- (iv)  $[P(NH_3)_4]^{2+}$  with  $PPh_3$  followed by reaction with  $HCl$
- (c)  $[Ni(CM)_4]^{2+}$  is kinetically \_\_\_\_\_ but thermodynamically \_\_\_\_\_.
- (d) 'Low spin complexes are labile but prefer associative mechanism'.  
[True or False]
- (e) How many metal-metal (M-M) bonds are there in  $Ir_4(CO)_{12}$ ?
- (f) Why metal-carbonyl complexes always obey 18 electron rule?
- (g) Why interfering radicals do not interfere till group II in the analysis of basic radicals?
2. Explain why/how:  $2 \times 4 = 8$
- (a) Square planar complexes are generally labile.
- (b) Solubility product plays an important role in qualitative analysis.
- (c) Direct nitration of ferrocene is not possible.
- (d) Ferrocene undergoes electrophilic substitution  $10^6$  times faster than benzene.

3. Answer **any three** of the following:  $5 \times 3 = 15$
- (a) Discuss the dissociative nucleophile substitution reaction in the light of CFT.
- (b) Discuss the methods of removal of fluoride and phosphate ions during the qualitative analysis of salt mixtures.  
 $2\frac{1}{2} + 2\frac{1}{2} = 5$
- (c) Explain the mechanism of inner sphere redox reaction of coordination compounds.
- (d) Write the plausible mechanism for the catalytic hydrogenation of alkenes using Wilkinson's catalyst,  $CIRh(PPh_3)_3$ . Identify the reaction type of each step.
- (e) Discuss the bonding in M-CO fragments. How, IR spectra can be used to distinguish between terminal and bridging CO groups?  $3 + 2 = 5$
4. Answer **any three** of the following:  $10 \times 3 = 30$
- (a) Write notes on the following:  $5 \times 2 = 10$
- (i) Multicenter bonding in methyl-lithium.
- (ii) Stepwise and overall formation constants of a reaction.

(b) The compound  $W(\eta^5-C_5H_5)((H)(CO)_3)$  reacts with  $C_3H_6$  to give three products A, B and C. Identify and draw the structure of compounds A, B and C. Each compound obeys the 18-electron rule.

(c) For the following species, calculate the number of electrons in the valance shell, give their reasonable structures and comment on their relative stabilities.  $2\frac{1}{2} \times 4 = 10$



(d) Discuss the preparation and structure of ferrocene. Explain the mechanism of acetylation reaction.  $2\frac{1}{2} + 2\frac{1}{2} + 5 = 10$

(e) On the basis of VBT, how will you explain lability and inertness of transition metal complexes? Discuss how the following factors affect the lability of a complex:  $4 + (2 \times 3) = 10$

(i) Geometry of the complex

(ii) Oxidation state of the metal ion

(iii) Ionic radius

(f) What are metal alkyls? Discuss the structural features of methyl lithium and trialkyl aluminium.  $2 + 4 + 4 = 10$