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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 : 1×7=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  $PPh_3$

Contd.



(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 :

2×4=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 :

5×3=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,  $ClRh(PPh_3)_3$ . 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 :

10×3=30

(a) Write notes on the following: 5×2=10

(i) Multicenter bonding in methyl-lithium.

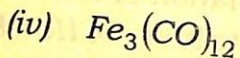
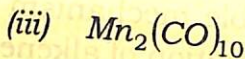
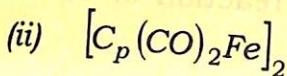
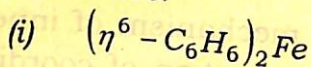
(ii) Stepwise and overall formation constants of a reaction.



(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 valence 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.

$$2 + 4 + 4 = 10$$