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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 election 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, $ClRh(PPh_3)_3$. 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 :

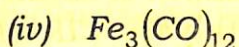
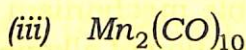
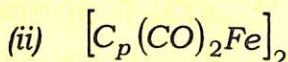
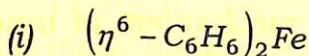
$$10 \times 3 = 30$$

- (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.

$$2 + 4 + 4 = 10$$