*(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. 2½×4=10

   (i) $\left(\eta^6 - C_6H_6\right)_2 Fe$

   (ii) $\left[C_p(CO)_2Fe\right]_2$

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

   (iv) $Fe_3(CO)_{12}$
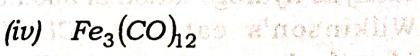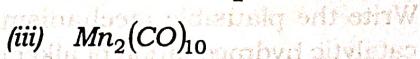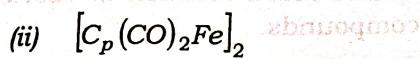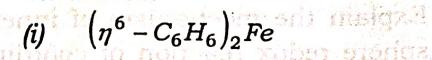
(d) Discuss the preparation and structure of ferrocene. Explain the mechanism of acetylation reaction. 2½+2½+5=10

(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+(2×3)=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

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

(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) $[Ni(CN)_4]^{2-}$ 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?

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.

2½+2½=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 methyllithium.

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