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

(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 ?

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. 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 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. $2\frac{1}{2}\times4=10$

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

(ii) $[C_p(CO)_2 Fe]_2$

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

(iv) $Fe_3(CO)_{12}$
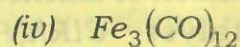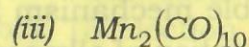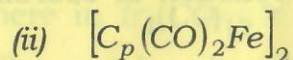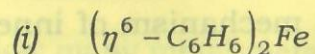
(d) Discuss the preparation and structure of ferrocene. Explain the mechanism of acetylation reaction. $2\frac{1}{2}+2\frac{1}{2}+5=10$

(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 : $4+(2\times3)=10$

(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. $2+4+4=10$

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