**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 $W(\eta^5\text{–}C_5H_5)((H)(CO)_3)$ 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) $\left(\eta^6 - C_6H_6\right)_2Fe$

(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

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