6 SEM TDC CHMH (CBCS) C 13

2022

(June/July)

CHEMISTRY

(Core)

Paper : C–13

(Inorganic Chemistry)

Full Marks : 53

Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct answer from the following : 1×7=7

(a) In the complex $(\sigma\text{-}C_3H_5)\,Re(CO)_5$, the allyl group is

(i) monohapto ligand

(ii) dihapto ligand

(iii) trihapto ligand

(iv) pentahapto ligand

(b) The stretching wave number of CO molecule is $2143\,cm^{-1}$. The C—O stretching wave number of CO in $Ni(CO)_4$ is

(i) $2060\,cm^{-1}$

(ii) $2160\,cm^{-1}$

(iii) $2260\,cm^{-1}$

(iv) $2243\,cm^{-1}$

(c) Which of the following complexes does not obey $18\,e^-$ rule?

(i) $Fe(\eta_5\text{-}C_5H_5)_2$

(ii) $Cr(\eta_3\text{-}C_5H_5)_2$

(iii) $Co_2(CO)_8$

(iv) $Fe(CO)_4PPh_3$

(d) Which of the following has minimum *trans*-effect?

(i) C_2H_4

(ii) NO_2^-

(iii) NH_3

(iv) Br^-

(Continued)

(e) Which of the following combinations of basic radicals belongs to group IV?

(i) Zn, Co, Ni

(ii) Zn, Co, Mg

(iii) Zn, Ni, Hg

(iv) Mn, Ni, Pb

(f) What is the chemical form of the precipitates of group V?

(i) Chloride

(ii) Sulphide

(iii) Hydroxide

(iv) Carbonate

(g) Which of the following complexes is called Wilkinson's catalyst?

(i) $RhCl(PPh_3)_3$

(ii) $Ir(CO)Cl(PPh_3)_2$

(iii) $HCo(CO)_4$

(iv) $Zr(CH_3)ClPh_2$

2. Answer any *five* from the following questions : 2×5=10

(a) How does a precipitation occur in solution during salt analysis? Why is H_2S passed in acidic medium for the precipitation of group II basic radicals? 1+1=2

(b) Give an example of reaction in which $HCo(CO)_4$ is used as catalyst. 2

(c) What is *trans*-effect? Write down the *trans*-series. 1+1=2

(d) Give one method of preparation of each of the following : 2

(i) Zeise's salt

(ii) Ferrocene

(e) Assuming 18-electron rule is valid, find the number of metal-metal bonds in metal carbonyls $Fe_3(CO)_{12}$ and $Co_4(CO)_{12}$. 2

(f) What are labile and inert complexes? Explain with examples. 2

UNIT—I

3. Answer any *two* from the following questions : 3×2=6

(a) What is common-ion effect? Discuss the application of common-ion effect in the qualitative analysis of inorganic salt. 1+2=3

(Continued)

(b) Explain why concentrated HCl is used in the flame test for basic radicals. Whether flame test can be done for a salt having Cu^{2+} ion in presence of BO_3^{3-} acid radicals? 1½+1½=3

(c) What is solubility product? Explain why during the precipitation of group III NH_4OH is added in presence of NH_4Cl. 1+2=3

UNIT—II

4. Answer any *four* from the following questions : 3×4=12

(a) Outline the synthesis of a low nuclearity carbonyl cluster. Discuss the structure of the cluster. 1+2=3

(b) Draw the MO energy level diagram of CO molecule and discuss its π-accepting ability. 2+1=3

(c) What is 18-electron rule? How is 18-electron rule helpful in determining the number of metal-metal bonds in metal carbonyl compounds? 1+2=3

(d) Discuss the structure and bonding in Zeise's salt. 3

(e) Discuss the role of triethyl aluminium in the polymerization of ethane. 3

(f) Discuss the bonding in ferrocene with the help of MOT. 3

UNIT—III

5. Answer any *four* from the following questions : $3\times4=12$

(a) Discuss the mechanism of the following reaction : 3

$$[Co(NH_3)_5Cl]^{2+} \xrightarrow[-Cl^-]{\text{slow}}$$

$$[Co(NH_3)_5]^{3+} \xrightarrow[+H_2O]{\text{fast}} [Co(NH_3)_5H_2O]^{3+}$$

(b) A thermodynamically stable complex may not be kinetically stable. Explain. 3

(c) Discuss the effects of the following factors on the rate of hydrolysis of octahedral complex : $1\frac{1}{2}\times2=3$

(i) Charge on the substrate

(ii) Steric effect

(Continued)

(d) Starting from $[PtCl_4]^{2-}$ and other ligands, outline the synthesis of *cis*- and *trans*-$[PtCl_2(NH_3)(NO_2)]$. 3

(e) Discuss the base hydrolysis reaction of a cobalt complex. 3

UNIT—IV

6. Answer any *two* from the following questions : 3×2=6

(a) Give the reaction path of the hydrogenation of olefin with the help of Wilkinson's catalyst. 3

(b) Discuss the route of hydroformylation reaction catalyzed by $HCo(CO)_4$. Mention the oxidation and insertion steps during the course of the reaction. 2+1=3

(c) Discuss Wacker process of oxidation of ethylene. 3

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