PG – 246

II Semester M.Sc. Degree Examination, June/July 2018
(CBCS Scheme)
CHEMISTRY
C-201 – Inorganic Chemistry – II

Time : 3 Hours Max. Marks : 70

Instructions : *Answer question number* **1** *and* ***any five*** *of the remaining.*

1. Answer **any ten** of the following : **(2×10=20)**

a) For the formation of complex $[Ni(en)_3]^{2+}$ (en = ethylene diamine), $logK_1$, $logK_2$ and $logK_3$ are 7.52, 4.83 and 3.10 respectively. Calculate overall stability constant.

b) What are the factors that favour high coordination number in complexes ?

c) Define 'stereochemical nonrigidity'. Name the technique used for its detection.

d) Distinguish between thermodynamic and kinetic stability of metal complexes.

e) How is the presence of hydride detected in metal hydridocarbonyl complexes ?

f) Define 'self assembly' in supramolecules. What are the types of interactions present in them ?

g) Derive the ground state term symbols for Ni^{2+}.

h) Deduce the total number of microstates for V^{2-} and Mn^{2+} ions.

i) What is spincrossover ?

j) Calculate the spin only magnetic moments of the following complexes

i) $K_3Fe(CN)_6$ ii) $HgCo(SCN)_4$

iii) $[Co(NH_3)_6]Cl_3$ and iv) $K[Cr(C_2O_4)_2(OH_2)_2]$

k) Name the type of transitions responsible for the following reactions :

i) $PtCl_4^{2-} \xrightarrow{h\nu} PtCl_4^{-} + Cl^{-} + \cdot Cl$

ii) $Co(NH_3)_5NCS^{2+} \xrightarrow{h\nu} [Co(NH_3)_5]^{2+} + \cdot NCS$

l) What is Kasha's rule ?

P.T.O.

2. a) Describe the determination of stability of metal complex by polarographic method.

   b) What are chelate and macrocyclic effects ? Explain with examples.

   c) What are the ways of O_2 binding to the metal ? Give one example for each. **(4+3+3=10)**

3. a) Write the structures of $Fe_3(CO)_{12}$ and $Ni(CO)_4$. Explain the metal carbonyl bonding in them.

   b) Why the complex $M(PEt_3)_3(CO)_3$ exhibits ν_{CO} at 2090 and 2055 cm^{-1} where as $M(PF_3)_3(CO)_3$ at 1937 and 1847 cm^{-1} ? Out of there two phosphines, which one is more π-barbonding ligand ?

   c) With neat sketches, describe the d orbital splitting in tetrahedral and squareplanar crystal field. **(4+3+3=10)**

4. a) Construct the molecular orbital diagram of $[Co(NH_3)_6]^{3+}$. Explain its salient features.

   b) What are the factors that affect CFSE ? Calculate CFSE of $[Co(NH_3)_6]^{3+}$ complex whose $\Delta_0 = 23000\ cm^{-1}$ and $P = 21000\ cm^{-1}$.

   c) What are dynamic and static Jahn Teller distortions encountered in metal complexes ? Give one example for each type. **(4+3+3=10)**

5. a) How do CFT account for the magnetic properties and colour of the metal complexes ?

   b) Give any two experimental evidences for metal ligand covalency in complexes.

   c) What are CT transitions ? Describe the types of such transitions encountered in metal complexes. **(4+3+3=10)**

6. a) Of the three Racah parameters, which determine the energy differences between (i) ^3P and ^3F and (ii) ^3P and ^1P state arising from the same atom ?

   b) Explain the salient features of Tanabe sugano diagrams.

   c) An octahedral cobalt (II) complex exhibits d-d transitions at 7150, 15200 and 19200 cm^{-1}. Assign these bands and calculate Nephelauxetic ratio. (B for Co^{2+} ion = 971 cm^{-1}). **(4+3+3=10)**

7. a) Describe VSM method of determining magnetic susceptibility of metal complexes.

b) Explain the effect of temperature on the susceptibility of different magnetic materials.

c) What is spin orbit coupling ? In which of the following configurations of tetrahedral complexes spin orbit coupling is expected ? d^2, d^3, d^4 and d^5.

(4+3+3=10)

8. a) Write briefly on photoredox reactions of transition metal complexes.

b) What are Adamson's rules ? What are its limitations ?

c) Predict the products of the following reactions :

i) $IrH_2\{diphos\}_2^+ \xrightarrow{h\nu} ? + ?$

ii) $[Cr(NH_3)_6]^{3+} + H_2O \xrightarrow[H^+]{h\nu} ? + ?$

iii) $[Cr(en)_3]^{3+} + H_2O \xrightarrow[H^+]{h\nu} ?$

(4+3+3=10)