(c) Define Jahn-Teller theorem. Giving reasons, in which case this effect would be observed ? 5

$t_{2g}^3 e_g^1$ or $t_{2g}^6 e_g^2$

5. Write short notes on (any **three**) :

(a) Spectrochemical series 5

(b) Limitations of crystal field theory 5

(c) Trans effect (π - bonding theory) 5

(d) Structure (heme unit) and functions of hemoglobin 5

6. (a) Calculate Crystal Field Stabilization Energy (CFSE) values for : 5

(i) d^5 low spin octahedral system and

(ii) d^6 tetrahedral ion in strong field

(b) Write short notes on the following (giving suitable examples) : 5

(i) Hydrate isomerism

(ii) Coordination position isomerism

(c) Explain the following : 5

(i) Charge effect on substitution reaction in square planar complexes.

(ii) The effect of nature of solvent on substitution reaction in square planar complexes.

***

[This question paper contains 4 printed pages]

Your Roll No. : .....

Sl. No. of Q. Paper : **1490** **I**

Unique Paper Code : 2172523501

Name of the Paper : Coordination Chemistry and its Application in Biological Systems

Name of the Course : **B.Sc. (Prog.) Life Science**

Semester : V

Time : 2 Hours ***Maximum Marks : 60***

Instructions for Candidates :

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Attempt any **four** questions.

(c) **All** questions carry equal marks.

1. (a) Give reasons for the following : 5

(i) Tetrahedral complexes are high spin.

(ii) Crystal field splitting energy for $[Cr(NH_3)_6]^{2+}$ is 10,200 cm^{-1}, while for $[Cr(NH_3)_4]^{2+}$ is 5,900 cm^1.

(b) Give the IUPAC names of the following complexes (**any five**) : 5

P.T.O.

(i) $K_3[Ag(S_2O_3)_2]$

(ii) $[Co(en)_2(ONO)Cl]Cl$

(iii) $[Pt(NH_3)_4(Cl)_2][PtCl_4]$

(iv) $[Ni(NH_3)_2(en)](CH_3COO)_2$

(v) $Ru[AgF_4]$

(vi) $[Cr(H_2O)_4Cl_2]NO_3$

(c) Complexes with chelating ligands are more stable than the complexes with non-chelating ligands. Explain, with a suitable example. 5

2. (a) On the basis of valence bond theory, answer the following questions for the six-coordinated complex ion : $[CoF_6]^{3-}$ 5

(i) What is the oxidation state of Co ?

(ii) What type of hybridization is involved ?

(iii) Whether the given complex is inner orbital or outer orbital complex ?

(iv) What is the magnetic behaviour of the complex ion ?

(v) Calculate the value of magnetic moment (spin only).

(b) Write chemical formulae for the following compounds : 5

(i) Potassium tetracyanidonickelate (II)

(ii) Teracarbonylnickel(0)

(iii) Tetramminecarbonatocobalt (III) chloride

(iv) Tris (ethylenediamine) chromium (III) amminepentacyanidonickelate (II)

(v) Pentaamminethiocyanato-N-chromium(III)tetrachloridozincate(II)

(c) Derive relation between stepwise and overall stability constant for a complex. 5

3. (a) The magnetic moment of $[Fe(H_2O)_6]^{3+}$ ion is 5.92 B.M. and that of $[Fe(CN)_6]^{3-}$ ion is 1.73 B.M. . Explain on the basis of crystal field theory. 5

(b) Using the reactants $[Pt(Cl)_4]^{2-}$, NH_3 and Cl, propose the effective routes for synthesis of cis- and trans-$[Pt(NH_3)_2Cl_2]$ isomers. 5

(c) Which metal ion is present in the active site of carbonic anhydrase ? Explain the role of this enzyme in biological system. 5

4. (a) Draw crystal field splitting diagrams indicating the number of electrons in each level for the following complexes : 5

(i) $[Co(CN)_6]^{3-}$ $(\Delta_o > P)$

(ii) $[Co(H_2O)_6]^{3+}$ $(\Delta_o < P)$

(b) Draw the geometrical isomers for the following complexes : 5

(i) $[PtClBr(py)(NH_3)]$

(ii) $[Cr(NH_3)_3(Cl)_3]$