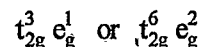


- (c) Define Jahn-Teller theorem. Giving reasons, in which case this effect would be observed ? 5



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 $[\text{Cr}(\text{NH}_3)_6]^{2+}$ is $10,200 \text{ cm}^{-1}$, while for $[\text{Cr}(\text{NH}_3)_4]^{2+}$ is $5,900 \text{ cm}^{-1}$.

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

- (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 tetracyanonickelate (II)
- (ii) Teracarbonylnickel(0)
- (iii) Tetramminecarbonatocobalt (III) chloride
- (iv) Tris (ethylenediamine) chromium (III) amminepentacyanonickelate (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 $[PtCl_4]^{2-}$, 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) $[Cr(NH_3)_3(Cl)_3]$