[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7002 **K**

Unique Paper Code : 2172523501

Name of the Paper : DSC-A5: Coordination Chemistry and its Applications in Biological Systems

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

Semester : V

Duration : 2 Hours Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **four** questions.
3. **All** questions carry equal marks.

1. (a) Write IUPAC name of the following complexes :

(i) $K_4[Ni(CN)_4]$

(ii) $[Co(NH_3)_6]$ Cr $(CN)_6]$

(iii) $[Fe\ (H_2O)_5NO]^{2+}$

(iv) $LiAlH_4$

(v) $[Ni\ (NH_3)_2Cl_2]$

(b) Explain the following in details :

(i) Strong and Weak Jahn-Teller distortion

(ii) Tetrahedral complexes are high spin

P.T.O.

(c) Draw all possible isomers of $[Cr(C_2O_4)_2(H_2O)_2]^-$. Which of these isomers will be optically active and why? (5,5,5)

2. (a) Calculate the number of unpaired electrons (n) and CFSE value in terms of CFS and P for the following complex :

(i) $[Fe\ (H_2O)_6]^{3+}$

(ii) $[CoCl_4]^{2-}$

(b) On the basis of Valence Bond theory answer the following questions for a six- coordinated complex ion $[Co\ (NO_2)_6]^{3-}$

(i) What is the oxidation state of Cobalt?

(ii) What type of hybridization is involved?

(iii) What will be no. of unpaired electron(s)?

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

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

(c) Write the chemical formula for the following complexes :

(i) Ammonium aquapentafluoronickelate(IV)

(ii) pentaamminecarbanatochromiun(III) chloride

(iii) Sodium pentacyanonitrosoniumferrate(I)

(iv) Tetracarbonylcobaltate (–1)

(v) Hexaamminecobalt(III) chloride (5,5,5)

3. (a) What are the differences between hemoglobin and myoglobin?

(b) Explain what is meant by terms stepwise formation constant Kn and overall formation constant βn of a coordination complex. How are these two constants related?

(c) What are the limitations of valence bond theory? (5,5,5)

4. (a) (i) What is the chelate effect'? Why does $[Co(en)_3]^{3+}$ have a higher value of stability constant than $[Co(NH_3)_6]^{3+}$?

(ii) Show how the d-orbital splitting changes as an octahedral complex undergoes tetragonal distortion and eventually becomes a square planar complex.

(b) Give the mechanism of carbonic anhydrase enzyme where it converts CO_2 to HCO_3^-.

(c) Write a short note on **(any two)** :

(i) Trans effect

(ii) Spectro-chemical series and its importance

(iii) Co-operative effect in hemoglobin (5,5,5)

5. (a) 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}. Give reasons.

(b) Explain $[NiCl_4]^{2-}$ is tetrahedral and paramagnetic but $[Ni(ON)_4]^{2-}$ ion is square planar and diamagnetic.

(c) (i) What is central active metal ion in carboxypeptidase enzyme? What is its coordination number?

(ii) Explain the function of carboxypeptidase enzyme. (5,5,5)

P.T.O.

6. (a) Discuss the mechanism of substitution reactions in square planar complexes.

(b) State and explain the factors that affect the stability of complex ions.

(c) Explain :

(i) Structure and function of Myoglobin

(ii) Oxygen binding curve for myoglobin (5,5,5)