



15 BWS 4007

PG - 198

II Semester M.Sc. Degree Examination, June 2016  
(CBCS)  
CHEMISTRY

C - 201 : Inorganic Chemistry - II (Coordination Chemistry)

Time : 3 Hours

Max. Marks : 70

**Instruction :** Answer question No. 1 and **any five** of the remaining.

1. Answer **ten** questions of the following :

(2×10=20)

- The value of  $\Delta G^\circ$  for a complex formation was found to be  $-12.05$  kJ/mol at  $25^\circ\text{C}$ . Calculate its stability constant (Given :  $R = 8.314$  JK $^{-1}$  mol $^{-1}$ ).
  - Explain why  $[\text{Cu}(\text{en})(\text{H}_2\text{O})_2]^{2+}$  is stabler than  $[\text{Cu}(\text{NH}_3)_2(\text{H}_2\text{O})_2]^{2+}$ ?
  - Explain the fact that in nitrosyl complexes, NO is capable of forming both linear and angular M-NO groups.
  - Indicate the electrons arrangement in  $t_{2g}$  and  $e_g$  orbitals in  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$  and  $[\text{FeCl}_6]^{3-}$ .
  - Draw the possible geometrical isomers for  $[\text{Cu}(\text{en})_2(\text{H}_2\text{O})_2]^{2+}$  and indicate which ones are optically active?
  - If  $\Delta_0$  value for  $[\text{CoCl}_6]^{4-}$  is  $20,430$  cm $^{-1}$ , calculate the value of  $\Delta_{T_d}$  for  $[\text{CoCl}_4]^{2-}$ .
  - Find out the number of microstates possible for  $p^2$  and  $d^2$  systems.
  - $[\text{CoCl}_4]^{2-}$  complex has higher molar absorptivity value and intense colored compared to that of  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ . Explain this observation.
  - Give two differences between Orgel and Tanabe-Sugano diagrams.
  - Both  $[\text{Ni}(\text{CN})_4]^{2-}$  and  $[\text{Ni}(\text{CO})_4]$  are in different geometries but magnetically similar. Explain this behavior.
  - What is Nephelauxetic effect? Explain.
  - Define quantum yield?
2. a) Discuss any two evidences for metal-ligand orbital overlap.  
b) Discuss the structure and bonding in  $\text{Mn}_2(\text{CO})_{10}$  and  $\text{Fe}_3(\text{CO})_{12}$ .  
c) Nature of the metal ion affects the stability of metal complexes. Explain with suitable examples.

(3+4+3=10)

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3. a) Discuss the factors affecting CFSE with suitable examples.  
 b) Set up the MO energy level diagram for  $[\text{FeF}_6]^{3-}$  and calculate its spin-only magnetic moment.  
 c) What is spectrochemical series? Why is it called so? (3+4+3=10)
4. a) Discuss the splitting pattern of d-orbitals in  $[\text{CoCl}_4]^{2-}$ . Show the electrons arrangement in each set of orbitals.  
 b) Discuss the bonding and structure of a tertiary phosphine complex of a transition metal.  
 c) What is meant by stereochemical non-rigidity? Explain how this phenomenon can be studied? (4+3+3=10)
5. a) Calculate the values of  $B'$  and  $\beta$  for  $[\text{V}(\text{H}_2\text{O})_6]^{2+}$  which exhibits absorption bands at 12340, 18500 and 27920  $\text{cm}^{-1}$  (Given:  $B$  for  $\text{V}^{2+}$  ion = 755  $\text{cm}^{-1}$ ). Assign these transitions.  
 b) Explain the following:  
 (i) Aqueous  $\text{MnSO}_4$  solution is almost colorless while that of  $\text{MnO}_4^-$  is intense pink colored.  
 (ii) The experimental magnetic moment of copper acetate monohydrate is lower than its spin-only value.  
 c) Predict the possible transitions for  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$  based on Orgel diagrams. (3+4+3=10)
6. a) Describe the Faraday's method for the determination of magnetic susceptibility of a complex.  
 b) Discuss the effect of temperature on magnetic susceptibility of ferromagnetic and antiferromagnetic compounds.  
 c) How do  $^3F$  and  $^3P$  free ion terms of a  $d^2$  metal ion get transformed in an octahedral crystal field? How many d-d transitions are expected? Assign these transitions. (3+4+3=10)
7. a) How are stepwise stability constant and overall stability constant related? Describe method for the determination of the stability constant of a complex by spectrophotometric method.  
 b) Discuss the magnetic and spectral properties of lanthanide complexes. (5+5=10)
8. a) Explain the various types of photochemical reactions possible for  $\text{Cr}^{3+}$  and  $\text{Co}^{3+}$ .  
 b) Write a brief note on solar energy conversion systems.  
 c) What is a spin-cross over system? Why this is not possible in a tetrahedral complex? (4+3+3=10)