



**II Semester M.Sc. Degree Examination, June/July 2014**  
**(2010-11 & Onwards) (NS)**  
**CHEMISTRY**  
**C-201 : Inorganic Chemistry – II (Coordination Chemistry)**

Time : 3 Hours

Max. Marks : 80

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

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

- a) Formation constant of  $[\text{Ni}(\text{en})_2]^{2+}$  is higher than that of  $[\text{Ni}(\text{NH}_3)_6]^{2+}$ . Explain.
- b) 'Isocyanide is not an obligatory  $\pi$ -acid'. Comment.
- c) Calculate the magnetic moment of the complexes  $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3] \cdot 3\text{H}_2\text{O}$  and  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$  using spin only formula.
- d) Give the splitting pattern of the ground term  $d^2$  system in an octahedral field. Give their relative energies.
- e) What is CFSE ? Calculate CFSE for the complex  $[\text{CoF}_6]^{4-}$ .
- f) How are CO and  $\text{H}^-$  peaks in hydrido carbonyl complexes distinguished using infrared spectroscopic technique ? Explain.
- g) Bring out the relationship between successive formation constant and overall stability constant of a complex with an example.
- h) Aqueous  $\text{MnO}_4^-$  solution is intensely colored while  $\text{MnCl}_2$  solution is almost colorless. Account for this.
- i) Predict the geometries of metal complexes whose coordination numbers are 5 and 6.
- j) State the selection rules in electronic spectroscopy.
- k) Explain the bonding in dihydrogen complexes.
- l) What is steric factor ? Explain.



2. a) Describe the utility of ORD technique in determining the absolute configuration of  $[\text{Co}(\text{s-alanine})_3]$  and  $[\text{Co}(\text{en})_2(\text{s-glutamate})]^+$  complexes.
- b) Write the Orgel diagram for a  $d^2$  octahedral complex. How could it be used for interpreting the spectral properties of  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$  and  $[\text{V}(\text{H}_2\text{O})_6]^{3+}$  ?
- c) Discuss the spectral, magnetic and bonding characteristics of  $[\text{CoF}_6]^{3-}$  with the help of MO energy level diagram. **(4+4+4)**
3. a) What are the different ways of bonding of  $\text{O}_2$  to metal complexes ? Give an example for each. How does  $\text{O}_2$  bind to Vaska's complex ?
- b) Discuss any two experimental evidences for covalency in M-L bonding of complexes.
- c) Explain ferro, ferri and antiferromagnetism. **(4+4+4)**
4. a) The electronic absorption spectrum of  $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$  exhibits bands at 17,400, 24,500 and 37,500  $\text{cm}^{-1}$ . Draw an Orgel diagram to assign the transitions and find out  $Dq$ ,  $B'$  and  $\beta$  (Given  $B$  for  $\text{Cr}^{3+}$  is 918  $\text{cm}^{-1}$ ).
- b) Give the salient features of CFT. Draw and explain the splitting pattern of metal d-orbitals in  $[\text{NiCl}_4]^{2-}$  and  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$  complexes.
- c) Write a note on self assembly in supra molecules. **(4+4+4)**
5. a) Describe the experimental determination of stability constant of a metal complex by pH-metric method.
- b) Explain Gauy's method for the determination of magnetic susceptibility of a compound.
- c) Write a structures of  $\text{Mn}_2(\text{CO})_{10}$  and  $\text{Fe}_3(\text{CO})_{12}$ . Explain the bonding of CO in these complexes. **(4+4+4)**
6. a) Discuss stereochemical non-rigidity in  $\text{Fe}_2\text{Cp}_2(\text{CO})_4$ . Which spectroscopic technique is used for its study ? Explain.
- b) How are Tanabe-Sugans diagrams different from Orgel diagrams ? Explain the spectral features of  $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$ .
- c) Discuss the factors affecting the stability of metal complexes. **(4+4+4)**
7. a) Give an account of the structure and bonding in metal nitrosyl complexes.
- b) What is Jahn-Teller distortion ? Discuss its consequences in transition metal complexes.
- c) Write a note on spectrochemical series. **(4+4+4)**