

II Semester M.Sc. Degree Examination, June/July 2018
(CBCS Scheme)
CHEMISTRY
C-201 – Inorganic Chemistry – II

Time : 3 Hours

Max. Marks : 70

Instructions : Answer question number 1 and any five of the remaining.

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

- a) For the formation of complex $[\text{Ni}(\text{en})_3]^{2+}$ (en = ethylene diamine), $\log K_1$, $\log K_2$ and $\log K_3$ are 7.52, 4.83 and 3.10 respectively. Calculate overall stability constant.
- b) What are the factors that favour high coordination number in complexes ?
- c) Define 'stereochemical nonrigidity'. Name the technique used for its detection.
- d) Distinguish between thermodynamic and kinetic stability of metal complexes.
- e) How is the presence of hydride detected in metal hydridocarbonyl complexes ?
- f) Define 'self assembly' in supramolecules. What are the types of interactions present in them ?
- g) Derive the ground state term symbols for Ni^{2+} .
- h) Deduce the total number of microstates for V^{2+} and Mn^{2+} ions.
- i) What is spincrossover ?
- j) Calculate the spin only magnetic moments of the following complexes
 - i) $\text{K}_3\text{Fe}(\text{CN})_6$
 - ii) $\text{HgCo}(\text{SCN})_4$
 - iii) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ and
 - iv) $\text{K}[\text{Cr}(\text{C}_2\text{O}_4)_2(\text{OH})_2]$
- k) Name the type of transitions responsible for the following reactions :
 - i) $\text{PtCl}_4^{2-} \xrightarrow{h\nu} \text{PtCl}_4^- + \text{Cl}^- + \cdot\text{Cl}$
 - ii) $\text{Co}(\text{NH}_3)_5\text{NCS}^{2+} \xrightarrow{h\nu} [\text{Co}(\text{NH}_3)_5]^{2+} + \cdot\text{NCS}$
- l) What is Kasha's rule ?



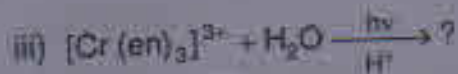
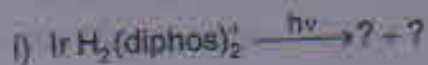
2. a) Describe the determination of stability of metal complex by polarographic method.
3. b) What are chelate and macrocyclic effects? Explain with examples.
- c) What are the ways of O_2 binding to the metal? Give one example for each. (4+3+3=10)
3. a) Write the structures of $Fe_3(CO)_{12}$ and $Ni(CO)_4$. Explain the metal carbonyl bonding in them.
- b) Why the complex $M(PzEt_3)_3(CO)_3$ exhibits ν_{CO} at 2090 and 2055 cm^{-1} where as $M(PF_3)_3(CO)_3$ at 1937 and 1847 cm^{-1} ? Out of these two phosphines, which one is more π -backbonding ligand?
- c) With neat sketches, describe the d orbital splitting in tetrahedral and squareplanar crystal field. (4+3+3=10)
4. a) Construct the molecular orbital diagram of $[Co(NH_3)_6]^{3+}$. Explain its salient features.
- b) What are the factors that affect CFSE? Calculate CFSE of $[Co(NH_3)_6]^{3+}$ complex whose $\Delta_o = 23000\text{ cm}^{-1}$ and $P = 21000\text{ cm}^{-1}$.
- c) What are dynamic and static Jahn Teller distortions encountered in metal complexes? Give one example for each type. (4+3+3=10)
5. a) How do CFT account for the magnetic properties and colour of the metal complexes?
- b) Give any two experimental evidences for metal ligand covalency in complexes.
- c) What are CT transitions? Describe the types of such transitions encountered in metal complexes. (4+3+3=10)
6. a) Of the three Racah parameters, which determine the energy differences between (i) 3P and 3F and (ii) 3P and 1P state arising from the same atom?
- b) Explain the salient features of Tanabe sugano diagrams.
- c) An octahedral cobalt (II) complex exhibits d-d transitions at 7150, 15200 and 19200 cm^{-1} . Assign these bands and calculate Nephelauxetic ratio. (B for Co^{2+} ion = 971 cm^{-1}). (4+3+3=10)



7. a) Describe VSM method of determining magnetic susceptibility of metal complexes.
- b) Explain the effect of temperature on the susceptibility of different magnetic materials.
- c) What is spin orbit coupling ? In which of the following configurations of tetrahedral complexes spin orbit coupling is expected ? d^2 , d^3 , d^4 and d^5 .

(4+3+3=10)

8. a) Write briefly on photoredox reactions of transition metal complexes.
- b) What are Adamson's rules ? What are its limitations ?
- c) Predict the products of the following reactions :



(4+3+3=10)

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