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SB-3507

M. Sc. (Part - II) Examination

March / April – 2011

Inorganic Chemistry : Paper - III

(Special Paper : Coordination Chemistry)

Time : **3** Hours] [Total Marks : **70**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ M. SC. (PART - II)

Name of the Subject :

☛ INORGANIC CHEMISTRY : PAPER - III

☛ Subject Code No. : 3 5 0 7 ☛ Section No. (1, 2,.....) : Nil

Seat No. :

Student's Signature

(2) Answer **all** questions.

(3) Figures to the **right** hand side of each question indicate full marks.

(4) Give neat and clean diagrams whenever applicable.

1 (a) Discuss the principle of Molecular Orbital Theory (MOT). Explain how molecular orbital treatment is applied to study the bonding and structure of $[CoCl_4]^{2-}$ complex. **12**

(b) What are the drawbacks of point charge model of metal-ligand bonding ? Give direct and indirect evidences of metal ligand orbital overlap.

OR

1 (a) What are the assumptions of Crystal Field Theory (CFT) ? Discuss the d-orbital splitting in

(i) Six coordinate complexes

(ii) Pentacoordinate complexes, and

(iii) Tetragonal complexes.

(b) What is Recah parameters ? The value of the Racah parameter for a complex is less than that for a free ion. How do you explain this ? Also, what does this difference indicate ? Explain the nephelauxetic series ?

2 (a) Explain the terms : **12**

(i) Transition moment integral

(ii) Oscillator strength

(b) Discuss the orbital and spin selection rules of electronic absorption. Under what conditions are these rules relaxed ?

OR

2 (a) Explain the electronic spectra of d^3 and d^7 metal ions in weak octahedral field using suitable examples. **12**

(b) Calculate ligand field parameters of Dq, B' and β values of $[Cr(H_2O)_6]^{+3}$ from observed ligand field spectra in O_h field :

$[Cr(H_2O)_6]^{+3}$:V_1 = 17,400, V_2 = 24,600, and V_3 = 37,800 cm^{-1}.

Bands use either ϑ_1 and ϑ_2 or ϑ_1 and ϑ_3 [B^o of Cr^{+3} = 918 cm^{-1}].

3 (a) Describe the Faraday method for measuring the magnetic susceptibility of a paramagnetic substance. Give the advantages and disadvantages of this method. **12**

(b) Calculate the magnetic moment of $K_2Pb\ [Co(NO_2)_6]$ complex.

[λ = -1030 cm^{-1} and 10 Dq 12,600 cm^{-1}]

(c) What R-S state will arise for a free ion with a d^2-configuration.

OR

3 (a) Explain the magnetic properties of complexes with T ground state using suitable examples. **12**

(b) Explain how orbital contribution to the magnetic moment takes place ? How orbital contribution can be quenched ?

(c) What are magnetically concentrated substances ? Explain antiferromagnetic interaction by super exchange mechanism.

4 Discuss the Irving-Rossotti three titration technique for the determination of the stability constants for the complex formed in aqueous solution. **10**

OR

4 Answer any three of the following : **10**

(i) What is chelate effect ? Describe it in terms of favourable entropy change. **10**

(ii) Why does the acid titration curve for the same volume of alkali show lower value of pH than reagents of the complex formed in aqueous solutions ?

(iii) Explain the effect of number of chelate rings on the stability of the complexes.

(iv) Explain the effect of the size of the chelate ring on the stability of alkaline earth metal chelates.

5 (a) Distinguish between : **12**

(i) Anation and Aquation reaction

(ii) Equilibrium constants and rate constants.

(b) Discuss the reaction mechanism of substitution reactions without breaking of M-L bond in Co (III) complexes.

(c) Justify that in O_h-complexes electron withdrawing ligand affects the rate of acid hydrolysis of trans isomers more than cis-ones.

OR

5 (a) Discuss an exmaple to jusify that an innersphere mechanism of electron transfer reactions of metal complexes in solution operates via formation of a ligand bridge. **12**

(b) Explain the hydrolysis of $[Co(en)_2L.C1]^+$ in which L = $O\bar{H}$, $C\bar{l}$ and NCs at cis position reacts more readily with retention of configuration.

6 Write notes on any **three** : **12**

(i) Orgel and Tanable Sugano diagram and their applications.

(ii) Static and Dynamic Jahn-Teller effect.

(iii) Origin of paramagnetism.

(iv) Streochemistry of penta-coordinated coordination complex.

(v) Steric effect on metal ligand stability.

(vi) 'Laporte' rule for electronic transition.
