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**ST. JOSEPH’S COLLEGE (AUTONOMOUS), BANGALORE-27**

**M.Sc. CHEMISTRY– II SEMESTER**

**SEMESTER EXAMINATION: APRIL 2017**

**CH 8115 : Inorganic Chemistry**

Time- 2 ½ hrs Max Marks-70

**This paper contains TWO printed pages and THREE parts.**

**PART A**

**Answer any SIX questions. 2 x 6 =12**

1. Calculate the octahedral site stabilization energy (OSSE) in Dq units for a d1 configuration.
2. Write and explain the order of metal ions in Irving-William stability order.
3. Ethylene diamine forms a more stable complex than propane-1,3-diamine with a given metal ion. Give reason.
4. Isocyanide can form complexes with metals in their normal oxidation states unlike CO. Explain.
5. Represent any two modes of binding SO2 ligand with metals.
6. What is meant by ‘hole formalism’?
7. Electronic spectral bands of high spin octahedral Mn2+ complexes have low intensity. Explain.
8. What is temperature independent paramagnetism? How does it compare with diamagnetism?

**PART B**

**Answer any FOUR questions. 12 x 4 =48**

1. a) Draw the appropriate MO energy level diagrams to explain why F¯ is a weak field ligand whereas CO is a strong field ligand.

b) Discuss the following:

 i) Nephelauxetic effect

 ii) Antiferromagnetic coupling (4+8)

1. a) Explain the following with respect to Jahn-Teller effect.

 i) The K3 value for the formation of [Cu(en)3]2+ from [Cu(H2O)6]2+ is abnormally low.

 ii) K2Pb[Cu(NO2)6] does not show Jahn-Teller distortion at room temperature.

b) What are the different types of binding of nitrosyl ligand to a transition metal? Explain the bonding in each type. (6+6)

CH-8115-A-17

1. a) Discuss the determination of stability constant of a complex by potentiometric method.

b) i) Explain macrocyclic effect in complexes with an example.

ii) [Ni(CN)4]2- is thermodynamically stable but kinetically unstable. Explain the statement and give the reason for the same. (6+6)

1. a) What is optical rotatory dispersion (ORD)? Explain the Cotton effect with respect to ORD curves for the enantiomers of the complex [Co(en)3]3+.

b) Explain the bonding in transition metal phosphine complexes. What is meant by Ligand Cone Angle in these complexes? What is its significance? (6+6)

1. a) [Ni(en)3]2+ absorbs at 11,000, 18,500 and 30,000 cm-1. Draw the relevant Orgel diagram and assign the bands.

b) What are Tanabe-Sugano diagrams? Explain their salient features.

c) Draw a partial MO energy level diagram of an octahdral hexahalocomplex showing four main classes of L→ M CT transitions. (4+4+4)

1. a) Draw a plot showing the experimental and calculated magnetic moments of trivalent lanthanide ions at 300 K. Explain the anomalous magnetic behaviour of Sm3+ and the spin-only behavior of Gd3+.

b) The spin-only magnetic moment value of Ni2+ is 2.83 BM. The experimental magnetic moment values of various octahedral Ni2+ complexes ranges from 2.8- 3.3 BM while those of tetrahedral Ni2+ complexes are in the region of 4.0 BM. How do you account for these observations? (6+6)

**PART C**

**Answer any TWO questions. 5 x 2 =10**

1. a) With proper reasoning predict whether the following oxide will have normal or inverse spinel structure: i) MnCr2O4 ii) NiFe2O4.

b) Almost all complexes of Co(III) are octahedral and low spin, while with Fe(III) both high spin and low spin octahedral complexes are observed. Give reason. (3+2)

1. Account for the following:

a) The carbonyl stretching frequencies for [Ni(CO)]4, [Co(CO4)]- and [Fe(CO4)]2- decrease gradually from 2060 cm-1 to 1790 cm-1.

b) [W(CO)5]2- is a 18 VE complex. It can add on a CO2 molecule to form [W(CO)5CO2]2- without the loss of any CO ligand. (3+2)

1. The hydration energies of Ca2+, Mn2+ and Zn2+ are plotted versus atomic number. A smooth curve passing through these points gave a value of 300 kJ mol-1 for the hydration energy of Ni2+. If 3A2g →3T2g transition of [Ni(H2O)6]2+ ion occurs at 8600 cm-1 estimate the true hydration energy of Ni2+ ion. (Given, 1cm-1 = 0.01196 kJmol-1).

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