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Register Number:

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

**M.Sc. CHEMISTRY – II SEMESTER**

**SEMESTER EXAMINATION: APRIL 2019**

**CH 8118: Inorganic Chemistry- II**

Time: 2 ½ hrs Max Marks: 70

**This paper contains two printed pages and three parts**

**PART A**

Answer any **six** of the following questions. **6 × 2 = 12**

1. Calculate the octahedral site stabilization energy in terms of Dq for an ion with d2 configuration.
2. Arrive at the ground state term symbol of Co2+.
3. Give the basic assumption of ligand field theory.
4. What is meant by chelate effect? What is its cause?
5. Does a transition metal form a more stable complex with 1,2- diaminoethane or 1,3- diaminopropane? Explain.
6. Explain why the synthesis of dinitrogen complexes is difficult.
7. Write the structure of the cyclic crown ether which specifically binds to K+ ion. What is the reason for the specificity of binding?
8. The ion CrO42- is weakly paramagnetic. Explain.

**PART B**

Answer any **four** of the following questions. **4 ×12 = 48**

1. a) Draw the MO energy level diagram of the complex [Co(NH3)6]3+ and explain its salient features. Explain the diamagnetic property of the complex based on this diagram.

b) Explain antiferromagnetic coupling. How does it serve as an evidence for metal- ligand covalent bonding? (6+6)

1. a) Explain why [Cu(en)2(OH2)2]2+ is more stable than [Cu(en)3]2+.

b) Give the salient features of Tanabe-Sugano diagrams. What are their advantages over Orgel diagrams?

c) With appropriate orbital overlap diagrams explain the bonding in metal phosphine complexes. (4+4+4)

1. a) Give the selection rules for the electronic spectra of complexes. Explain why the weak field octahedral complexes of Mn2+ are much less intensely coloured than those of Cr3+.

b) [VCl4]2- ion exhibits absorption bands at 7200, 12000 and 19000 cm-1. With a suitable diagram assign these transitions. (6+6)

1. a) Explain how the following lanthanide ions differ from one another in their paramagntic behaviours?: i) Pr3+ ii) Sm3+ iii) Gd3+.

b) Explain how the orbital contribution to magnetic moment gets quenched in transition metal complexes. (6+6)

1. a) Discuss the potentiometric method of determining the stability constant of complexes.

b) Distnguish between stepwise stability constant and overall stability constant of complexes. Arrive at an expression relating them. (6+6)

1. a) Discuss the nature of metal- ligand bonding in isocyanide complexes. Explain why isocyanide stabilizes metals in both low and normal oxidation states.

b) What is circular dichroism (CD)? Explain the Cotton effect with respect to the CD curves for the enantiomers of the complex, [Co(en)3]3+.

**PART C**

Answer any **two** of the following questions. **2 × 5 = 10**

1. Two complexes of Ni(II) are believed to be tetrahedral and octahedral. Each has three absorption bands, but complex A has ε ≈ 10 and B has ε ≈ 150. Which of these is probably the tetrahedral complex? Explain. Measurement of which physical property would exclude the possibility of either being square planar? Explain.
2. a) Arrange the following metal carbonyls in the increasing order of carbonyl stretching frequency: [ Mn(CO)6]+, [Cr(CO)6], [V(CO)6]-. Justify your answer.

b) The absorption frequency of NO+ in [Fe(NO)(CN)5]2- is 1944 cm-1 whereas it is 1730 cm-1 in [Mn(NO)(CN)5]3-. Explain. (3+2)

1. a) The divalent metal ions in the first transition series show a preference for octahedral geometry over tetrahedral geometry. Nevertheless, the number of tetrahedral complexes formed is in the order Co>Fe>Ni. Explain this observation.

b) The two transition metals that consistently form normal spinels are Zn2+ and Cr3+. Account for this observation. (3+2)