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Register Number:

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

**M.SC. CHEMISTRY- II SEMESTER**

**SEMESTER EXAMINATION APRIL 2018**

**CH 8115: INORGANIC CHEMISTRY**

**Time: 2 ½ hours Max. marks: 70**

*Note: This question paper has* ***2*** *printed pages and 3 parts. All parts are compulsory.*

**PART A**

**Answer any SIX of the following. Each question carries 2 marks. 6x2=12**

1. Give the important geometries of complexes with coordination number 8.
2. Draw the d- orbital splitting pattern in a trigonal bipyramidal ligand field.
3. What is meant by molecular recognition in supramolecular chemistry?
4. Give the selection rules for the electronic spectra of transition metal complexes.
5. Arrive at the ground state spectroscopic term symbol for Ni3+.
6. In the stepwise formation of [Fe(o-phen)3 ]2+ complex, K3> K2. Give reason.
7. Draw the orbital overlap diagram to show the bonding in metal-isocyanide complexes.
8. CrO42- ion is weakly paramagnetic eventhough it does not have unpaired electrons. Explain.

**PART B**

**Answer any FOUR of the following. Each question carries 12 marks. 4x12=48**

1. a) Explain the following: i) high spin octahedral Cr2+ complexes are distorted ii) the formation constant K3 value of [Cu(en)3]3+ is very low. (6+6)

b) Draw the MO energy level diagram of the octahedral complex, [Co(NH3)6 ]3+. Based on the diagram comment on its magnetic property.

1. a) Discuss the bonding in metal nitrosyl complexes on the basis of MO theory. (6+6)

b) What is nephelauxetic effect? Give the electronic spectral evidence for this effect.

1. a) What is Circular Dichroism(CD)? Explain how the absolute configuration of a complex is determined using CD curves. (6+6)

b) Explain fluxional behavior using Fe(CO)5 as an example. Give the Berry pseudorotation mechanism for the same.

CH 8115-A-18

1. a) Discuss Job’s spectrophotometric method of determining the stability constant and composition of coordination complexes. (6+6)

b) Answer the following:

i) Between the ligands H2N-CH2-CH2-NH2and (CH3)2NCH2CH2N(CH3)2, which one forms a more stable complex with a given metal ion? Justify.

ii) Cd2+ reacts separately with CH3NH2 and ethylenediamine to form complexes with coordination no. 4 in aqueous solution. Write the chemical equations for their formation and compare their stabilities with proper reasoning.

1. a) The electronic spectrum for Cr(III) shows three bands at 16,000, 17700 and 33400 cm-1. Draw the Orgel diagram and assign these transitions. Calculate the values of 10 Dq, B’ and β (B value for free Cr3+ ion is 918 cm-1). Comment on M-L bonding in the complex. (8+4)

b) Explain the following:

 i) [CoCl4]2- is more intensely coloured than [Co(H2O)6]2+ .

 ii) The electronic spectrum of [Mn(H2O)6]2+ shows a large number of low intensity

 bands.

1. a) With the help of a neat diagram explain the determination of magnetic moment of a metal complex using the Guoy method. (6+6)

b) Explain how the following lanthanide ions differ from one another in their paramagnetic behavior: Pr3+, Sm3+, Gd3+.

**PART C**

**Answer any TWO of the following. Each question carries 5 marks. 2x5=10**

1. High spin octahedral Co2+ complexes show large positive deviations whereas low spin octahedral Co2+ complexes show only small positive deviations from their respective spin- only magnetic moment values. Explain these observations.
2. Evaluate the correctness of the following statements: a) In an octahedral field it takes less energy to promote a t2g2 ion to the t2g(dxy) eg(dz2)state than to the t2g(dxy) eg(dx2-y2) state.

b) A set of p orbitals remain degenerate in an octahedral field. c) transition metal complexes are weakly coloured because the excitation energies for the d-d transitions are small.

1. In the following pairs of complexes, one is octahedral and the other is tetrahedral. Pick out the octahedral and tetrahedral complex from each pair citing reasons for your choice. a) Co(II)-H2O and Co(II)-Cl  ̶ b) Fe(III)-Cl ̶ and Co(III)-Cl  ̶ .