

Register Number:

DATE:

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

**M.Sc. CHEMISTRY- II SEMESTER**

**SEMESTER EXAMINATION APRIL 2022**

(Examination conducted in July 2022)

**CH 8118: 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. Draw the d- orbital splitting pattern in a trigonal bipyramidal ligand field.
2. Give two geometries of complexes with coordination number 7.
3. What are cryptands and cryptates?
4. Write the selection rules for electronic spectra.
5. Arrive at the ground state spectroscopic term symbol for Ni2+.
6. Which of the following is a more stable complex, [Ni(en)3]2+ or [Ni(NH3)6]2+? Give reason.
7. The stability constants of the complex ions, [Fe(CN)6]3- and [Fe(CN)6]4- are about 1031 and 106 respectively. Comment on this observation.
8. Draw the orbital overlap diagram to show the bonding in metal-isocyanide complexes.

**PART B**

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

1. a) With proper reasoning explain the following: i) NiCr2O4 is a normal spinel (∆o for hexaaqua complexes of Ni2+ and Cr3+ are 8500 cm-1 and 17,400 cm-1 respectively) ii) [Cu(en)3]2+ complex is unstable.

b) Draw an appropriate MO energy level diagram for the tetrahedral complex, [CoCl4]2-. Based on the diagram comment on its magnetic property. (6+6)

1. a) Depict the variation of hydration energy of divalent metal ions of first row transition series and explain the reason for the shape of the curve based on crystal field theory.

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

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

b) Explain fluxional behavior of Fe(CO)5 giving the Berry pseudorotation mechanism. (6+6)

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

b) i) Distinguish between stepwise and overall stability constants taking a suitable example. ii) What is meant by macrocyclic effect? Give a suitable example. (6+6)

1. a) Draw an appropriate energy level diagram for [Cr(H2O)6]3+. Show the splitting pattern of spectroscopic terms in the presence and absence of ligand field. Assign the spin allowed electronic transitions in the electronic spectrum. Indicate which transition corresponds to 10Dq value.

b) Explain the following:

 i) The colour of [CoCl4]2- is more intense than that of [Co(H2O)6]2+ .

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

1. a) Explain the following types of paramagnetic behaviour: i) large multiplet separation ii) small multiplet separation. Give the formula used to calculate the magnetic moment in each case.

b) Explain how the following lanthanide ions differ from one another in their paramagnetic behavior: Pr3+, Sm3+, Gd3+. (6+6)

**PART C**

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

1. The bright red colour of [Cu(phen)2]+ complex is not due to d-d transition (structure of phen ligand is given below). Give reason. What is the colour due to? Explain. Mention the probable geometry and magnetic property of the complex.



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. 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  ̶ .

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