



ST. JOSEPH'S UNIVERSITY, BENGALURU -27
M.Sc (CHEMISTRY) – II SEMESTER
SEMESTER EXAMINATION: APRIL 2023
(Examination conducted in May 2023)
CH 8121 – INORGANIC CHEMISTRY II
(For current batch students only)

Register Number:

Date:

Time: 2 Hours

Max Marks: 50

This paper contains 2 printed pages and 3 parts

PART-A

Answer any 8 questions.

(8x2 =16)

1. Draw the crystal field splitting pattern of d orbitals in a trigonal bipyramidal ligand field.
2. What is meant by nephelauxetic effect? How is it related to covalent character of M-L bond?
3. Differentiate between the terms kinetic stability and thermodynamic stability of complexes.
4. Arrive at the spectroscopic ground state term symbol of a d^8 ion.
5. The intensities of electronic spectral bands in $\text{trans-}[\text{Co}(\text{en})_2\text{Cl}_2]^+$ are about four times less than its cis isomer. Give reason.
6. The observed magnetic moments of Gd^{3+} complexes match well with those calculated using spin-only formula. Give reason. (at. no. of Gd = 64)
7. Write the mathematical expression for Curie-Weiss law and explain the terms involved.
8. Draw the orbital overlap diagram to illustrate the bonding in metal-isocyanide complexes.
9. What is Tolman's cone angle? Mention its significance.
10. Obtain the total electron count for the metal carbonyl cluster, $[\text{Fe}_4\text{C}(\text{CO})_{12}]^{2-}$.

PART-B

Answer any 2 questions.

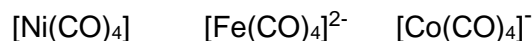
(2x12 =24)

11. a) Which among the following has a larger hydration energy and cite the reason:
(i) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ (ii) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ (4+4+4)
b) Sketch the qualitative molecular orbital energy level diagram for an octahedral complex with no M-L π -bonding.
c) Write Irving William stability order. How do you justify the order?
12. a) Sketch any four binding modes of nitrite ligand in metal-nitrite complexes. Explain how IR spectroscopy is used to differentiate the binding modes of nitrite ligand. (6+6)

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b) The complex, $[\text{Ni}(\text{NH}_3)_6]^{2+}$ shows three absorption maxima at $10,750 \text{ cm}^{-1}$, $17,500 \text{ cm}^{-1}$ and $28,200 \text{ cm}^{-1}$. Draw an appropriate Orgel diagram and assign the bands based on the diagram.

13. a) Arrange the following complexes in the decreasing order of M-C bond strength. Justify the order. (3+3+3+3)



b) The ORD spectrum of $(-)-[\text{Rh}(\text{en})_3]^{3+}$ shows a positive Cotton effect. Draw its ORD curve and assign the absolute configuration.

c) Depict any three binding modes of hydride ligand in metal hydrides and mention the nature of bonding in each type.

d) Explain briefly the paramagnetic behaviour of the type, 'large multiplet separation'. Give the formula used to calculate the magnetic moments of ions of this type.

PART-C

Answer any 2 questions.

(2x5 =10)

14. A hexaaqua complex of a metal ion having $3d^n$ configuration gives many transitions in the UV- Vis region of the electromagnetic spectrum. When a sample of concentration 20 moles dm^{-3} was placed in a sample tube of path length 1 cm , an absorbance of 1.5 was observed at $\lambda_{\text{max}} = 500 \text{ nm}$. Identify the configuration of the metal ion ($3d^n$) and comment on the nature of transitions.

15. Both chromium(II) fluoride and manganese(II) fluoride have a central metal ion surrounded by six fluoride ligands. The Mn-F bond lengths are equidistant, but four of the Cr-F distances are long and two are short. How do you account for these observations?

16. Which among the following metal ion/s in their tetrahedral complexes would be expected to show orbital contribution towards magnetic moment? Explain your answer.

