

(c) Inner and Outer orbital complex

(d) Spectrochemical series

(5,5,5)

(1000)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4056

H

Unique Paper Code : 2172012401

Name of the Paper : DSC 10 : Coordination
Chemistry and Reaction
Mechanism

Name of the Course : B.Sc. (Hons) Chemistry
(NEP-UGCF-2022)

Semester : IV

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **six** questions in all.
3. **All** Questions carry equal marks.

P.T.O.

1. (a) Which is greater: Crystal field splitting in tetrahedral complex or in octahedral complex. Justify your answer giving reasons.
- (b) Write the various steps involved in the formation of the complex $[\text{Fe}(\text{bpy})_3]^{2+}$ from $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$. Third equilibrium constant K_3 is observed to be greater than the second equilibrium constant K_2 . Give reason for the same.
- (c) Explain the factors affecting crystal field splitting in octahedral complex. (5,5,5)
2. (a) Write all the possible isomers of $[\text{PtCl}_2(\text{NH}_3)_2(\text{py})_2]$. Predict which of the isomer is optically active? Justify your answer.
- (b) Arrange the following complexes in order of anticipated decrease in molar conductance in aqueous solution. Give reason.

7. (a) Define Jahn - Teller theorem. In solid state CuF_2 is octahedrally surrounded by 6 F^- ions, with 2 Cu—F bond distances are $2.01 \text{ \AA}$ and 4 Cu—F bond distances are $1.85 \text{ \AA}$. Explain
- (b) Draw and explain the crystal field splitting diagram for square planar complex.
- (c) Give an example of the following ligands, write their structures and mention the donor atoms present in them :
 - (i) bidentate ligand
 - (ii) hexadentate ligand (5,5,5)
8. Write short note on : (Any three)
 - (a) Structural isomerism
 - (b) Theories of Trans effect

6. (a) Write the formula for the following complexes according to the IUPAC system of nomenclature :

(i) μ -amido- μ -superoxidobis[bis(ethane-1,2-diamine)cobalt(III)]nitrate

(ii) tetraamminechloridonitrito-N-cobalt(III) ion

(iii) triamminediaquachloridocobalt(III) sulphate

(iv) tetrakis(triphenylphosphane)platinum(0)

(v) sodium carbonylpentacyanido-C-ferrate(III)

(b) Using Valence Bond theory identify the following as labile and inert complex :

(i) $[\text{V}(\text{NH}_3)_6]^{3+}$

(ii) $[\text{Cr}(\text{CN})_6]^{3+}$

(c) Write merits and demerits of crystal field theory.
(5,5,5)

$[\text{Pt}(\text{NH}_3)_6]\text{Cl}_4$, $[\text{Pt}(\text{NH}_3)_3\text{Cl}_3]\text{Cl}$, $\text{K}_2[\text{PtCl}_6]$

(c) How does the Valence bond theory account for the fact that $[\text{Ni}(\text{CN})_4]^{2-}$ is diamagnetic and square planar but $[\text{NiCl}_4]^{2-}$ is paramagnetic and tetrahedral.
(5,5,5)

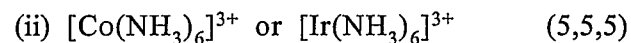
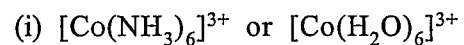
3. (a) A solution containing 2.674 g of $\text{Co}(\text{NH}_3)_6\text{Cl}_3$ (Molar mass = 267.4) is passed through a cation exchange resin. The chloride ion solution thus obtained gave 4.305 g of AgCl (molar mass = 143.5) precipitate with AgNO_3 solution. Determine the correct formula of the complex.

(b) Name the type of isomerism in the following pairs of isomers. How will you distinguish the isomers?

(i) $[\text{Co}(\text{en})_2(\text{H}_2\text{O})\text{Cl}]\text{Cl}_2$ and
 $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl} \cdot \text{H}_2\text{O}$

(ii) $[\text{PtCl}_2(\text{NH}_3)_4]\text{Br}_2$ and $[\text{PtBr}_2(\text{NH}_3)_4]\text{Cl}_2$

(c) Giving suitable reason explain which of the following in the given pair of complexes will have greater value of Δ_0 :

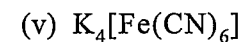
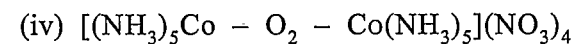
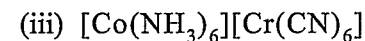
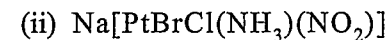
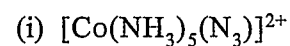


4. (a) Draw MO diagram for $[\text{Co}(\text{NH}_3)_6]^{3+}$.

(b) Calculate the CFSE for d^7 complex in terms of Δ_0 for an octahedral complex, when the ligand is (i) iodide ion (ii) cyanide ion.

(c) What is trans effect? Using trans effect how would you distinguish between cis- and trans- $[\text{PtCl}_2(\text{NH}_3)_2]$ (5,5,5)

5. (a) Write IUPAC names of the following complexes :



(b) What is meant by thermodynamic and kinetic stability of the complexes? Explain giving suitable examples.

(c) What is meant by chelate effect? Which of the following complexes has greater stability? Explain giving reasons.

$[\text{Co}(\text{pn})_3]^{3+}$ or $[\text{Co}(\text{tn})_3]^{3+}$ where pn is 1,2-diaminopropane and tn is 1,3-diaminopropane.

(5,5,5)