

(c) Coordination complexes exhibit different kinds of isomerism :

(i) Name and discuss the isomerism shown by $K_3[Co(NO_2)_6]$ and $K_3[Co(ONO)_6]$.

(ii) What kind of isomerism will $[CoCl_2(en)_2]^+$ exhibit? Draw the possible isomers.

(5,5,5)

5. (a) The CO is referred to as a π acid ligand? Explain.

(b) The ν_{C-O} values in $[Fe(CO)_4]^{2-}$, $[Co(CO)_4]^-$ and $Ni(CO)_4$ are 1788, 1918 and 2121cm^{-1} respectively while the ν_{C-O} value for $CO(g)$ is 2143cm^{-1} . Explain the trend.

(c) Describe how synergistic effect in metal carbonyls lead to multiple bonding between the metal and the carbon.

(5,5,5)

6. (a) Explain the structure of Zeise's salt and discuss the bonding of the olefin and metal in the complex.

(b) What is Jahn-Teller effect? Describe the conditions which lead to strong distortions in octahedral complexes. Draw the crystal field splitting energy diagram showing tetragonal elongation.

(c) Explain why $[Co(NH_3)_6]^{3+}$ is an inner orbital complex whereas $[Ni(NH_3)_6]^{2+}$ is an outer orbital complex.

(5,5,5)

(2000)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1488

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Unique Paper Code : 2172513501

Name of the Paper : DSC: Coordination Chemistry and Organometallics

Name of the Course : B.Sc. Analytical Chemistry/
Industrial Chemistry/
Chemistry Physical
Science/Chemistry
Electronics Science

Semester : V

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **four** questions out of **six** questions.
3. Each question carries equal marks.
1. (a) Give the IUPAC names of **any five** complexes/ions of the following :

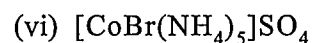
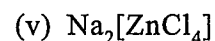
(i) $[CoCl_2(NH_3)_4]NO_3$

(ii) $K_4[Fe(CN)_6]$

(iii) $[Pt(Py)_4][PtCl_4]$

(iv) $[Cr(C_6H_6)_2]$

P.T.O.



(b) Write the formulae of **any five** complexes/ions of the following :

(i) Potassium tetraiodomercurate(II)

(ii) Dichlorobis-ethylenediamine cobalt (III) nitrate

(iii) Hexaaquachromium (III) chloride

(iv) Pentaammineiodocobalt (III) sulphate

(v) Potassium tetrachloromercurate (II)

(vi) Potassium hexachloroplatinate (IV)

(c) Using Valence bond theory determine the hybridization, geometry and magnetic behavior of the complex ion $[\text{CoF}_6]^{3-}$. Will this coordination compound be an inner orbital complex or outer orbital complex? Explain why. (5,5,5)

2. Write short notes on **any three** of following :

(i) Crystal Field Theory

(ii) Synergistic effect

(iii) Methyl Lithium

(iv) Geometrical isomerism in Octahedral complex (5,5,5)

3. (a) In both the complexes $\text{Ni}(\text{CO})_4$ and $[\text{Ni}(\text{CN})_4]^{2-}$, Ni is bonded to four monodentate ligands. Does that mean that both the compounds have same geometry and structure? Predict the geometry and magnetic behavior of both the compounds.

(b) The $\text{CoCl}_3 \cdot 6 \text{H}_2\text{O}$ has three distinctly different crystalline compounds, A is violet, B is blue-green, and C is dark green. Each compound is octahedral. Upon titration with excess silver nitrate, A produces three equivalents of AgCl , B produces two equivalents of AgCl , and C produces one equivalent of AgCl . Determine the formulas of the compounds. Match the colors to the formulas.

(c) Calculate the CFSE values in d^4 octahedral complex in weak and strong field ligand system.

(5,5,5)

4. (a) Using the 18 electron rule as a guide find/identify:

(i) the number of CO ligands in $[\text{Fe}(\text{NO})_2(\text{CO})_n]$, $[\text{Co}(\eta^5\text{-C}_5\text{H}_5)(\text{CO})_n]$

(ii) the charge on the species $[\text{Co}(\text{CO})_4]^x$

(iii) the number of ligands m and n in $[\eta^6\text{-C}_6\text{H}_6]_n\text{Cr}(\text{CO})_m]$

(b) How are organometallic compounds classified on the basis of bonding? Give an example of each type.