

(c) NiFe_2O_4 is inverse spinel while Mn_3O_4 is a normal spinel. Explain on the basis of CFT. (5,5,5)

5. (a) Explain the nature of bonding in Zeise's salt.

(b) The magnitude of the crystal field splitting in tetrahedral complexes are considerably less than in octahedral fields. Explain.

(c) Explain the crystal field splitting of d-orbitals in octahedral symmetry. (5,5,5)

6. (a) Define John-Teller theorem. Give the crystal field splitting diagram of the distorted complex and explain.

(b) Write the IUPAC names of the following compounds :

(i) $\text{Na}_3[\text{Co}(\text{ox})_3]$

(ii) $[\text{Al}(\text{OH})(\text{H}_2\text{O})_5]^{2+}$

(iii) $\text{K}_2[\text{Co}(\text{N}_3)_4]$

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

(v) $[\text{Fe}(\text{en})_3][\text{FeCl}_4]_3$

(c) Draw the structure of methyllithium. Explain the structure. (5,5,5)

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[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5841

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Unique Paper Code : 2174001203

Name of the Paper : GE: Coordination and Organometallic Compounds

Name of the Course : All Undergraduate Courses except with Chemistry Discipline

Semester : II / IV

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**.
 3. **All** questions carry equal marks.
 4. Attempt all parts of a question together.
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1. (a) What is meant by term haptacity of a ligand? How it is designated? Show clearly with two examples that the haptacity of a same ligand have varying haptacity.

P.T.O.

(b) Define the term :

- (i) Central metal and Ligand
- (ii) Coordination number and Oxidation number
- (iii) Chelating ligands
- (iv) Ambidentate ligands
- (v) Organometallic compounds

(c) Explain on the basis of valence bond theory that $[\text{Ni}(\text{CN})_4]^{2-}$ ion with square planar structure is diamagnetic and the $[\text{Ni}(\text{Cl})_4]^{2-}$ ion with tetrahedral geometry is paramagnetic. Explain the structure of two complexes. (5,5,5)

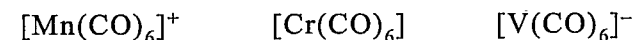
2. (a) Explain using MO diagram how CO is referred to as π -acid ligand. Discuss the nature of bonding involved in Metal and CO ligand.

(b) Calculate the EAN or 18 e^- count for following :

- (i) $[\text{Fe}_2\text{CO}_9]$
- (ii) $(\eta^5-\text{C}_5\text{H}_5)\text{Fe}(\text{CO})_2\text{Cl}$
- (iii) $[\text{Co}(\text{CO})_4\text{Cl}]$
- (iv) $\text{Ni}(\text{CO})_4$
- (v) $\text{Cr}(\text{CO})_6$

(c) Discuss the factors affecting the magnitude of crystal field splitting (Δ). (5,5,5)

3. (a) Arrange the following species in increasing order of the IR stretching frequency of C-O bond and give reason.



(b) Using IUPAC norms write the formulas for the following :

- (i) Potassiumtetracyanonickelate(II)
- (ii) Hexaaquatitanium(III) ion
- (iii) Pentaamminenitrito - N - cobalt(III) ion
- (iv) Tetrabromidocuprate(II) ion

(c) Using VBT, derive the structures of $\text{Ni}(\text{CO})_4$ and $\text{Mn}_2(\text{CO})_{10}$

(d) Arrange the following species in the order of increasing Jahn Teller distortion in an octahedral environment: high spin Co(III), low spin Co(II) and Ti(III) (3,4,4,4)

4. (a) Ferrocene on acetylation with excess of reagent shows heteroannular substitution while on alkylation with excess of reagent shows homoannular substitution. Give reason.

(b) Derive the structure of $\text{Mn}_2(\text{CO})_{10}$ and give its one method of preparation. Also calculate the number of M-M bond present in $\text{Mn}_2(\text{CO})_{10}$ compound.