



(b) Calculate the crystal field stabilization energy (CFSE) for the complex  $[\text{Cr}(\text{L})_6]^{2+}$  (L is a monodentate neutral ligand), if the mean pairing energy and the magnitude of crystal field splitting energy ( $\Delta_0$ ) for the complex was found to be  $23,500 \text{ cm}^{-1}$  and  $13900 \text{ cm}^{-1}$  respectively. (5)

(c) In what respect does ferrocene show similarities with benzene? Explain citing relevant examples. (4)

6. (a) What is synergic effect? Explain its significance in the formation and stability of carbonyl compounds? (6)

(b) The complex  $[\text{NiCl}_4]^{2-}$  is paramagnetic while  $[\text{Ni}(\text{CN})_4]^{2-}$  is diamagnetic. Propose the structures for these complexes on the basis of crystal field theory (CFT). (5)

(c) Define the following :

(i) Hapticity

(ii) Spectrochemical series (4)

(1000)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6050

H

Unique Paper Code : 2174001203

Name of the Paper : GE : Coordination and Organometallic Compounds

Name of the Course : B.Sc. (H) / B.Sc. (Prog.)

Semester : II

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 in all.
3. **All** questions carry equal marks.

1. (a) What is Jahn Teller distortion? How does it impact the d orbital energy level in  $\text{Cu}^{2+}$  ( $d^9$ ) ion in an octahedral ligand field? (6)

(b) Explain the structure and bonding in Zeise's salt. (5)

(c) What is denticity in the context of ligands? Give one example for each of the following ligands :

P.T.O.

- (i) Bidendate ligand  
 (ii) Polyendate ligand  
 (iii) Ambidentate ligand (4)
2. (a) What is crystal field stabilization energy (CFSE)? Why is it different for octahedral and tetrahedral complexes? (6)
- (b) Give the structure of the following organometallic compounds :
- (i)  $\text{Fe}_2(\text{CO})_9$   
 (ii)  $\text{Mn}_2(\text{CO})_{10}$   
 (iii)  $\text{Al}_2(\text{CH}_3)_6$   
 (iv)  $\text{Co}_2(\text{CO})_8$  (solution)  
 (v)  $[\text{V}(\text{CO})_6]^-$  (5)
- (c) Explain the variation of C-O stretching frequency in the following carbonyl compounds :
- $[\text{Mn}(\text{CO})_6]^+ = 2090 \text{ cm}^{-1}$   
 $[\text{Cr}(\text{CO})_6] = 2000 \text{ cm}^{-1}$   
 $[\text{V}(\text{CO})_6]^- = 1860 \text{ cm}^{-1}$  (4)
3. (a) What is the basis on which organometallic compounds are classified? Give one example of each class. Which of the following is not an organometallic compound?  $[\text{Ti}(\text{OC}_2\text{H}_5)_4]$ ,  $\text{Si}(\text{C}_6\text{H}_5)_4$ ,  $\text{B}(\text{CH}_3)_3$ ,  $[\text{Cu}(\text{OOCCH}_3)_2]$  (6)

- (b) What is EAN rule? Give the valence electron count for the following organometallic compounds :
- (i)  $[\text{Cr}(\text{CO})_5]^{2-}$   
 (ii)  $(\eta^6\text{-C}_6\text{H}_6)_2 \text{Fe}$   
 (iii)  $[\text{IrBrCl}(\text{CH}_3)(\text{CO})(\text{PPh}_3)_2]$   
 (iv)  $[\text{Re}(\text{CO})_5]$  (5)
- (c) What is chelate effect? How is it known to impact the stability of coordination compounds? (4)
4. (a) Discuss the structure and bonding in methyllithium. Draw the structure of its unit cell and mention the coordination number of Li and C in it. (6)
- (b) Give the IUPAC names of the following : (5)
- (i)  $\text{K}_4[\text{Ni}(\text{CN})_2(\text{C}_2\text{O}_4)_2]$   
 (ii)  $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$   
 (iii)  $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$   
 (iv)  $[\text{Pt}(\text{NH}_3)_2 \text{Cl}(\text{NO}_2)]$   
 (v)  $\text{Na}_3[\text{Fe}(\text{CN})_5\text{NO}]$
- (c) List the drawbacks of Valence bond theory. (4)
5. (a) Predict the geometry and calculate the magnetic moment for the following complexes using valence bond theory (VBT).