

U.G. 6th Semester Examination - 2023

CHEMISTRY

[HONOURS]

Course Code : CHEM-H-CC-T-13

(Inorganic)

Full Marks : 40

Time : 2½ Hours

*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.*

1. Answer any five from the following questions:

2×5=10

- Starting from appropriate Grignard reagent how would you prepare ferrocene?
- CH_4 and CCl_4 , both belong to the T_d point group, but CHCl_3 does not— Explain.
- What is minamata disease? Mention the antidotes used for the treatment of this disease.
- The angular part of the wave function of nd_z^2 orbital contains $(3\cos^2\theta - 1)$; assign symmetry sign to the orbital.

[Turn Over]

- e) Depict the structure of $[\text{Ti}(\text{C}_5\text{H}_5)_4]$ and comment on the oxidation state of the metal and hapticity of the ligands.
- f) Write the name and draw the structure of one Fe-S protein.
- g) Give an example of a molecule in which an S_2 improper rotation axis is present. Mention the other symmetry elements present in that molecule.
- h) The compound $[(\eta^5\text{-C}_5\text{H}_5)_2\text{Fe}_4(\text{CO})_n]$ obeys EAN rule. Find n.

2. Answer any two from the following questions:
 $5 \times 2 = 10$
- a) i) Ferrocene belongs to D_{5d} point group, not to D_{5h} . Give reasons.
- ii) List all the symmetry elements found in SF_6 molecule.
 $3 + 2 = 5$
- b) i) Draw the structure of chlorophyll a.
- ii) Show the application of oxidative addition and reductive elimination in a reaction pathway. Write down the steps involved.
 $2 + 3 = 5$

- e) i) What products do you expect if $\text{H}_2\text{C}=\text{CH}_2$ and $\text{H}_3\text{C}-\text{CH}=\text{CH}_2$ are used separately as substrates in Ziegler-Natta catalysis?
- ii) Arrange the following complexes in order of increasing $\nu_{\text{C-O}}$ with proper reasoning:
 $[\text{Mn}(\text{CO})_6]^+$, $[\text{Cr}(\text{CO})_6]$ and $[\text{V}(\text{CO})_6]^-$
 $2 + 3 = 5$
- d) i) Define Bohr effect in connection to oxygenation of haemoglobin and myoglobin with proper plot.
- ii) What is leghemoglobin? How it inhibits the activity of nitrogenase? $(2 + 1) + 2 = 5$

3. Answer any two from the following questions:
 $10 \times 2 = 20$
- a) i) Draw the structures of all the isomers of WF_6 (F is the central atom). Assign the point group of each isomer.
- ii) Write a note on chirality and point group.
- iii) Count the number of two-fold axes in XeF_4 molecule. Indicate the point group.
- iv) F_2 , C_2 , θ_2 , θ_1 . What do these make the point group symbol? Reason your answer.
 $2 + 3 + 3 + 2 = 10$

b) i) State the structure and binding of Zeise's salt. Do you expect any rotation of ethylene molecule in this salt without disturbing its structure? How would you explain the lengthening of coordinated olefinic C-C bond in complex formed over the C-C bond in free hydrocarbon? Can you guess which Pt-Cl bond distance will be longest? 'The colour of bromine solution is discharged by passing ethylene but not using Zeise's salt.' Explain with respect to the binding in Zeise's salt.

ii) Comment on the relative yields of acylation of ferrocene by acetyl chloride in presence of anhydrous aluminium chloride, when (x) the reagents are employed in 1:1 ratio and (y) acetyl chloride is added in excess.

$$(2+1+1+1+1)+4=10$$

c) i) In solid state, $[\text{Co}_2(\text{CO})_8]$ possesses μ_2 -CO but $[\text{Mn}_2(\text{CO})_{10}]$ does not contain any bridging CO- explain.

ii) What is Fischer-Tropsch reaction? State its application.

iii) Write down the steps involved in Wacker process.
3+3+4=10

d) i) Metabolic disorder is responsible for Wilson's disease- explain. Name the recommended antidotes used in the treatment of this disease.

ii) What is bio-phosphorylation? Which enzymes are responsible for this process? How are they involved?

iii) Write a brief note on the Hill reaction in photosynthesis.
3+4+3=10