



‘समानो मन्त्रः समितिः समानी’

UNIVERSITY OF NORTH BENGAL

B.Sc. Honours 6th Semester Examination, 2023

CC13-CHEMISTRY

INORGANIC CHEMISTRY

Time Allotted: 2 Hours

Full Marks: 40

The figures in the margin indicate full marks.

1. Answer any **five** questions from the following: 1×5 = 5
 - (a) Explain the term “hapticity” in organometallic compounds.
 - (b) Write down the IUPAC name of $[\text{Pt}(\text{NH}_3)_4][\text{Pt}(\text{CN})_4]$.
 - (c) How do you distinguish PO_4^{3-} and AsO_4^{3-} in a solution following semimicro analysis?
 - (d) The concept of solubility product is very important in group analysis for inorganic ions — Illustrate with an example.
 - (e) Explain the electronic effect of a π -acidic ligand with a suitable example.
 - (f) Tetrahedral complexes do not show *cis*- and *trans*-isomerism — Account on.
 - (g) Depict the structure of Zeise salt and mention the bonding involved within it.
 - (h) Write down the detection method of Aluminium ion through Alizarin Red-S dye.

2. Answer any **three** questions of the following: 5×3 = 15
 - (a) (i) What is Wilkinson’s catalyst? 1+4
 (ii) Discuss the catalytic role of Wilkinson’s catalyst in the hydrogenation of olefins.
 - (b) (i) How do you prepare the Ziegler-Natta catalyst? 1 $\frac{1}{2}$ + 3 $\frac{1}{2}$
 (ii) Discuss the structure and properties of trialkylaluminium compounds.
 - (c) Determine the formal oxidation states following the *d*-electron counts of the following compounds. 2 $\frac{1}{2}$ + 2 $\frac{1}{2}$
 - (i) $(\eta^6 - \text{C}_6\text{H}_6)_2\text{Mo}$
 - (ii) $(\text{CO})_5(\text{CH}_3\text{CH}_2)\text{Re}$
 - (d) (i) What happen when – 2 $\frac{1}{2}$ + 2 $\frac{1}{2}$
 Ferrocene is reacted with R – COCl in presence of AlCl_3 .
 (ii) CuCl_2 is treated with AgNO_3 in water medium followed by the addition of NH_4OH .

- (e) (i) Derive the relationship between the stepwise formation constant and the overall formation constant. 2+3
- (ii) How do you identify a bridging CO-group and a terminal CO-group in metal carbonyl compounds?

3. Answer any *two* questions of the following: 10×2 = 20

- (a) (i) Discuss the structure, properties and bonding of ferrocene. 4+2+(2+2)
- (ii) What do you know about hydroformylation reactions? Give examples.
- (iii) What is synergistic effect? How does it relate to the bonding in metal carbonyls?

- (b) (i) Draw the structure of $\text{Co}_4(\text{CO})_{14}$. Using isolobal analogy, show which of the following fragments you would use to replace one of the Co-fragments in the above cluster? (1+6)+3



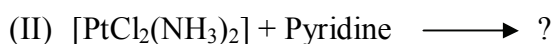
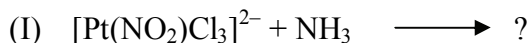
Write down the structures of the clusters so formed.

- (ii) The observed stretching frequencies in $[\text{V}(\text{CO})_6]^-$, $[\text{Cr}(\text{CO})_6]$ and $[\text{Mn}(\text{CO})_6]^+$ are 1860, 2000 and 2090 cm^{-1} respectively. Explain the trend.

- (c) (i) Show the possible geometric isomers for MA_3B_3 type complex. 2+2+(3+3)
[A and B are monodentate ligands]

- (ii) Typically square planar complexes are optically inactive. Give an example of its exception and draw the structure.

- (iii) Write down the possible formation of isomers from the following reaction and draw the structures of the product.



- (d) (i) What is Schlenk equilibrium? Which type of species show the Schlenk equilibrium? 3+3+2+2

- (ii) What will happen to the catalytic property if Ph_3P group is replaced by Me_3P in the Wilkinson's catalyst?

- (iii) Explain in brief for the carbide mechanism of Fischer-Tropsch mechanism.

- (iv) Account on the *trans*-effect for the square planar complexes in the substitution reaction.

—×—