

2024

CHEMISTRY — HONOURS

Paper : CC-13

(Inorganic Chemistry - 5)

Full Marks : 50

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*Answer **Question no. 1** which is compulsory and **any eight** questions from the rest (**question nos. 2 to 13**).

1. Answer **any ten** questions : 1×10
- (a) Name the metal whose deficiency/excess is related to Parkinson's disease.
 - (b) Write the oxidation state(s) of Cu both in oxy form and deoxy form of Hemocyanin.
 - (c) Write a reagent used to remove NO_2^- from the mixture of NO_3^- and NO_2^- in aqueous solution.
 - (d) Write down the composition of canary yellow precipitate formed during the test for PO_4^{3-} ion.
 - (e) What binding mode of NO is there in the compound $[\text{Ir}(\text{CO})(\text{Cl})(\text{NO})(\text{PPh}_3)_2]^+$?
 - (f) Write down the names of the reagents used to convert ferrocene to mono acetyl ferrocene.
 - (g) Give an example of non-heme Fe-protein that carries oxygen.
 - (h) Write down the structure of a metal complex having triply bridging CO.
 - (i) Which acid radicals among SO_4^{2-} , S^{2-} , NO_3^- and SCN^- give positive response to the Iodine-azide test?
 - (j) $\text{Mn}_2(\text{Co})_{10} + \text{H}_2 \rightarrow \text{A}$. Identify A.
 - (k) Write down the chemical formula of Wilkinson's catalyst.
 - (l) Give one advantage of use of Rhodium-Catalyst over Cobalt Catalyst in hydroformylation reaction.
2. (a) What is common ion effect? How does common ion effect help to separate metal ions in groups for inorganic qualitative analysis?
- (b) How does nature protect Fe(II) in Haemoglobin from its oxidation in presence of O_2 ? 3+2
3. (a) Describe the mechanistic steps involved in the Catalytic Hydroformylation process. Identify any two 16e species generated in this process.
- (b) $\text{Na}_2\text{H}_2\text{EDTA}$ is not used in the treatment of heavy metal toxicity. — Explain with an example. 3+2
4. (a) Discuss the structural features of Zeise's salt anion— $[\text{Pt}(\text{C}_2\text{H}_4)\text{Cl}_3]$.
- (b) What is 'British Anti Lewisite'? How does it function in biological system? 3+2

Please Turn Over

5. (a) Discuss the main functions of Haemoglobin (Hb) and Myoglobin (Mb) with respect to O_2 transport in human body and hence explain the plot of O_2 binding curve for Hb and Mb with partial pressure of O_2 .
- (b) Is it possible to get a dimeric carbonyl of Vanadium at room temperature? Justify. 3+2
6. (a) Explain the mechanism of anticancer activity of *cis*-DDP mentioning the binding of Pt(II)-centre with DNA-bases as ligands.
- (b) Explain why interfering acid radicals should be removed before the analysis of Gr-III metal ions. 3+2
7. (a) How does $Na^+ K^+$ pump operate across the biological membranes to transport the metal ions?
- (b) How can you detect both Br^- and I^- in their mixture using Cl_2 -water? 3+2
8. (a) Discuss the chemistry involved in the separation of Group-III_A cations during qualitative group analysis.
- (b) Explain why—
 $Ni(CO)_4$ does exist but $[Zn(CO)_4]^{2+}$ not. 3+2
9. (a) Explain the trends of C – O stretching frequencies of the given metal carbonyls:
 $[V(CO)_6]^-$, $[Cr(CO)_6]$, $[Mn(CO)_6]^+$
 $\nu_{C-O} (cm^{-1})$: 1860 2000 2090
- (b) $Rh(PEt_3)_3Cl$ is not a suitable Wilkinson's type catalyst for hydrogenation of olefins.— Explain. 3+2
10. (a) Write down the active site structure of carbonic anhydrase. Mention the mechanistic steps involved in the enzymatic process.
- (b) How can you prove the free rotation of the C_5 -rings of ferrocene? 3+2
11. (a) What will be the change in C – C bond distance when hydrogen atoms in ethylene are substituted by fluorine atoms in Zeise's salt?— Justify your answer.
- (b) Write down any two biological functions of iron and calcium each. 3+2
12. (a) What do you mean by 'Fluxional' molecule? Is $[RuCl(NO)_2(PPh_3)_2]^+$ ion fluxional? Justify your answer.
- (b) Write down the structures of anti-arthritis gold drugs— Solgonol and Aurofin. 3+2
13. (a) Explain the functioning of carbonate-bicarbonate buffering system mentioning its biological importance.
- (b) Find the values of x and y in the following compound using 18e rule :
 (i) $[Fe(\eta^5-Cp)(\eta^1-Cp)(CO)_x]$
 (ii) $[Fe(\eta^5-Cp)(CO)_x(NO)_y]$. 3+2