

2025

## 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.1. Answer *any ten* questions :

1×10

- (a) Give example of a metal carbonyl compound that does not obey 18-electron rule.
  - (b) Mention an antidote for mercury poisoning.
  - (c)  $\text{Co}_2(\text{CO})_8 \xrightarrow{\text{NO}} \text{A}$ . Identify the organometallic compound, A.
  - (d) Between two compounds  $\text{Fe}(\text{OH})_3$  and  $\text{Ca}(\text{OH})_2$  whose solubility product is higher at a particular temperature?
  - (e) Give an example of NO-containing fluxional molecule.
  - (f) Which metal ion is present in the compound used for the treatment of Sickle cell anemia?
  - (g) Name one example of nonheme iron protein.
  - (h) Name the metal in the second transition series that has natural biological functions.
  - (i) What are the group reagents used for the precipitation of group IV metal ions?
  - (j) Find the number (n) of CO ligands in the complex  $\text{Fe}_4(\text{CO})_n$  using 18-electron rule.
  - (k) Find out the molecular formula of the compound containing  $\eta^6\text{-C}_6\text{H}_6$ , CO and Cr.
  - (l) Give examples of two 'metal deficient' diseases.
2. (a) "Precipitation of ZnS fails in HCl solution when  $\text{H}_2\text{S}$  gas is passed but it does occur on addition of sodium acetate."— Why?
- (b) What happens when Fe(II) of haemoglobin is oxidised to Fe(III)?
3. (a) What is Ziegler-Natta Catalyst? What products do you expect if  $\text{CH}_2 = \text{CH}_2$  and  $\text{H}_3\text{C} - \text{CH} = \text{CH}_2$  are separately subjected to Ziegler-Natta Catalyst?
- (b) Explain with examples 'essential' and 'beneficial' elements in living system.

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4. (a)  $[\text{Co}(\text{diars})_2(\text{NO})]^{2+} + \text{SCN}^- \rightarrow \text{A}$ . Identify A. Explain the chemistry behind the reaction.  
[diars = 1, 2-bis (dimethylarsino) benzene].
- (b) Explain the term 'Bohr effect' in connection to release of  $\text{O}_2$  from haemoglobin. 3+2
5. (a) Explain the carbonyl stretching frequencies  $[\bar{\nu}(\text{CO}), \text{cm}^{-1}]$  in the following compounds :
- |                                        |                            |                            |                           |
|----------------------------------------|----------------------------|----------------------------|---------------------------|
|                                        | $[\text{Cr}(\text{CO})_6]$ | $[\text{Mo}(\text{CO})_6]$ | $[\text{W}(\text{CO})_6]$ |
| $\bar{\nu}(\text{CO}), \text{cm}^{-1}$ | 2000                       | 1984                       | 1960                      |
- (b) Why  $\text{Pb}^{2+}$  is included both in Group I and Group II in qualitative analysis? 3+2
6. (a) What are ionophores? What are their roles in the metal ion transport across biological membrane?
- (b) "Ferrocene undergoes electrophilic substitution at a faster rate compared to benzene."— Explain. 3+2
7. (a) Explain 'Oxidative addition' reaction in organometallic chemistry with a suitable example. What conditions must be met for such a reaction to occur?
- (b) "Metal complexes can be used as drugs."— Discuss with one example. 3+2
8. (a) Explain 'chromyl chloride' test. Why bromides and iodides do not give tests similar to chromyl chloride test?
- (b) How does lead exert its toxic effect in biological system? 3+2
9. (a) Indicate various modes of binding i.e.  $\eta^1$ ,  $\eta^3$  and  $\eta^5$  of cyclopentadiene taking proper examples.
- (b) Name a cation which is not obtained from a metal. How can you test the presence of this cation? 3+2
10. (a) Applying 18-electron rule find out the number of metal-metal bonds in  
(i)  $[\text{Co}_6(\text{CO})_{14}]^{4-}$  (ii)  $[\text{Fe}_5(\text{CO})_{15}]^{2-}$ .
- (b) Discuss the biological roles of the following ions :  
(i)  $\text{Zn}^{2+}$  (ii)  $\text{Mg}^{2+}$ . 3+2
11. (a) What is chelation therapy? Explain the term with a suitable example.
- (b) Explain why carbon monoxide is a very weak base towards  $\text{BF}_3$  but it is a very strong one towards nickel. 3+2
12. (a) Discuss the magnetic behaviour of oxy-hemocyanine.
- (b) Arrange the following species in increasing order of metal-carbon bond length :  
 $[\text{Ni}(\text{CO})_4]$ ,  $[\text{Fe}(\text{CO})_4]^{2-}$ ,  $[\text{Co}(\text{CO})_4]^-$ . 3+2
13. (a) What is co-operative effect? Discuss the effect with respect to  $\text{O}_2$ -transport in human body.
- (b) Between ferrocene and cobaltocene, which one is more stable and why? 3+2