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) $Co_2(CO)_8 \xrightarrow{NO} A$. Identify the organometallic compound, A.

(d) Between two compounds $Fe(OH)_3$ and $Ca(OH)_2$ 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 $Fe_4(CO)_n$ using 18-electron rule.

(k) Find out the molecular formula of the compound containing $\eta^6 - C_6H_6, CO$ and Cr.

(l) Give examples of two 'metal deficient' diseases.

2. (a) "Precipitation of ZnS fails in HCl solution when H_2S 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+2

3. (a) What is Zieglar-Natta Catalyst? What products do you expect if $CH_2 = CH_2$ and $H_3C - CH = CH_2$ are separately subjected to Zieglar-Natta Catalyst?

(b) Explain with examples 'essential' and 'beneficial' elements in living system. 3+2

4. (a) $[Co(diars)_2(NO)]^{2+} + SCN^- \rightarrow A$. 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 O_2 from haemoglobin. 3+2

5. (a) Explain the carbonyl stretching frequencies $\left[\bar{\upsilon}(CO), cm^{-1}\right]$ in the following compounds :

	$[Cr(CO)_6]$	$[Mo(CO)_6]$	$[W(CO)_6]$
$\bar{\upsilon}(CO), cm^{-1}$	2000	1984	1960

   (b) Why 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. η^1, η^3 and η^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) $[Co_6(CO)_{14}]^{4-}$ (ii) $[Fe_5(CO)_{15}]^{2-}$.

    (b) Discuss the biological roles of the following ions :

    (i) Zn^{2+} (ii) 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 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 :

    $[Ni(CO)_4]$, $[Fe(CO)_4]^{2-}$, $[Co(CO)_4]^-$. 3+2

13. (a) What is co-operative effect? Discuss the effect with respect to O_2-transport in human body.

    (b) Between ferrocene and cobaltocene, which one is more stable and why? 3+2