

IV. CrO is basic, Cr_2O_3 is amphoteric and CrO_3 is acidic in nature. 2

V. $[\text{Co}(\text{NH}_3)_6]^{3+}$ is more stable than $[\text{Co}(\text{NH}_3)_6]^{2+}$. 2

Or

(b) How are essential metals in biological system classified ? Mention each class with definition and write the name of each element present in it. 5

(c) What is Na/K pump ? Discuss the functioning of Na/K pump. 5

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3 (Sem-4/CBSCS) CHE HC 1

2024

CHEMISTRY

(Honours Core)

Paper : CHE-HC-4016

(**Inorganic Chemistry-III**)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following: $1 \times 7 = 7$

(i) In transitional metal complexes the metal acts as

- (a) Lewis acids
- (b) Lewis bases
- (c) Neutral compounds
- (d) Amphoteric compounds

(Choose the correct answer)

Contd.

(ii) Which oxidation state of Arsenic is most toxic ?

(iii) In which one of the following species does the transition metal ion have d^3 electronic configuration ?

(a) $[Cr(NH_3)_6]^{3+}$

(b) $(Co(OH_2)_6)^{2+}$

(c) $[CoF_6]^{3-}$

(d) $[Fe(CN)_6]^{3+}$
(Choose the correct answer)

(iv) What are macrocyclic ligands ? Give one example.

(v) Write the general valence shell electronic configuration of group 6 elements of the periodic table.

(vi) In EDTA, total number of chelating rings are.

(a) 5
(b) 3
(c) 4
(d) 6
(Choose the correct answer)

(vii) Carbonic anhydrase is a zinc enzyme that catalyses the

(a) hydrolysis of the terminal peptide bond of a peptide chain

(b) hydration of CO_2 and dehydration of carbonic acid

(c) binding of dioxygen to haemoglobin

(d) None of the above processes
(Choose the correct answer)

2. Answer the following : $2 \times 4 = 8$

(i) " Cu^{2+} ions are coloured and paramagnetic, whereas Zn^{2+} ions are colourless and diamagnetic." Explain why.

(ii) Draw the geometrical isomers of $[CrCl_2(en)]^{2+}$ and state whether they are optically active or not.

(iii) Write the full name and formula of the ligands whose abbreviations are given below :

dmg, acac, phen, edta

(iv) How does Latimer diagram help to examine the thermodynamic feasibility of a species for disproportionation ?

3. Answer **any three** questions from the following : $5 \times 3 = 15$

- (i) "Transition metals act as good catalysts". Explain with proper reasons. Write the name of the transition metal which is used as catalyst in the Haber's process for synthesis of ammonia. $4+1=5$
- (ii) Discuss the mechanism of dioxygen binding and release by haemoglobin.
- (iii) "Octahedral complexes are more stable and more common than tetrahedral complexes." Explain.
- (iv) What is lanthanide contraction ? What causes lanthanide contraction ? Why the lanthanides do not form oxocations ?
- (v) Discuss the magnetic character of square planer d^8 complexes with the help of crystal field theory.

4. Answer the following questions : $10 \times 3 = 30$

(i) Either

(a) The pairing energy for Mn^{3+} is $28,000 \text{ cm}^{-1}$. The Δ_0 for the complexes $[Mn(H_2O)_6]^{3+}$ and $[Mn(CN)_6]^{3-}$ are $15,800 \text{ cm}^{-1}$ and $38,500 \text{ cm}^{-1}$ respectively. From these values identify the high-spin and low-spin complexes and write the electronic configuration.

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(b) Describe the preparation of $KMnO_4$ from pyrolusite ore. How does acidified permanganate solution react with the following species ? Write the ionic equation for the reactions.

$2+3=5$

- (i) Fe^{2+} ions
- (ii) Oxalic acid

(c) "The third ionization enthalpy of manganese is very high." Explain why.

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Or

(d) Why is the separation of lanthanides difficult? Discuss the ion exchange method for the separation of lanthanides. $2+4=6$

(e) "Actinides have greater tendency to form complexes than lanthanides." Explain why. 4

(ii) Either

(a) Explain the origin of Jahn-Teller distortion by crystal field theory. What are the conditions for Jahn-Teller distortion in the tetrahedral and octahedral complexes? $4+1+1=6$

(b) Compare the Jahn-Teller distortions in $Ni(II)$ and $Cu(II)$. 2

(c) Explain why $trans-[Cu(en)_2(H_2O)_2]^{2+}$ is more stable than $cis-[Cu(en)_2(H_2O)_2]^{2+}$. 2

Or

(d) Write the general mechanisms by which a toxic metal can attack the human body. Give an account of the toxicity due to lead and mercury. $3+2+2=7$

(e) "Excess as well deficiency of an essential metal is harmful to human body." Justify the statement with an example. 3

(iii) Either

(a) Assign suitable reasons for the following :

- I. The Mn^{2+} compounds are more stable than Fe^{2+} towards oxidation to their $+3$ state. 2
- II. In the $3d$ series, the enthalpy of atomization of Zn^{2+} is the lowest. 2
- III. Sc^{3+} is colourless in aqueous solution whereas Ti^{3+} is coloured. 2