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3 (Sem-4/CBCS) CHE-HC 1

2025

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 as directed : $1 \times 7 = 7$

(i) What is ambidentate ligand ? Give example.

(ii) The number of heme groups present per haemoglobin molecule is

(a) 4

(b) 3

(c) 6

(d) 2

(Choose the correct answer)

(iii) Of the five d-orbitals of a Transition metal ion in a square planer complex, the orbital with highest energy will be

- (a) d_{xy}
- (b) $d_{x^2-y^2}$
- (c) d_{z^2}
- (d) d_{yz}

(Choose the correct answer)

(iv) Wilson diseases is caused by the deficiency of

- (a) Cu
- (b) Hg
- (c) Pb
- (d) Fe

(Choose the correct answer)

(v) Give an example of Macrocyclic ligand.

(vi) Which one of the following has the largest atomic radius?

- (a) Fe
- (b) Co
- (c) Cr
- (d) Zn

(Choose the correct answer)

(vii) Carbonyl ligand is also known as π -acid ligand because

- (a) it has filled hybrid orbital
- (b) it has vacant π antibonding orbital
- (c) it has vacant π bonding molecular orbital
- (d) it has vacant hybrid orbital

(Choose the correct answer)

2. Answer the following: 2×4=8

- (i) Hydrated copper sulphate is blue in colour but anhydrous copper sulphate is colourless. Explain.
- (ii) Draw geometrical isomers of the complex $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$. Are the isomers optically active?
- (iii) What is disproportionation reaction? Explain with example.
- (iv) Transition elements have high atomization energy. Explain.

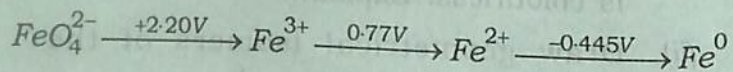
3. Answer **any three** questions from the following: 5×3=15

- (i) Describe separation of lanthanides by ion-exchange method.

(ii) Explain John-Teller distortion by crystal field theory. What are the conditions of John-Teller distortion is an octahedral complex? How can you predict Z-out and Z-in distribution is an octahedral complex?
 $2+2+1=5$

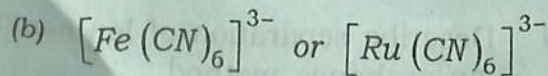
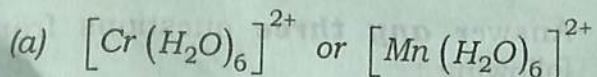
(iii) Define Transition element. Write their general electronic configuration. "Zn, Cd and Hg are not considered as true Transition element." Explain why? Write electronic configuration of Cr^{3+} .
 $1+1+2+1=5$

(iv) What is Latimer diagram? Latimer diagram for iron is given as



Determine the value of $E_{FeO_4^{2-}/Fe^{2+}}^0$
 $1+4=5$

(v) What is crystal field stabilization energy? Which one of the given pairs of complexes has largest CFSE?
 $1+4=5$



4. Answer **any three** from the following questions : $10 \times 3 = 30$

(i) (a) Explain magnetic property and colour of transition metal complexes with the help of crystal field theory.
 $2+2=4$

(b) Discuss about the oxidation states of first row Transition elements.
 3

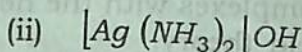
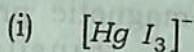
(c) Write consequences of lanthanide contraction.
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(ii) (a) Write applications of Frost diagram.
 6

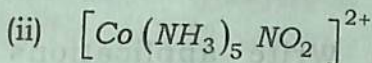
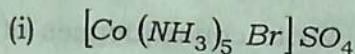
(b) Write application of potassium permanganate in quantitative analysis.
 4

(iii) Discuss the synthesis, structures and bonding in $Fe(CO)_5$, $Fe_2(CO)_9$, and $Fe_3(CO)_{12}$. Compare the σ - and π -bonding ability of Co and NO^+ as ligands.
 $6+4=10$

(iv) (a) Write IUPAC name of the following compounds : 1×2=2



(b) What type of isomerism are exhibited by the following complexes ? 1×2=2



(c) Define the terms 'labile' and 'inert' of the coordination compounds. Compare these aspects with stability of compounds with appropriate examples. 2+4=6

(v) (a) Discuss the function of Haemoglobin and Myoglobin. Explain the terms 'cooperative effect' and 'Bohr effect'. 6

(b) Give an account of Storage and Transport of iron in human body. 4