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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}

(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

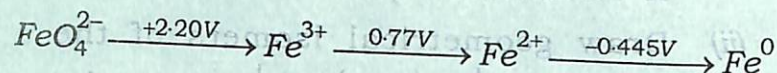
(i) Describe separation of lanthanides by ion-exchange method.

- (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+} .
 $1+1+2+1=5$

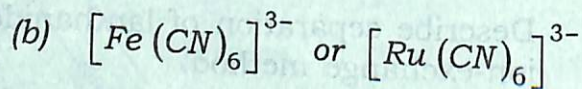
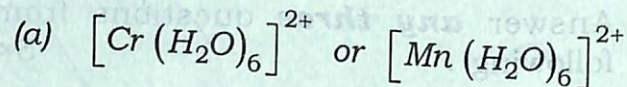
- (iv) What is Latimer diagram? Latimer diagram for iron is given as



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

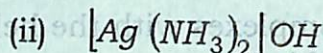
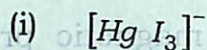
- (c) Write consequences of lanthanide contraction. 3

- (ii) (a) Write applications of Frost diagram. 6

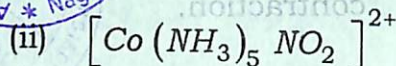
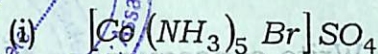
- (b) Write application of potassium permanganate in quantitative analysis. 4

- (iii) Discuss the synthesis, structures and bonding in $Fe(CO)_5$, $Fe_2(CO)_9$, and $Fe_3(CO)_{12}$. Compare the π - and π -bonding ability of Co and Co^+ as ligands. $6+4=10$

(iv) (a) Write IUPAC name of the following compounds : $1 \times 2 = 2$



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



(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

(vi) (a) Write toxic effect of *Hg* and *As* in biological system. $2+2=4$

(b) What important roles iron and zinc play in biological system ? $2+2=4$

(c) Write about use of *Pt* or *Au* complexes in medicine. 2