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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.

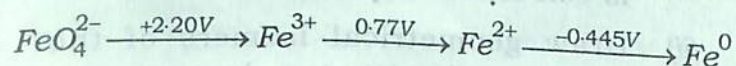
3. Answer **any three** questions from the following: 5×3=15

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

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

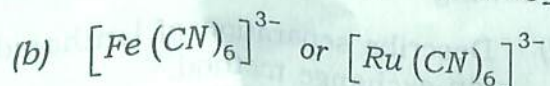
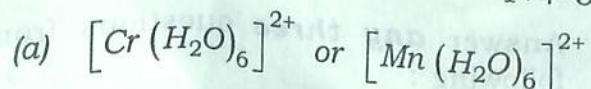
(iii) Define Transition element. Write their general electronic configuration. "Zn, Cd and Hg are not considered as true Transition element." Explain why? Write electronic configuration of Cr^{3+} . $1+1+2+1=5$

(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

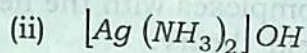
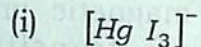
(c) Write consequences of lanthanide contraction. 3

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

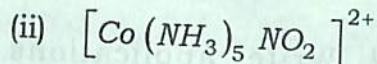
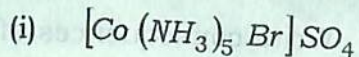
(b) Write application of potassium permanganate in quantitative analysis. 4

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