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3 (Sem-4/CBCS) CHE HC 1

2023

CHEMISTRY

(Honours Core)

Paper : CHE-HC-4016

(Inorganic Chemistry-III)

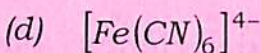
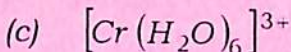
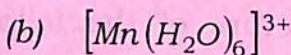
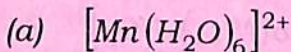
Full Marks : 60

Time : Three hours

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

1. Answer the following : 1×7=7

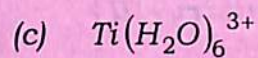
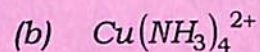
(i) The compound which exhibits Jahn-Teller distortion is



(Choose the correct answer)

Contd.

- (ii) Which metal helps in blood clotting ?
(iii) For which of the following ions, colour is not due to a d-d transition ?



(Choose the correct answer)

- (iv) What is the main iron storage protein in biological system ?
(v) What type of isomerism is exhibited by the complex $[\text{Co}(\text{NH}_3)_5\text{NO}_2]^{2+}$?
(vi) Draw the structure of the following complex :
Tri- μ -hydroxo bis
[triammine chromium(III)]
(vii) Which metal deficiency causes pernicious anemia ?

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

(i) Explain why Ce^{+3} and Tb^{+3} are colourless but show strong absorption in UV region.

(ii) How does mercury cause toxicity in living system ?

(iii) Why do transition metals show variable oxidation states ?

(iv) Determine the crystal field splitting energy Δ_0 of a d^6 complex having $10 Dq = 25,000 \text{ cm}^{-1}$ and $P = 15,000 \text{ cm}^{-1}$. Consider low spin complex.

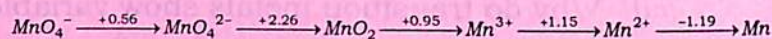
3. Answer **any three** questions from the following : $5 \times 3 = 15$

(i) Using crystal field theory explain the difference in magnetic property of $[\text{CoF}_6]^{3-}$ and $[\text{Co}(\text{CN})_6]^{3-}$.

(ii) Comment on the spectral and magnetic properties of actinide elements compared to lanthanides.

(iii) What is Na/K pump ? Write the mechanism of action of Na/K pump.

(iv) Given below is the Latimer diagram of manganese in acidic medium : $2+3=5$



(a) Which species are likely to disproportionate and why ?

(b) Calculate standard reduction potential for the couple $\text{MnO}_4^{2-}/\text{Mn}^{3+}$

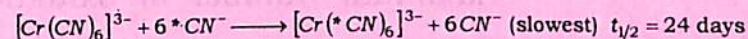
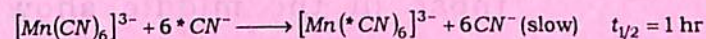
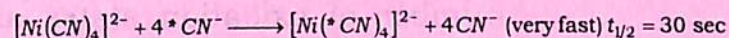
(v) Discuss the mechanism of binding of dioxygen with hemoglobin.

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

(i) Explain the bonding of $[\text{Co}(\text{NH}_3)_6]^{3+}$ with the help of molecular orbital theory. Draw the energy level diagram and also predict the magnetic property of the complex. $6+3+1=10$

(ii) (a) Explain the evidences in favour of the covalency of metal-ligand bonding in complexes. 5

(b) What inferences can be drawn from the following reactions ? 5



(iii) Write about the use of chelating compounds in medicinal chemistry.

(iv) Answer the following questions regarding oxidation states exhibited by the first transition series elements :

(a) List the oxidation states shown by each element indicating the unstable states within bracket.

(b) All the elements except scandium exhibits $a+2$ oxidation state whereas scandium exhibits $a+3$ oxidation state only. Explain.

(c) Why do the elements at each end of the series exhibit minimum number of oxidation states and those in the middle show a maximum number of oxidation states ?

(d) Why are the higher oxidation states stabilised by oxide or fluoride ? $3+2+3+2=10$

(v) What is lanthanide contraction and what is its cause ? Discuss the separation of lanthanides using ion exchange method. Explain why La^{3+} is colourless but Lu^{4+} is orange red. $1+2+5+2=10$

(vi) What special feature of Zn^{2+} makes it an excellent candidate for different enzymes ? Write the structure and function of carbonic anhydrase enzyme with suitable diagram. $2+2+6=10$
