

Total number of printed pages-7

3 (Sem-4/CBCS) CHE HC 1

2023

**CHEMISTRY**

(Honours Core)

Paper : CHE-HC-4016

**(Inorganic Chemistry-III)**

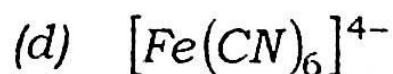
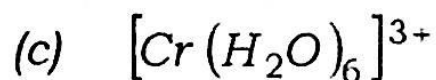
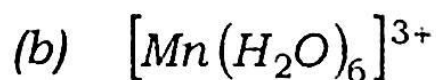
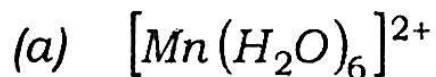
Full Marks : 60

Time : Three hours

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

1. Answer the following : 1×7=7

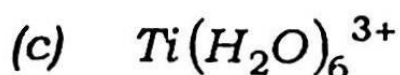
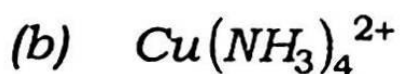
(i) The compound which exhibits Jahn-Teller distortion is



(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  $[Co(NH_3)_5NO_2]^{2+}$  ?
- (vi) Draw the structure of the following complex :  
Tri- $\mu$ -hydroxo bis  
[triammine chromium(III)]
- (vii) Which metal deficiency causes pernicious anemia ?

2. Answer the following : 2×4=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  $\Delta_0$  of a  $d^6$  complex having  $10 Dq = 25,000 \text{ cm}^{-1}$  and  $P = 15,000 \text{ cm}^{-1}$ . Consider low spin complex.

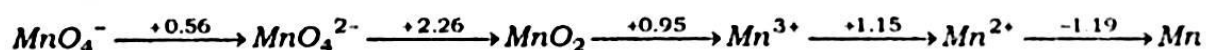
3. Answer **any three** questions from the following : 5×3=15

(i) Using crystal field theory explain the difference in magnetic property of  $[CoF_6]^{3-}$  and  $[Co(CN)_6]^{3-}$ .

(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  $\text{MnO}_4^{2-}/\text{Mn}^{3+}$

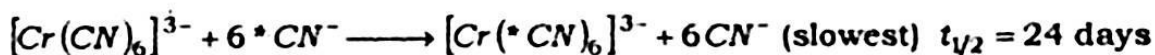
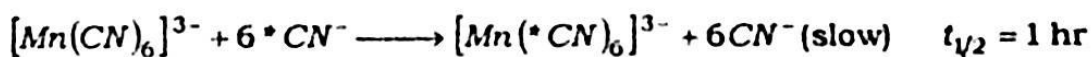
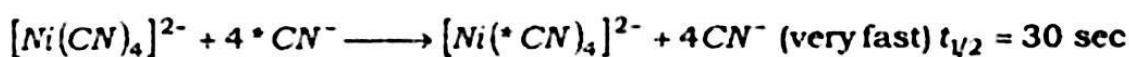
(v) Discuss the mechanism of binding of dioxygen with hemoglobin.

4. Answer **any three** questions from the following : 10×3=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.  $2+2+6=10$

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