

# Unit Practice Test

## for Board Examination

Time allowed : 2 Hrs.

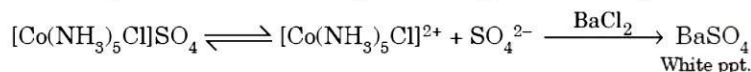
Maximum Marks : 35

1. Give one example of linkage isomer. (1)
2. Why does  $\text{NH}_3$  readily form complexes but  $\text{NH}_4^+$  does not? (1)
3. Give an evidence that  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$  and  $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Cl}$  are ionisation isomers. (1)
4. Name the central metal atom present in haemoglobin and vitamin  $\text{B}_{12}$ . (1)
5. Name one example of a hexadentate ligand. (1)
6. Write the IUPAC names of the following :  
(i)  $\text{K}_3[\text{Fe}(\text{CN})_5\text{NO}]$  (ii)  $[\text{Cr}(\text{NCS})(\text{NH}_3)_5][\text{ZnCl}_4]$  (2)
7. Draw the structures of optical isomers of  
(i)  $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$  (ii)  $[\text{Cr}(\text{NH}_3)_2\text{Cl}_2\text{en}]^+$  (2)
8. The hexaaquamanganese(II) ion contains five unpaired electrons, while the hexacyanomanganese(II) ion contains only one unpaired electron. Explain this using crystal field theory. (2)
9. What is meant by stability of a coordination compound in solution? Explain. (2)
10. Explain non-ionic nature of  $\text{CoCl}_3 \cdot 3\text{NH}_3$  on the basis of Werner's coordination theory. (2)
11. On the basis of valence bond theory, explain the shape and magnetic behaviour of the following coordination compounds:  
(i)  $[\text{Ni}(\text{CN})_4]^{2-}$  (ii)  $[\text{Ni}(\text{CO})_4]$  (iii)  $[\text{Co}(\text{NH}_3)_6]^{3+}$  (3)
12. Explain the following (3)  
(a)  $\text{Co}(\text{NH}_3)_5\text{Cl}_3$  gives three ions in solution.  
(b) Geometrical isomerism is not possible in tetrahedral complexes.  
(c) Most of the tetrahedral complexes are high spin complexes.
13. (a) Define chelate and chelating ligand. Give one example of each.  
(b) Explain briefly the role of coordination compounds in analytical chemistry and extraction of metals. (3)
14. What are metal carbonyls? Discuss bonding in metal carbonyls. (3)
15. (a)  $[\text{Fe}(\text{CN})_4]^{4-}$  and  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$  are of different colours in dilute solutions. Why?  
(b) What is spectrochemical series? (3)
16. (a) What is crystal field splitting and crystal field splitting energy? Draw and explain the splitting of  $d$ -orbitals in an octahedral field of ligands.  
(b) What do you understand by weak field and strong field ligands? With the help of crystal field theory calculate the number of unpaired electrons in octahedral complexes of  $\text{Fe}^{3+}$  in the presence of  
(i) weak field ligand (ii) strong field ligand (5)

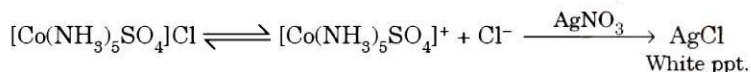
► To check your performance, see HINTS AND SOLUTIONS TO SOME QUESTIONS at the end of Part I of the book.

## UNIT 9 : COORDINATION COMPOUNDS

1.  $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]\text{Cl}_2$  and  $[\text{Co}(\text{NH}_3)_5(\text{ONO})]\text{Cl}_2$
2.  $\text{NH}_3$  contains a lone pair of electrons which can coordinate with metal ion to form the complex compound. However, in  $\text{NH}_4^+$ , the lone pair is bound to  $\text{H}^+$  and, therefore, is not available for bonding to metal ion. Hence,  $\text{NH}_4^+$  does not form complexes readily.
3.  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$  give  $\text{SO}_4^{2-}$  ions in aqueous solution which give white ppt. with  $\text{BaCl}_2$  solution.

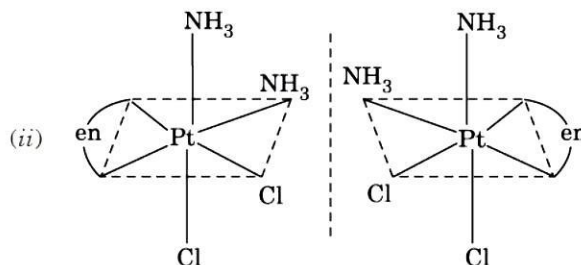
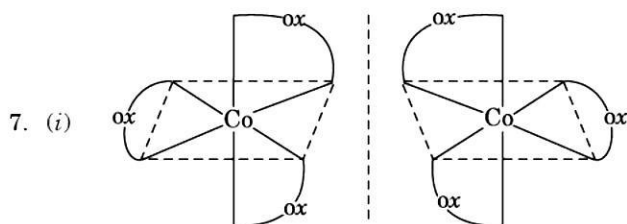


$[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Cl}$  gives  $\text{Cl}^-$  ions in aqueous solution which give white ppt with  $\text{AgNO}_3$  solution.

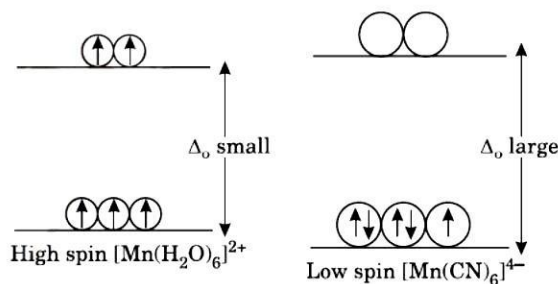


Since the two compounds have same molecular formula but give different ions in solution, they are ionisation isomers.

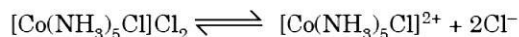
4. iron, cobalt
5. Ethylenediamminetetraacetate ion (EDTA)
6. (i) Potassium pentacyanonitrosylferrate (II)  
(ii) Pentaammine thiocyanato-N-chromium (III) tetrachloridozincate (II)



8.  $\text{Mn(II)}$  has  $3d^5$  electronic configuration. Water is a weak field ligand and therefore  $\Delta_o$  is small. Thus, the hexaqua complex will be high spin complex containing 5 unpaired electrons. On the other hand,  $\text{CN}^-$  is a strong field ligand and therefore,  $\Delta_o$  is large. Thus, in its cyano complex, the electrons pair up and have only one unpaired electron.



12. (a)  $\text{Co}(\text{NH}_3)_5\text{Cl}_3$  exists as  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$  and ionises in solution as :



Therefore, it gives 3 ions in solution.

- (b) Tetrahedral complexes do not show geometrical isomerism because the relative positions of all ligands attached to the central atom are same with respect to each other.
- (c) The tetrahedral crystal field splitting  $\Delta_t$  is about  $4/9 \Delta_o$  for octahedral complexes. This is always less than repulsion due to pairing of electrons. Therefore, most of the complexes in tetrahedral field are high spin complexes.