

# INDIAN SCHOOL MUSCAT

## CHEMISTRY DEPARTMENT

### QUESTION BANK

#### Co-ordination compounds

- 1 Define the following:
  - (i) Co-ordination compounds ;
  - (ii) Ligand ; Ambidentate ligand ;
  - (iii) Co-ordination number
  - (iv) Oxidation number ;
  - (v) Denticity ;
  - (vi) Co-ordination polyhedron ;
  - (vii) Chelating agents
  - (viii) Chelate compounds;
  - (ix) Isomerism;
  - (x) CFSE;
  - (xi) Spectrochemical series
- 2 Write the IUPAC name and denticity of the following ligands:  
NH<sub>3</sub>; H<sub>2</sub>O; NO; CO; X<sup>-</sup>; OH<sup>-</sup>; cyanide ion; nitrite ion; thiocyanate ion; CO<sub>3</sub><sup>2-</sup>; SO<sub>4</sub><sup>2-</sup>; O<sup>2-</sup>; en; dien; trine; oxalate ion; dmg; EDTA<sup>3-</sup>; EDTA<sup>4-</sup>; o-phenanthroline; pyridine
- 3 Explain the following types of isomerism with suitable examples:
  - (i) Ionisation
  - (ii) co-ordination
  - (iii) linkage
  - (iv) hydrate
  - (v) cis-trans in square planar and octahedral complexes
  - (vi) facial and meridional
  - (vii) optical isomerism
- 4 Give the salient features of Werner's theory of complexes. Mention two limitations.
- 5 On the basis of VB theory, explain the geometry and magnetic properties of the

following complexes.

- (i)  $[\text{Cr}(\text{NH}_3)_6]^{3+}$  ;
- (ii)  $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ ;
- (iii)  $[\text{Fe}(\text{CN})_6]^{3-}$ ;
- (iv)  $[\text{Co}(\text{NH}_3)_6]^{3+}$ ;
- (v)  $[\text{CoF}_6]^{3-}$  ;
- (vi)  $[\text{Ni}(\text{CO})_4]$ ;
- (vii)  $[\text{Ni}(\text{CN})_4]^{2-}$  ;
- (viii)  $[\text{Cu}(\text{NH}_3)_4]^{2+}$  ;
- (ix)  $[\text{PtCl}_4]^{2-}$  ;
- (x)  $[\text{Pt}(\text{CN})_4]^{2-}$

6 Give the salient features of Crystal field theory.

7 On the basis of CFT, explain formation of a) octahedral complex b) tetrahedral complex.

8 Explain the conditions under which a high/low spin octahedral complex would be formed.

9 Give reasons:

- a)  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$  is a high spin complex while  $[\text{Fe}(\text{CN})_6]^{4-}$  is a low spin complex.
- b) Complexes of 3<sup>rd</sup> transition series are generally low spin complexes.
- c) Complexes with 4-7 d electrons are more stable with strong ligands than with weak ligands.
- d)  $[\text{CoF}_6]^{3-}$  is a high spin complex while  $[\text{Co}(\text{NH}_3)_6]^{3+}$  is a low spin complex.
- e)  $\text{Mn}^{2+}$  in aq solution is colourless.
- f) All tetrahedral complexes are of high spin.
- g)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$  is pink while  $[\text{CoCl}_4]^{2-}$  is blue.

10 Explain the bonding in carbonyls with suitable examples:

11 Give the structure of

- (i)  $[\text{Ni}(\text{CO})_4]$ ;
- (ii)  $[\text{Fe}(\text{CO})_5]$ ;
- (iii)  $[\text{Mo}(\text{CO})_6]$  ;
- (iv)  $[\text{Mn}_2(\text{CO})_{10}]$  ;



12 Give applications of complexes in

(i) biological systems

(ii) qualitative analysis

(iii) metallurgy

(iv) medicine

(v) organic synthesis

(vi) photography

(vii) catalyst

13 Explain the following terms:

(i) Crystal field splitting in an octahedral field

(ii) Spectrochemical series

14 For the complex  $[\text{Fe}(\text{en})_2\text{Cl}_2]\text{Cl}$ , identify (Fe = 26), Identify

(i) The oxidation number of Fe

(ii) The magnetic behaviour of the complex

(iii) Hybridisation of Fe

(iv) The number of geometrical isomers possible

(v) Whether optical isomer is possible or not?

(vi) Name of the complex

15 Write three Shortcomings of valence bond theory:

16 Explain on the basis of valence bond theory that  $[\text{Ni}(\text{CN})_4]^{2-}$  ion with square planar structure is diamagnetic and the  $[\text{NiCl}_4]^{2-}$  ion with tetrahedral geometry is paramagnetic.