Atomic Energy Central School, Indore

Class XII Chemistry CO-ORDINATION COMPOUNDS Worksheet 1/6

Questions

1. On the basis of the following observations made with aqueous solutions, assign secondary and primary valences to metals in the following compounds and also write their formulae:

Formula	Moles of AgCl precipitated per mole of the compounds with excess $AgNO_3$
(i) $PdCl_2.4NH_3$	2
(ii) $NiCl_2.6H_2O$	2
(iii) $PtCl_4.2HCl$	0
(iv) $CoCl_3.4NH_3$	1
(v) $PtCl_2.2NH_3$	0

2. What is meant by unidentate, didentate and ambidentate ligands? Give two examples for each.

3. $FeSO_4$ solution mixed with $(NH_4)_2SO_4$ solution in 1:1 molar ratio gives the test of Fe^{2+} ion but $CuSO_4$ solution mixed with aqueous ammonia in 1:4 molar ratio doesn't give the test of Cu^{2+} ion. Explain why?

4. Explain with two examples each of homoleptic and heteroleptic complexes.

5. Specify the oxidation numbers & co-ordination numbers of the metals in these coordination entities:

(i) $[Co(H_2O)(CN)(en)_2]^{2+}$ (ii) $[PtCl_4]^{2-}$ (iii) $[Cr(NH_3)_3Cl_3]$ (iv) $[CoBr_2(en)_2]^{+}$ (v) $K_3[Fe(CN)_6]$

Answers

1.

Formula	No of primary valencies	No of primary valencies	Formula
(*i*) $PdCl_2.4NH_3$	2	4	$[Pd(NH_3)_4]Cl_2$
(ii) $NiCl_2.6H_2O$	2	6	$[Ni(H_2O)_6]Cl_2$
(iii) $PtCl_4.2HCl$	0	6	$[Pt(Cl)_4(HCl)_2]$
(iv) $CoCl_3.4NH_3$	1	6	$[Co(NH_3)_4Cl_2]Cl$
(v) $PtCl_2.2NH_3$	0	4	$[Pt(NH_3)_2Cl_2]$

2. When a ligand is bound to a metal ion through a single donor atom, the ligand is said to be **unidentate.** Ex. Cl^- or NH_3
   When a ligand can bind through two donor atoms, the ligand is said to be **didentate.**
   Ex. $H_2NCH_2CH_2NH_2$ (ethane-1,2-diamine) and $C_2O_4^{2-}$ (oxalate)
   Ligand which can ligate through two different atoms is called **ambidentate ligand**. Ex: NO_2^- , SCN^-
3. $FeSO_4$ solution mixed with $(NH_4)_2SO_4$ solution give free ions of Fe^{2+} ion in solution. So it gives test.
   When $CuSO_4$ solution is mixed with aqueous ammonia, it forms a complex $[Cu(NH_3)_4]^{2+}$. As Cu^{2+} is bound to the ligands, it will not give the test.
4. Complexes in which a metal is bound to only one kind of donor groups, are known as homoleptic. *e.g.*, $[Co(NH_3)_6]^{3+}$. Complexes, in which a metal is bound to more than one kind of donor groups, are known as heteroleptic. *e.g.*, $[Co(NH_3)_4Cl_2]^{+}$
5. (i)Co = +3 , CN= 6 (ii)Pt = +2 ,CN=4 (iii)Cr = +3, CN= 6 (iv) Co = +3, CN= 6 (v) Fe = +3, CN= 6

Agitha R Menon
PGT, Chemistry