CH1012 Tutorial 3 Answers

1. Name the following compounds:

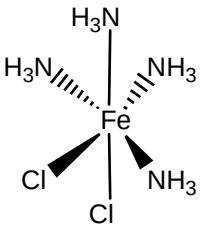
- $[Co(NH_3)_6]Cl_3$ hexaamminecobalt(III) chloride
- $Na_3[CoF_6]$ sodium hexafluorocobaltate(III)
- $[Co(NH_3)_3Cl_3]$ triamminetrichlorocobalt(III)
- $[Pt(NH_3)_2(NO_2)_2]$ diamminedinitroplatinum(II)
- $K_3[Ru(CN)_5Br]$ potassium bromopentacyanoruthenate(III)
- $Na_3[AgF_4]$ sodium tetrafluoroargentate(I)
- $[Co(en)_3]Cl_3$ tris(ethylenediamine)cobalt(III) chloride

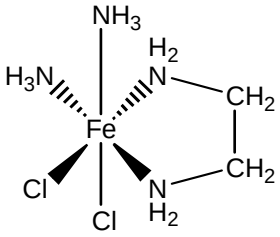
2. Give examples of monodentate, bidentate and polydentate ligands and complexes formed from them.

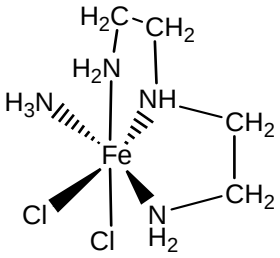
Monodentate ligands NH_3, H_2O, CO, PPh_3, Cl^-, NO_2^-, CN^-, OCN^-

Bidentate ligands en {= $NH_2CH_2CH_2NH_2$}, ox {= $OC(=O)C(=O)O^{2-}$}
acac {= $OC(CH_3)CHC(CH_3)O^-$ }

Polydentate ligands trien {= $NH_2CH_2CH_2NHCH_2CH_2NH_2$},
EDTA {= $(COO)_2CH_2NCH_2CH_2NCH_2(COO)_2$







3. Why are metal chelate complexes particularly stable?

A transition metal ion behaves like an alkali metal ion in aqueous solution - it has a hydration shell of water molecules. When a chelate ligand coordinates with the ion it displaces the water molecules in the shell very effectively therefore a large increase in entropy accompanies the formation of a chelate complex like $[Pb(EDTA)]^{2+}$ and the complex is very stable.

4. What is the maximum number of **unpaired d electrons** that a transition metal atom or ion may possess? Provide an example of a transition metal complex with this metal in it.

5 unpaired electrons in the 5 d orbitals.

An example of a complex containing this configuration. $[Mn(H_2O)_6]^{2+}$

5. What is the coordination number and oxidation state at the transition metal in each of the following complexes?

	Coordination number		Oxidation state
• $Na_3[AgF_4]$	4	$-3 = Ag + (4 \times -1)$	$\Rightarrow$ Ag = +1
• $[Co(en)_3]Cl_3$	6	$+3 = Co + (3 \times 0)$	$\Rightarrow$ Co = +3
• $[Pt(NH_3)_2(NO_2)_2]$	4	$0 = Pt + (2 \times 0) + (2 \times -1)$	$\Rightarrow$ Pt = +2