Transition Elements (13.2.1) - elements that contain an incomplete d sublevel in one or mor of their oxidation states (3d in first row)

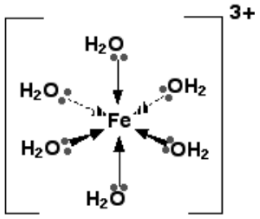
***Variable oxidation numbers (+2 most common) - (13.2.3) - 4s electrons are lost first, then 3d.**

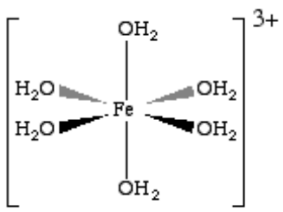
Sc = 3+	**Mn = 4+ or 7+**
Ti = 4+	**Fe = 3+**
V = 3+	**Co = 3+**
Cr = 3+ or 6+	**Cu = 1+**

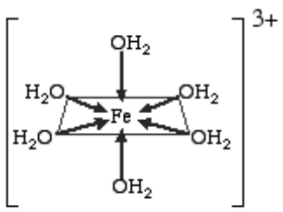
Zn is often considered NOT to be a transition metal, because neither Zn nor Zn^{2+} has an incomplete d sublevel (13.2.2). Same for compounds of Sc^{3+}.

Ligand - an atom, molecule, or anion that is rich in valence electrons (13.2.4).

***ligands combine with transition metals to form complex ions (Lewis Acid-Base reaction) Water is a very common ligand.**

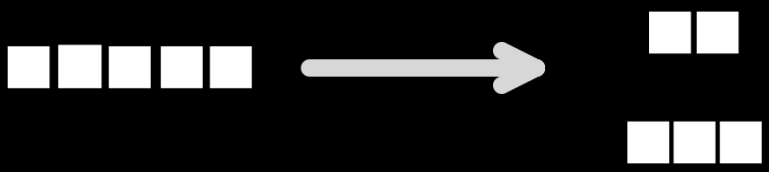






The ligand "donates" a pair of electrons to the electron-poor metal ion to form coordinate covalent bonds. (13.2.5)

Transition Metal Colors - Complex ions often form colored (coloured) solutions - due to splitting of the partially-filled d sublevel.



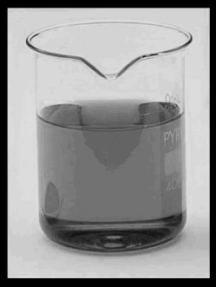
Electrons moving between orbitals within the split d sublevel cause color. Certain color(s) is (are) absorbed in promoting electron from lower to higher d-orbital. (13.2.6)

Transition metal colors to know:

Mn^{2+} = pink MnO_4^- = purple

Cu^{2+} = blue Ni^{2+} = green

CrO_4^{2-} = yellow $Cr_2O_7^{2-}$ = orange



Other uses for transition metals (13.2.7):

Catalysts - increase rate of a chemical reaction without being chemically changed at the end of the reaction

*MnO_2 - catalyzes the decomposition of H_2O_2.

*V_2O_5 - catalyzes the conversion of SO_2 to SO_3 (Contact process to make sulfuric acid)

Fe - catalyzes the synthesis of NH_3 from N_2 and H_2 (Haber process).

Fe - binds with heme group to assist in transport of oxygen in blood.

Ni - surface catalyst in dehydrogenation of alkenes to form alkanes.

Co - cofactor in vitamin B_{12}.

Pd and Pt - catalytic converters - convert CO, NO_x, and C_nH_{2n+2} to CO_2, N_2, and H_2O.