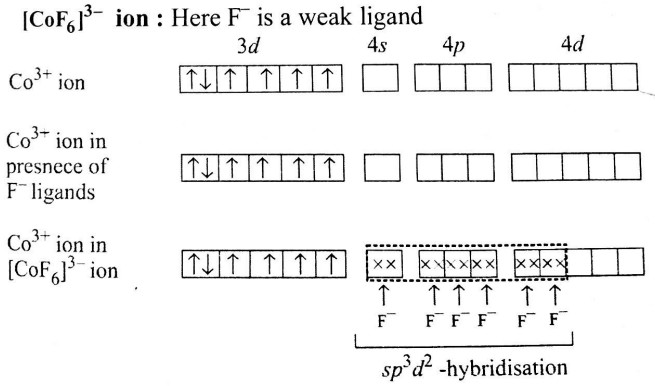
(2) Outer Orbital Octahedral Complexes

The complexes in which two n^{th} d-($d_{x^2-y^2}$, d_{z^2}) one n^{th} s and three n^{th} p (p_x, p_y and p_z) orbitals (i.e., all orbitals from outer most shell) participate in hybridisation giving rise to sp^3d^2 hybridisation, are called outer-orbital octahedral complexes. Since no pairing occur in these complexes and the d-electrons are arranged according to Hund's rule to give the maximum number of unpaired electrons. So these complexes are also called high spin or spin free complexes. The energy of ns, np and nd-orbitals is quite high, so the complexes will be reactive or labile. The magnetic moment depends on the number of unpaired electrons. These complexes are generally formed in the presence of weak ligands.

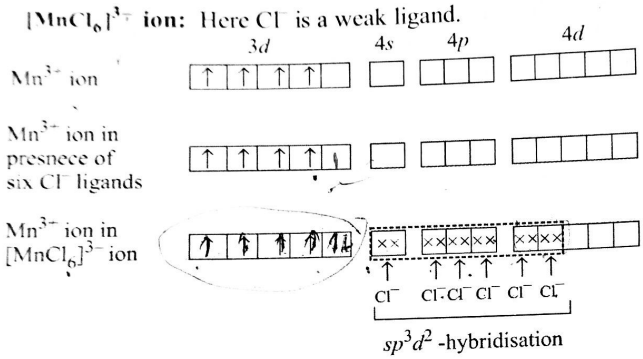
Note: The octahedral complexes of metal cation/atom of configuration d^1, d^2 and d^3 are inner orbital complexes whether the ligand is weak or strong. The complexes of metal cation/atom of configuration d^8, d^9 and d^{10} are outer orbital complexes whether the ligands are weak or strong. The octahedral complexes of metal ion of configuration d^4, d^5, d^6, d^7 are inner orbital complexes with strong ligands and outer orbital complexes with weak ligands.

Examples of Outer Orbital Octahedral Complexes

(1) $[CoF_6]^{3-}$ ion : Here F^- is a weak ligand



(2) **$[MnCl_6]^{3-}$ ion:** Here Cl^- is a weak ligand.



(3) **$[Ni(NH_3)_6]^{2+}$ ion :** In this complex ion, Ni(28) is present as Ni^{2+} ion. Ni atom has valence shell configuration, $3d^8 4s^2$ and Ni^{2+} has valence shell configuration, $3d^8$. Magnetic measurement indicate that this complex ion is paramagnetic and has two unpaired electrons. All the eight 3d electrons occupy all the five orbitals. Thus there is no vacant 3*d*-orbitals which can participate in hybridisation. Thus, 4*s*, 4*p* and two 4*d*-orbitals participate in hybridisation giving rise to sp^3d^2 hybrids. The sp^3d^2-hybrids form bonds to ligands by accepting six lone pair of electrons (one lone pair from each ligand).