Chemistry Study Materials for Class 12
(NCERT Based Notes of Chapter - 09)
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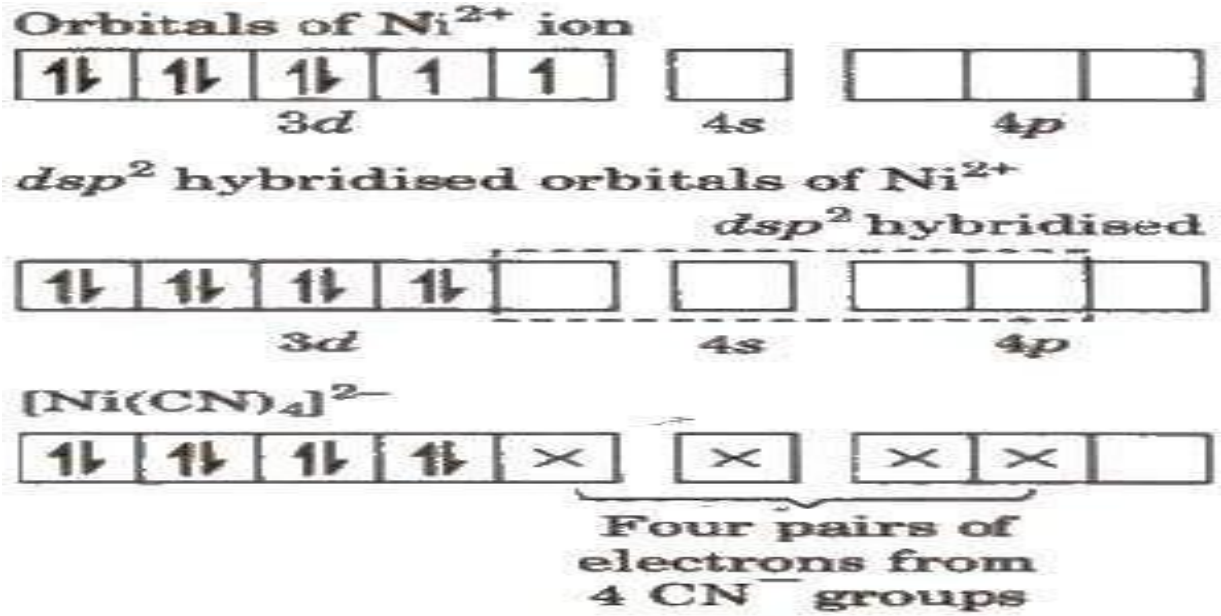
Co-ordination Compounds

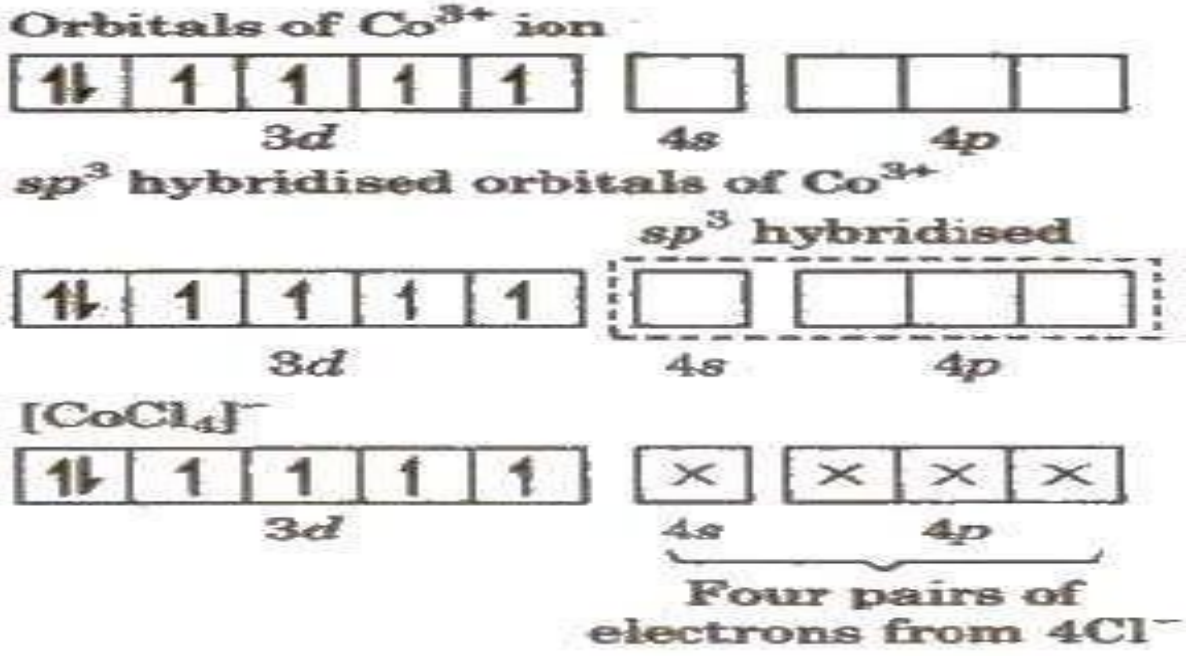
4-ligands (unidentate) tetrahedral entity.

(i) Inner orbital complex, $[Ni(CN)_4]^{2-}$



All electrons are paired so complex will be diamagnetic in nature.

(ii) Outer orbital complex, $[CoCl_4]^-$



Since, complex has unpaired electrons. So it will be paramagnetic in nature.

S. No.	Inner orbital complexes	Outer orbital complexes
1.	Strong field or low spin ligands	Weak field or high spin ligands
2.	Hybridization is dsp2(where one orbital of 3d, one orbital of 4s and two orbitals of 4p)	Hybridization is sp3 (where orbital of 4s and three orbitals of 4p)
3.	Square planar shape	Tetrahedral shape

Limitations of VBT

This theory could not explain the quantization of the magnetic data, existence of inner orbital and outer orbital complex, change of magnetic moment with temperature and colour of complexes.

Crystal Field Theory (CFT)

This theory was proposed by H. Bethe and van Vleck. Orgel in 1952 applied this theory to coordination compounds. In this theory, ligands are treated as point charges in case of anions and dipoles in case of neutral molecules.

The five d-orbitals are classified as

(i) Three d-orbitals i.e., d_{xy}, d_{yz} and d_{zx} are oriented in between the coordinate axes and are called t_{2g} – orbitals.

(ii) The other two d-orbitals, i.e., $dx^2 – y^2$ and dz^2 oriented along the x – y % axes are called e_g – orbitals.

Due to approach of ligands, the five degenerate d-orbitals split. Splitting of d-orbitals depends on the nature of the crystal field.

[The energy difference between t_{2g} and e_g level is designated by Δ and is called crystal field splitting energy.]

By using spectroscopic data for a number of coordination compounds, having the same metal ions but different ligand, the crystal field splitting for each ligand has been calculated. A series in which ligand are arranged in order of increasing magnitude of crystal field splitting, is called **spectrochemical series**.

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