Co-ordination Chemistry

V.B.T (Valence bond theory) -

Complex compound consist of metal (d, f-block) and ligand (Cl, CN, OH etc)

⇒ According to VBT each metal having same oxidation number.

⇒ According to VBT each complex compound having same ligand and co-ordination number.

⇒ According to VBT each complex compound show magnetic behaviour (para and di magnetic behaviour)

⇒ According to VBT each complex compound show colour or colourless properties.

⇒ According to VBT each complex compound having some hybridization.

⇒ VBT obey weak ligand theory.

Example :-

$K_4[Ni(Cl)_6]$
└> Weak ligand

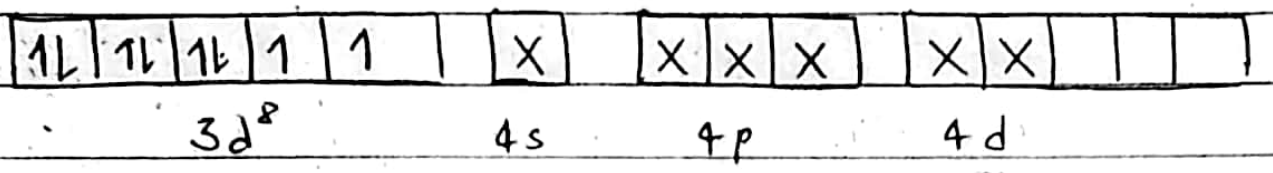
$4 + x - 6 = 0$

$x = 6 - 4$

$= 2$

$_{28}Ni = [Ar], 3d^8, 4s^2$

$Ni^{+2} = [Ar], 3d^8, 4s, 4p, 4d$



⇒ Paramagnetic properties due to unpaired e^-

⇒ d^8 = coloured compound

⇒ Hybridisation = 1s + 3p + 2d = sp^3d^2

⇒ Shape / Structure = Octahedral

⇒ Magnetic moment = $\sqrt{n(n+2)}$ BM

$= \sqrt{2(2+2)}$

$= \sqrt{8}$ BM

⇒ C.No = 6 (ligand = co-ordination number).

$K_2[Fe(Cl)_4]$

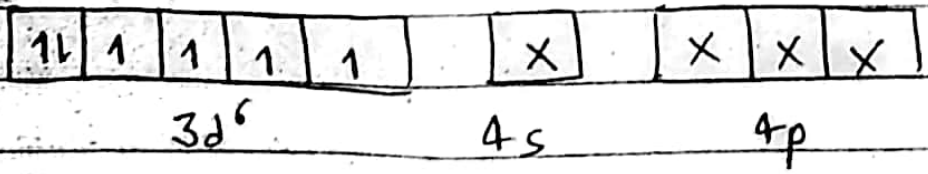
↳ Weak ligand

$2 + x - 4 = 0$

$x = 2$

$_{26}Fe = [Ar], 3d^6, 4s^2$

$Fe^{2+} = [Ar]\ 3d^6, 4s, 4p$



⇒ Para magnetic
⇒ $3d^6$ (coloured compound)
⇒ sp^3
⇒ Shape = Tetrahedral
⇒ Magnetic moment = $\sqrt{4(4+2}$ BM
= $\sqrt{24}$ BM

Co-ordination no. = 4 (∵ ligand = C.N)

Crystal field theory :-

According to crystal field theory complex compound show splitting of d-orbital into two set of orbital.
When ligand approch towards it.
⇒ It show spectra line of complex compound.
⇒ No. of spectra line = n+1
where, n = No. of unpaired e^-.
⇒ It show inner as well as outer hybrid orbital d^2sp^3, sp^3d^2, dsp^2, sp^3 etc..
⇒ It show magnetic properties in strong ligand as well as weak ligand.
eg (para and di magnetic properties).
⇒ It show magnetic moment in strong ligand as well as weak ligand.
⇒ It show colour and colourless in case of strong ligand as well as weak ligand.