DISTRIBUTION OF d-ELECTRONS IN $d\epsilon^{t_{2g}}$ & $d\gamma^{e_g}$ Orbitals IN OCTAHEDRAL COMPLEXES:→

The distribution of d-electrons in dε and dγ orbital takes place on the basis of the nature of the ligands, i.e whether the ligands are weaker or stronger. Thus two cases arise:—.

P < Δo (i) When the ligands are Weaker (weak field):→ (High spin complex.)

It has been that under the influence of weaker ligands the energy difference, Δo between dε and dγ orbitals is comparatively small so, all the five d-orbitals of these two orbitals may be supposed to be degenerate. i.e in presence of weaker ligands all the d-orbitals have the same energy, and consequently the distribution of d-electrons in dε & dγ sets takes place according to Hund's rule, which states, Electron will pair up only when each of the five d-orbitals is at least singly filled.

It may be clearly understood by means of the following example.

The d-orbital Contains 10 electron; Hence in this case electron. no. 1, 2, 3 go to dε level, and 4, 5 go to the dγ level, then 6, 7, 8 (three electron) go to dε level and the remaining two electrons 9 & 10 will occupy dγ sets.

$$d\epsilon^{1,2,3} \longrightarrow d\gamma^{4,5} \rightarrow d\epsilon^{6,7,8} \rightarrow d\gamma^{9,10}$$

For example, If we Consider the octahedral Complex i.e $[CoF_6]^{3-}$, which Contains Weaker ligands, The distribution of Six d-electrons of Co^{+3} ion ($Co^{+3} \rightarrow 3d^6$) in dε & dγ sets will be $d\epsilon^4, d\gamma^2$. Complex which Contains weaker

ligans are refered as Weak field or low field Complex.

In the formation of such type of complexes $\Delta_o < P$, where P is average pairing energy, which is the energy required to pair two electrons in the same orbital, & Δ_o is Octahedral Crystal field splitting Energy.

(ii) When the ligands are stronger:→ (Strong field) or high spin complex.

$P > \Delta_o$

Now we consider the octahedral Complexes Containing stronger ligands, the distribution of d- electrons in $d\epsilon$ and dr sets does not obey Hund's rule.

Thus in stronger field the first six electrons numbered as 1, 2, 3, 4, 5 & 6, these electrons will go to $d\epsilon$ set and the remaining four electrons numbered as, 7, 8, 9 & 10 enters into dr set.

This can be shown as:—

$$d\epsilon^{1,2,3,4,5,6} \longrightarrow dr^{7,8,9,10}$$

Let us consider on the distribution of six 'd' electron of Co^{+3} ion ($Co^{+3} \longrightarrow 3d^6$) in the complex ion $[Co(NH_3)_6]^{+3}$ which contains stronger ligand, Thus it is quite obvious that the distribution will be takes as $d\epsilon^6 dr^0$ i.e $t_{2g}^6 e_g^0$ (where teg stands for triply regenerate and eg stands for doubly regenerate orbitals).

The Complex which Contains stronger field ligand like NH_3 is called Strong field Complex or High field Complex.

For these Complex, $\Delta_o > P$

i.e the C.F. splitting in octahedral Complex is greater than the Pairing Energy.