Strong Ligand :-

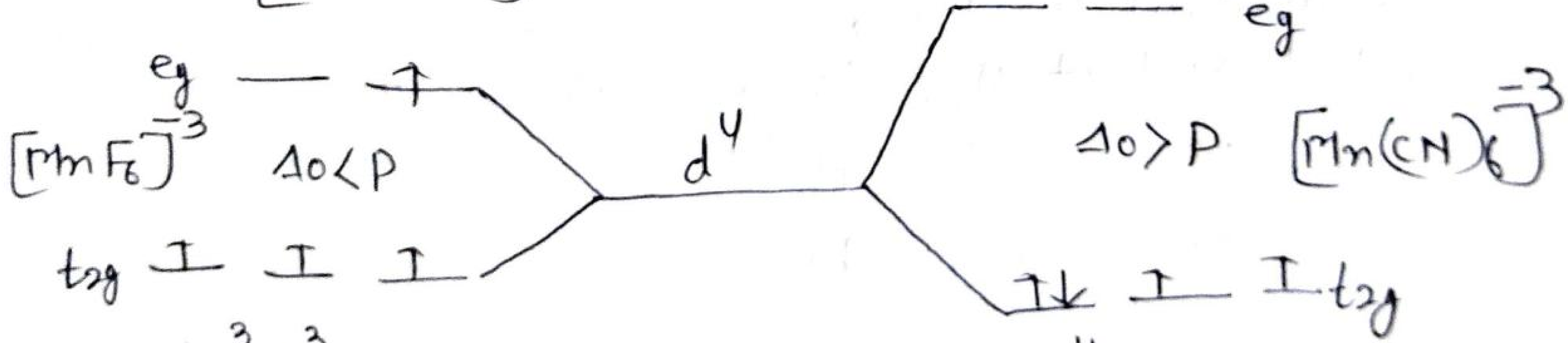
When a ligand is strong it causes greater repulsion to d-electrons, hence the extent of splitting of d-orbitals is comparatively larger. So in such cases $\Delta_o > P$ and so spin paired or low spin octahedral complexes are formed. Ex – CN^-, NO, CO etc.

Weak Ligand :-

If a ligand is weak it does not cause greater repulsion to d-electrons hence the extent of splitting is small and so $\Delta_o < P$. In such cases spin free or high spin octahedral complexes are formed. Ex – Cl^-, F^-, Br^- H_2O etc.

Q. Predict the μ_s value of $[MnF_6]^{-3}$ and $[Mn(CN)_6]^{-3}$.

→ $[MnF_6]^{-3}$ = Mn(III)
$[Mn(CN)_6]^{-3}$ = Mn(III)
} d^4 system



$t_{2g}^3 e_g^3$

$n = 4$

$\mu_s = \sqrt{n(n+2)}$ BM
$= \sqrt{4(4+2)}$ BM
$= \sqrt{24} = 2\sqrt{6}$ BM

$t_{2g}^4 e_g^0$

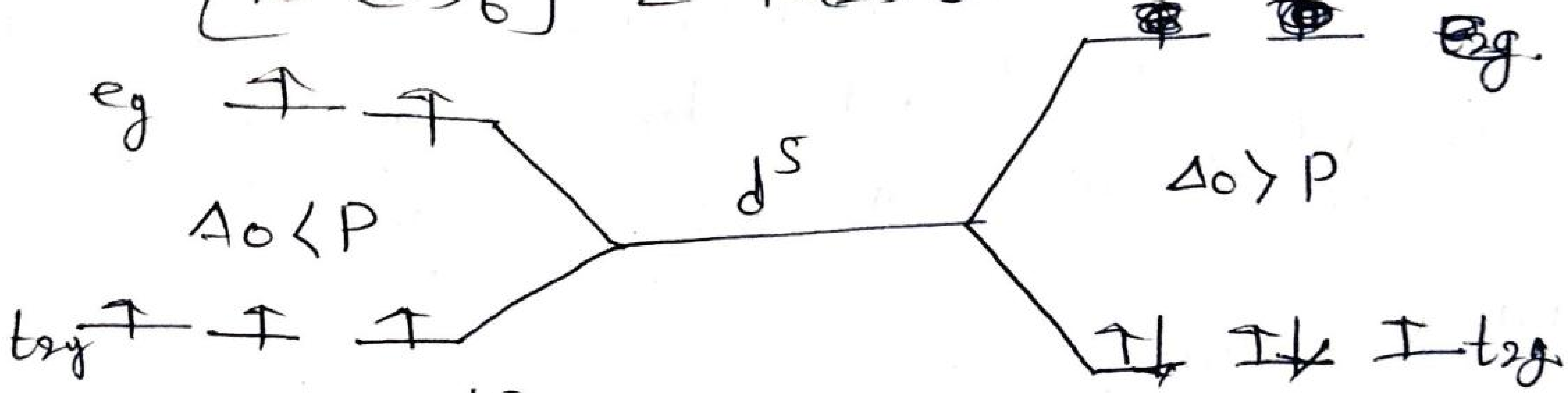
CN^- = strong ligand

$n = 2$

$\mu_s = \sqrt{2(2+2)}$ BM
$= \sqrt{8}$ BM
$= 2\sqrt{2}$ BM.

Q Predict μ_s value of $[Fe(H_2O)_6]^{+3}$ and $[Fe(CO)_6]^{+3}$.

→ $[Fe(H_2O)_6]^{+3}$ = Fe(III) } d^5 system.
$[Fe(CO)_6]^{+3}$ = Fe(III) }



$[Fe(H_2O)_6]^{+3}$

H_2O = Weak ligand

$\mu_s = \sqrt{5(5+2)}$ BM

$= \sqrt{35}$ BM

$[Fe(CO)_6]^{+3}$

CO = strong ligand

$\mu_s = \sqrt{1(1+2)}$ BM

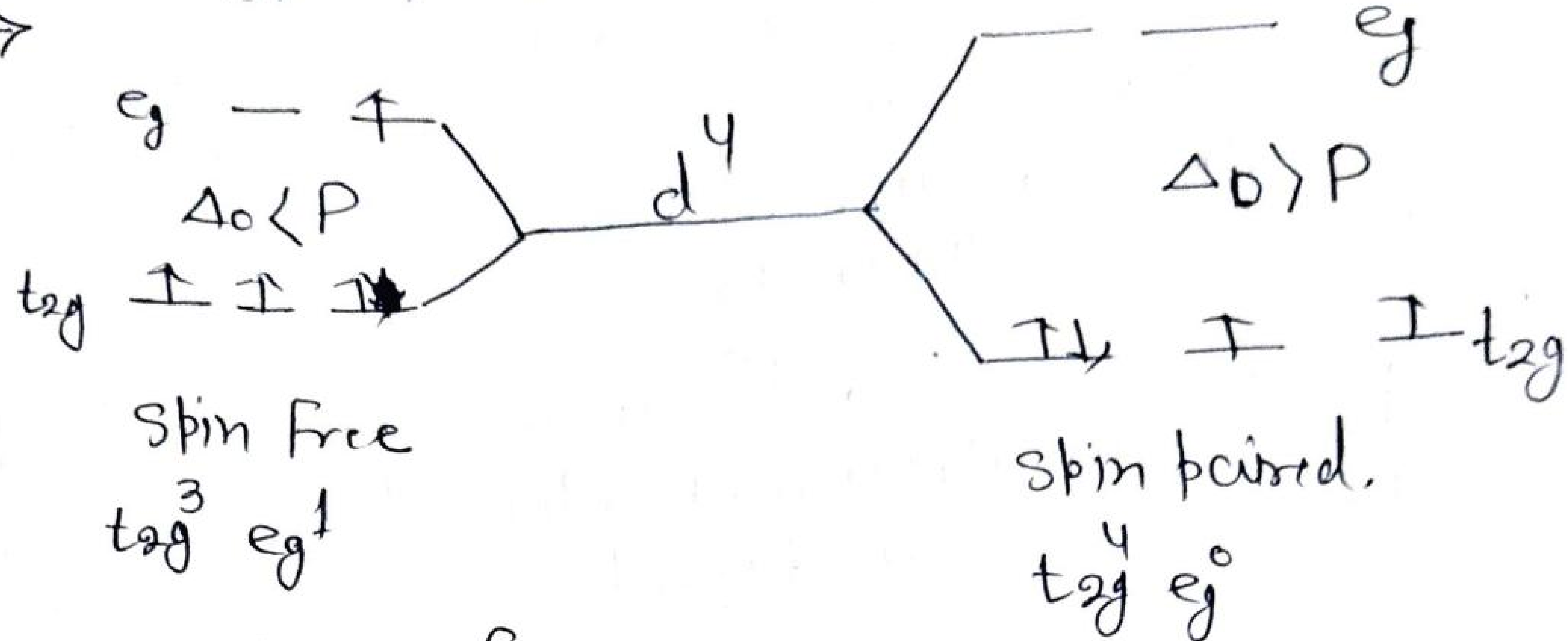
= 1.732 BM.

$\mu_s\ [Fe(H_2O)_6]^{+3} > \mu_s\ [Fe(CO)_6]^{+3}$

As CO is a strong ligand Δo > P, so it is low spin octahedral complex or spin paired octahedral complex, in which there is one unpaired electron but H_2O is a weak ligand for which Δo < P, so it is high spin or spin free octah complex, in which there are 5 unpaired electron

Q. Spin paired oh. complexes are more stable than spin free oh. complexes. Explain.

→



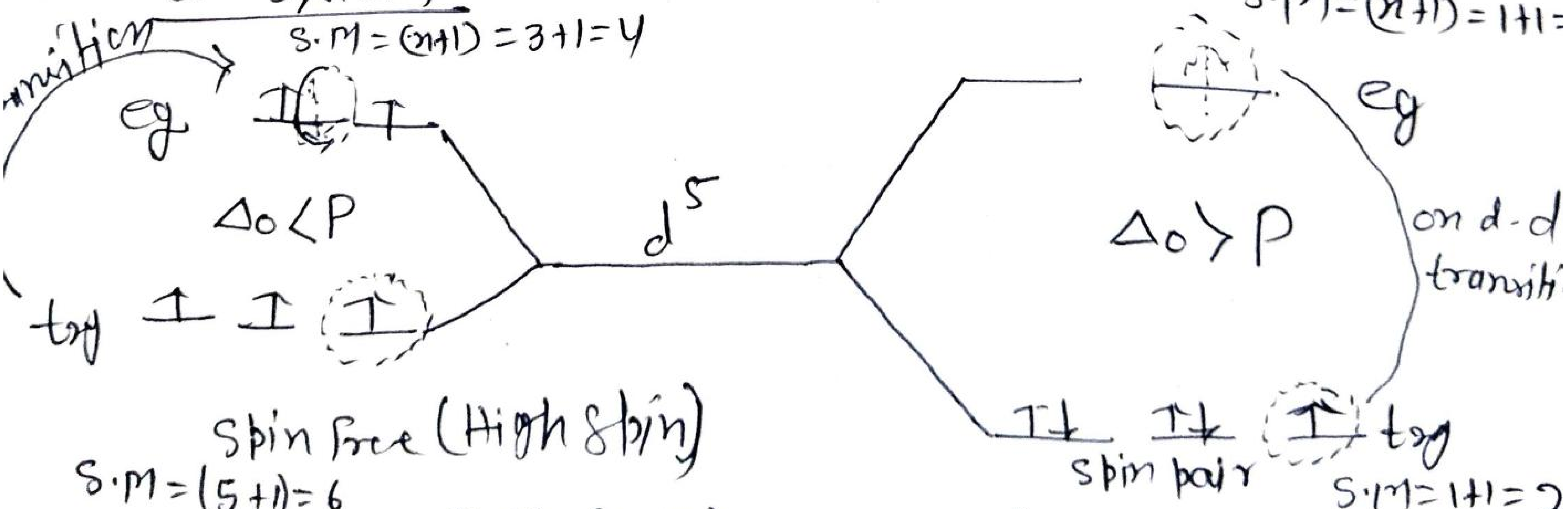
~~The magnitude of CFSE of O.C. (octahedral complexes) is greater than that of spin~~

The magnitude of CFSE of spin paired octahedral complexes (O.C) is greater than that of spin free O.C. that's why spin paired O.C are more stable than spin free O.C.

$C.F.S.E = 3 \times -4Dq + 6 \times -1Dq$.
$= -12Dq + 6Dq$.
$= -6Dq$.

$C.F.S.E =$
$4 \times -4Dq + 0 \times 6Dq$
$= -16Dq$

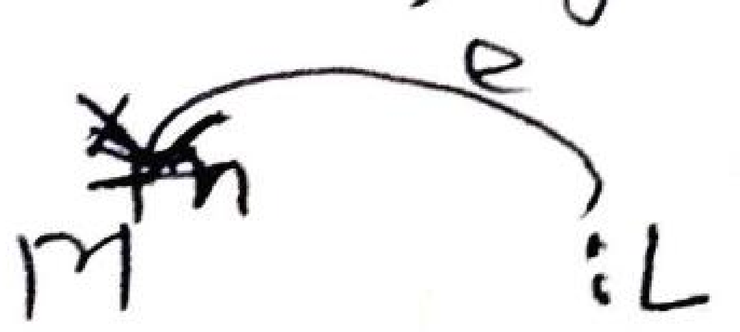
* d^5 system



S.M = (n+1) ; n = No. of unpaired electrons.

High spin O.C of d^5 system is not coloured due to d-d transition because it is spin forbidden transition since, S.M changes in case of $\Delta_o < P$ hence this transition is not allowed. But in $\Delta_o > P$, transition is allowed because there is no change in spin multiplicity.

So, d^5 is not coloured due to d-d transition but coloured due to charge transfer from ligand.



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