

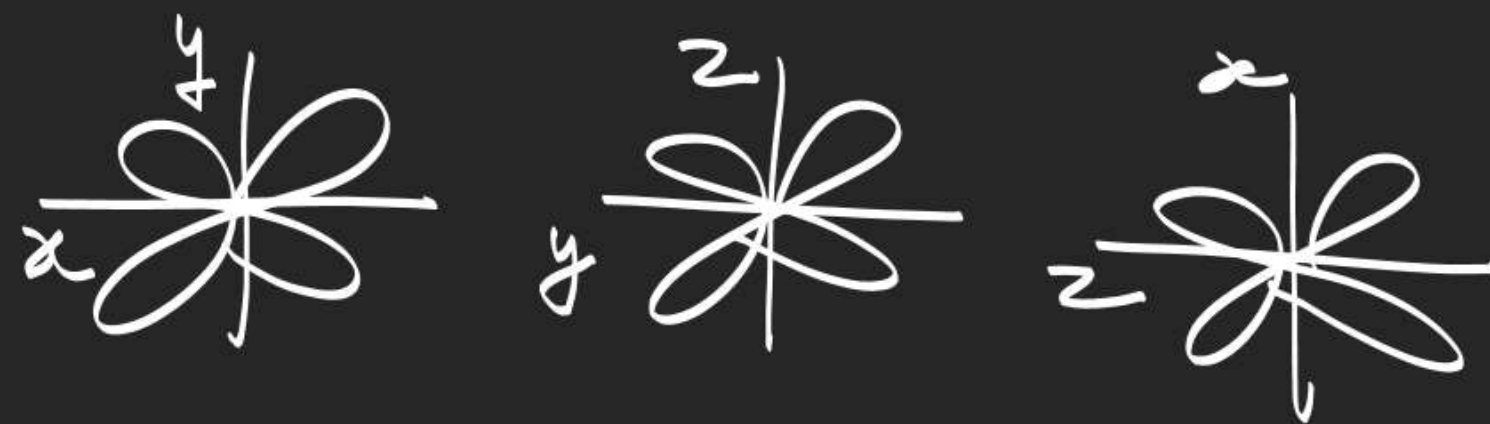
# COORDINATION CHEMISTRY

C.F.T



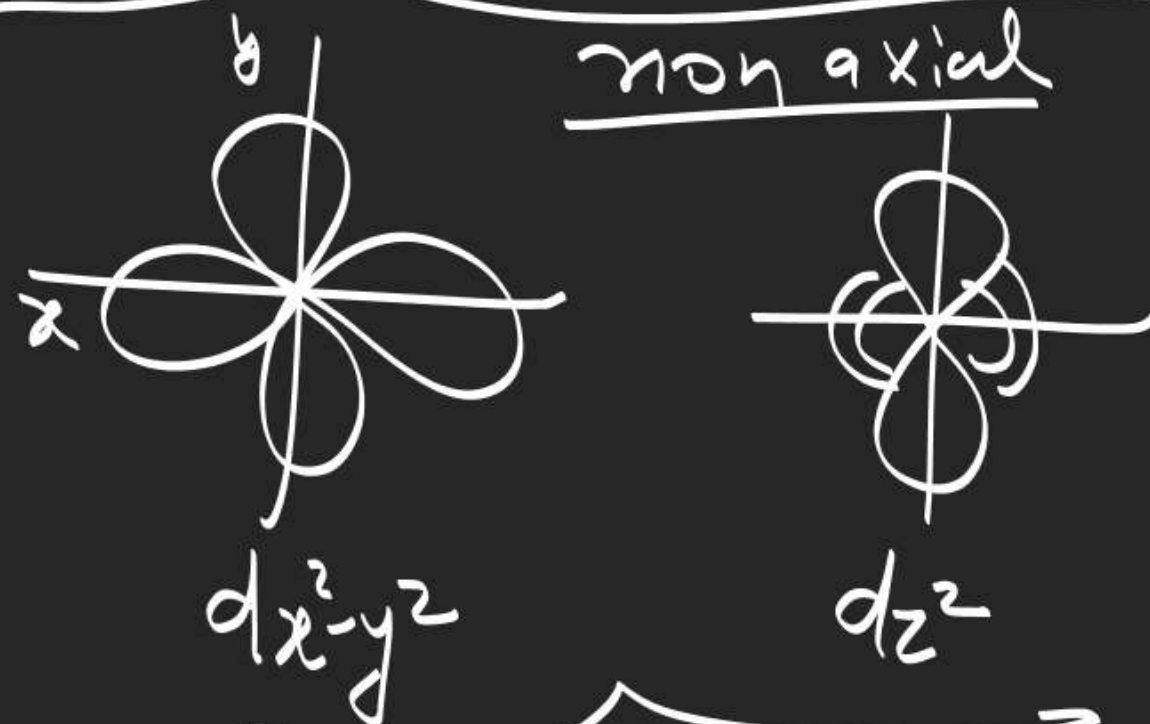
- ① van Vleck and Bethe
- ② -ive ligand  $\rightarrow$  acts as point charge  
neutral ligand acts as dipole
- ③ acc. to C.F.T pure electrostatic attraction present between Metal Cation and ligand. but it is not true due to synergic bonding

$\frac{Ni(CO)_4}{Fe(CO)_5}$  explain by MOT



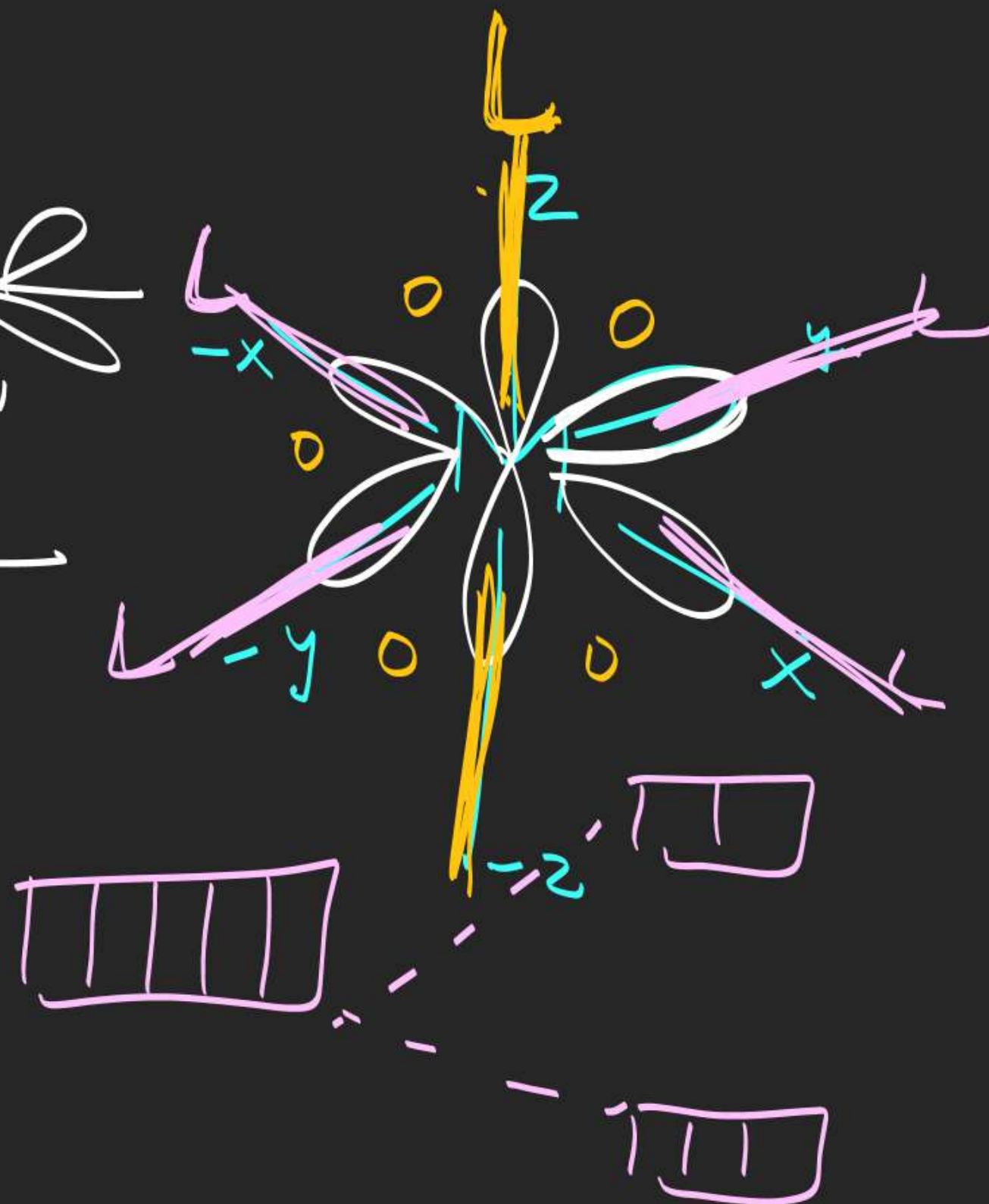
$d_{xy}$   $d_{yz}$   $d_{xz}$

non axial



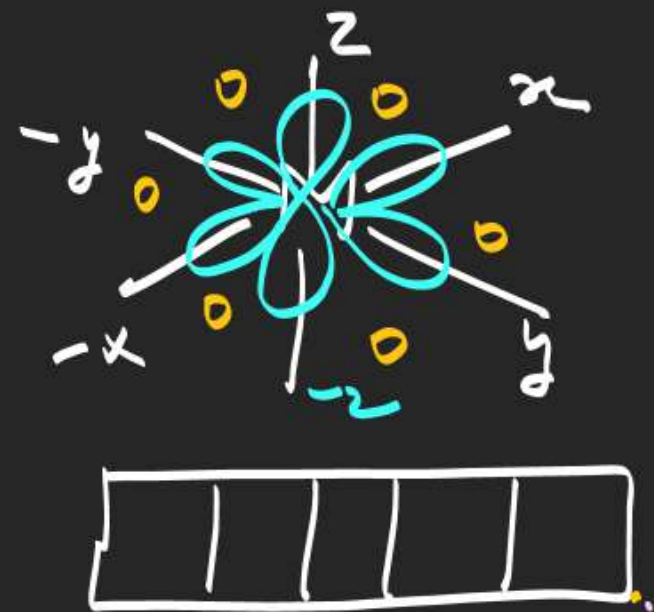
$d_{x^2-y^2}$   $d_{z^2}$

axial

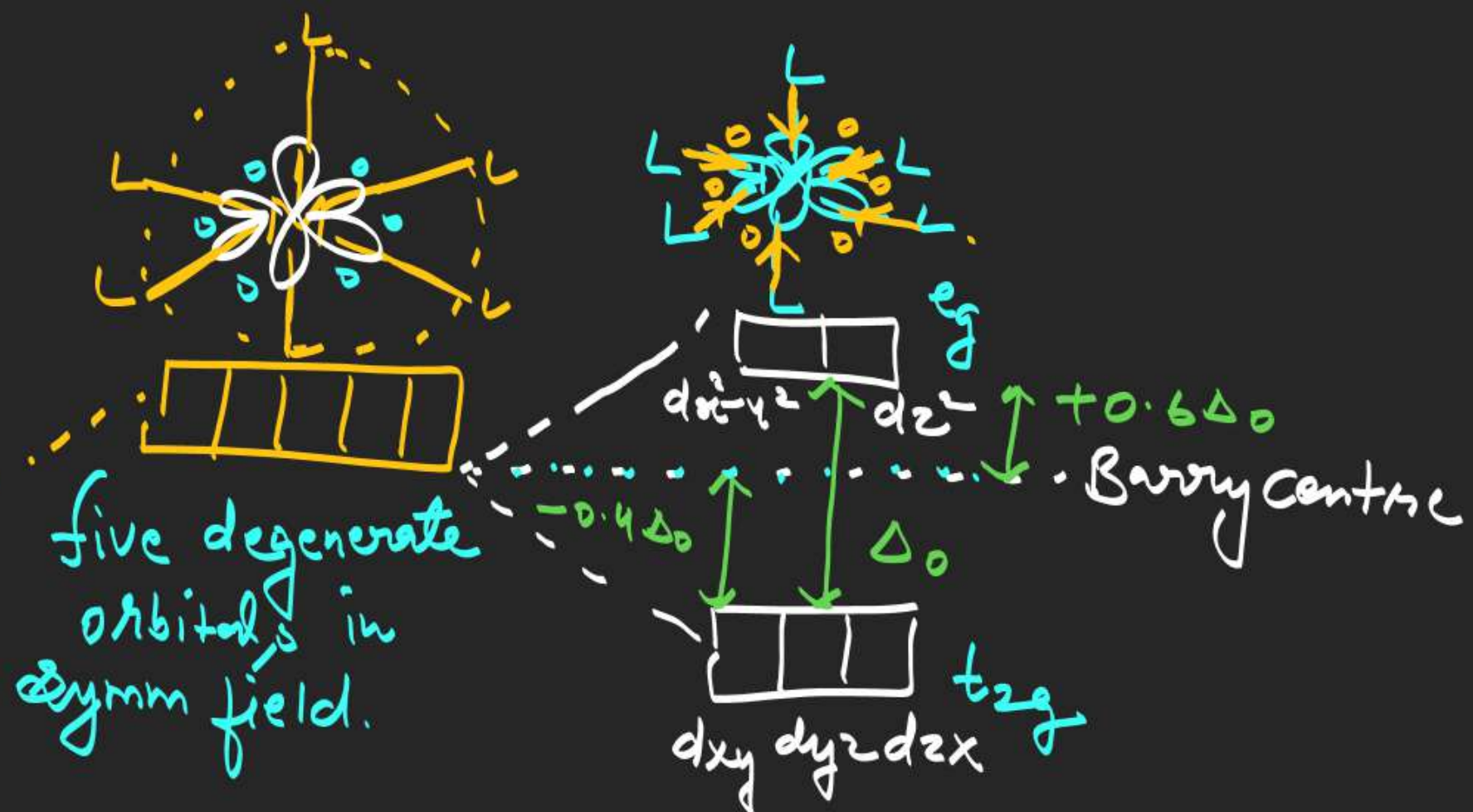




# Octahedral splitting



five degenerate orbital  
of free metal cation



$$\Delta_o = \text{C.F.S.E for octahedral}$$

C.F.S.E = crystal field splitting energy

S.F-L

W.F-L

$$\Delta_o > P$$



$$\Delta_o < P$$



$d^1$  to  $d^9$



$P$  = pairing energy  
 req-energy for pairing

for octahedral

high spin  $\Rightarrow$  number of u.p.e  $\uparrow$

low spin  $\Rightarrow$  number of u.p.e  $\downarrow$

$d^1$  to  $d^3 \Rightarrow$  no low spin / no high spin

$d^8$  to  $d^10 \Rightarrow$

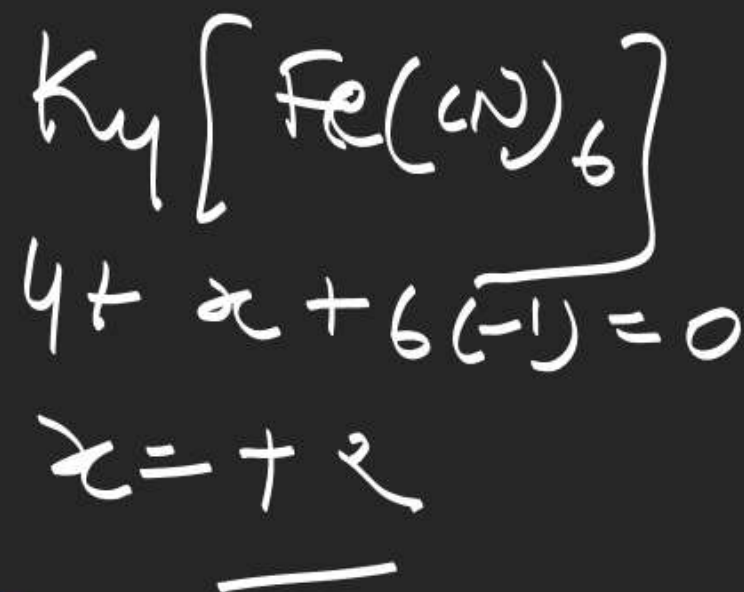
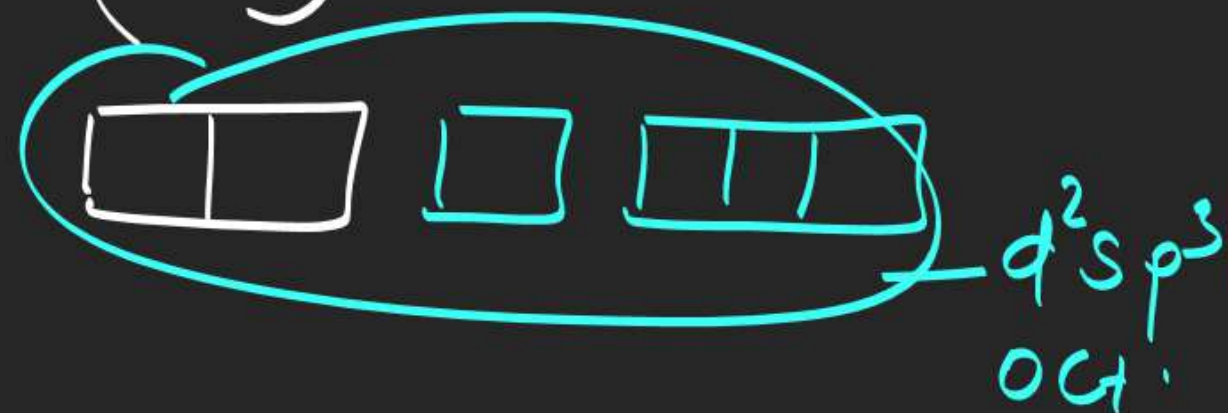
$d^4$  to  $d^7$   $\xrightarrow{\text{S.F-L}}$  low spin

$\xrightarrow{\text{W.F-L}}$  high spin





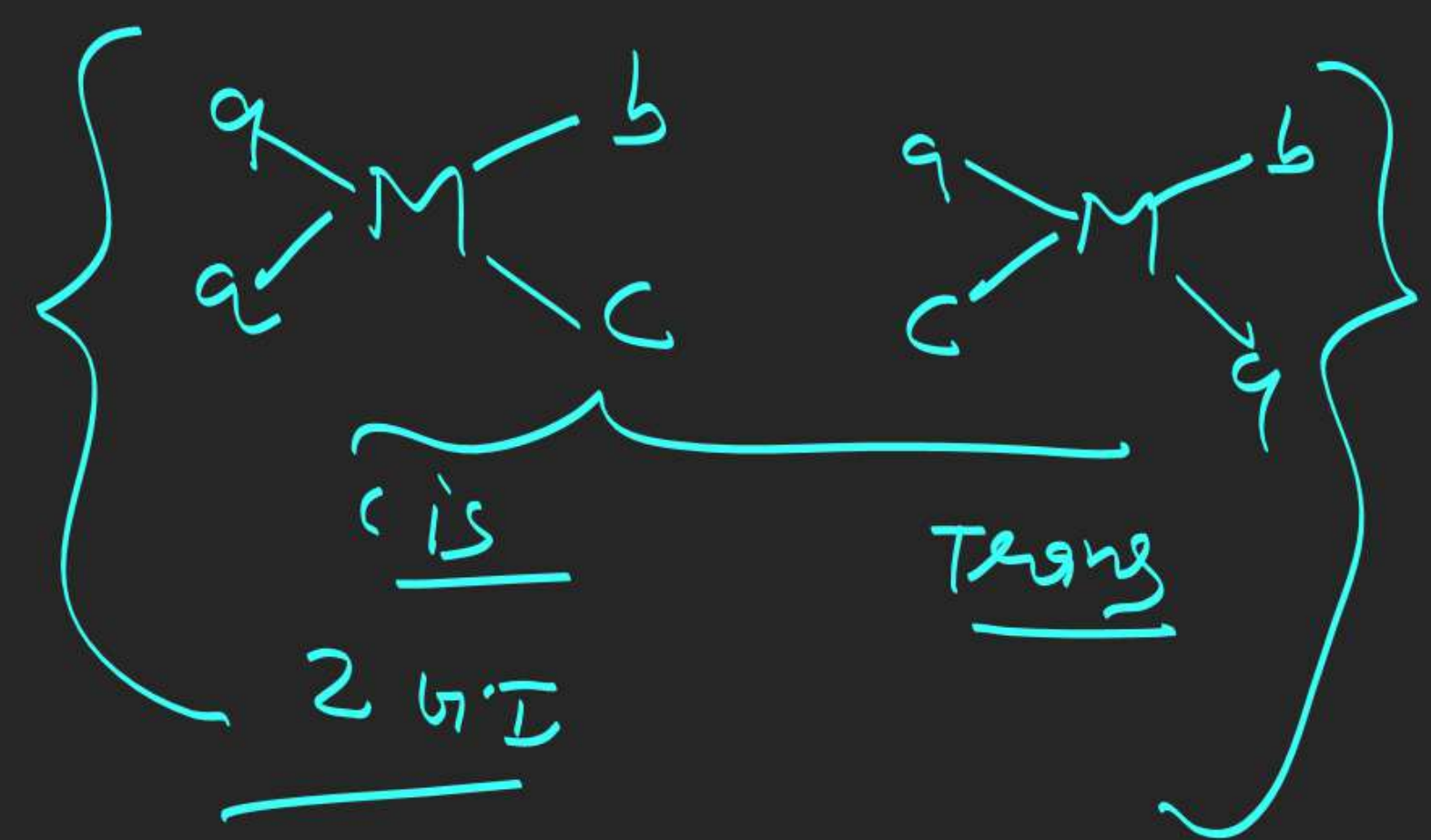
① CN (S.F.L)

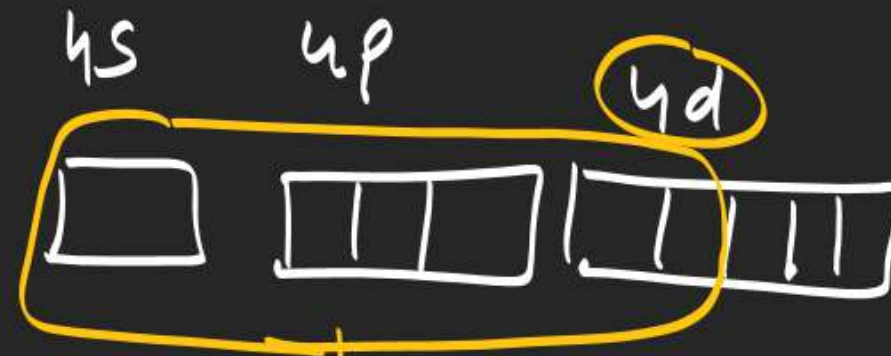
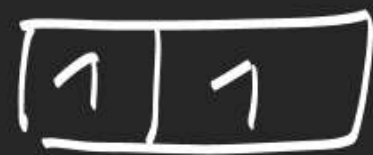
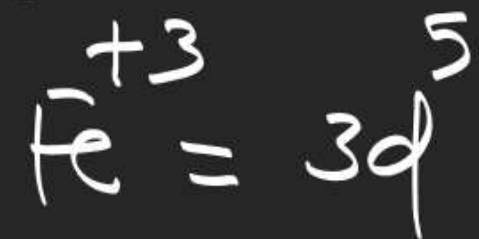
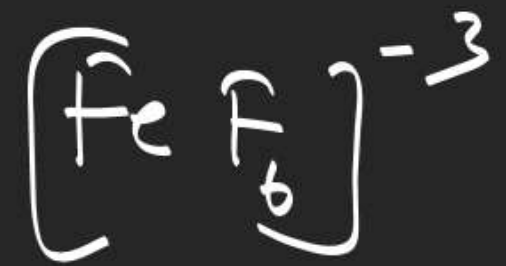


Diq  
 $\mu = 0$

low spin  
inner orbital

$Ma_2bc$        $[Ma_2bcd]$





Oct.

Para



$\mu = 5.92$   
 outer orbital  
 high spin



for  $C.N = 6$  (octahedral)

• Key point

$d^1$  to  $d^3$  — always  $d^2sp^3$  inner

$d^8$  to  $d^{10}$  — always  $sp^3d^2$  outer

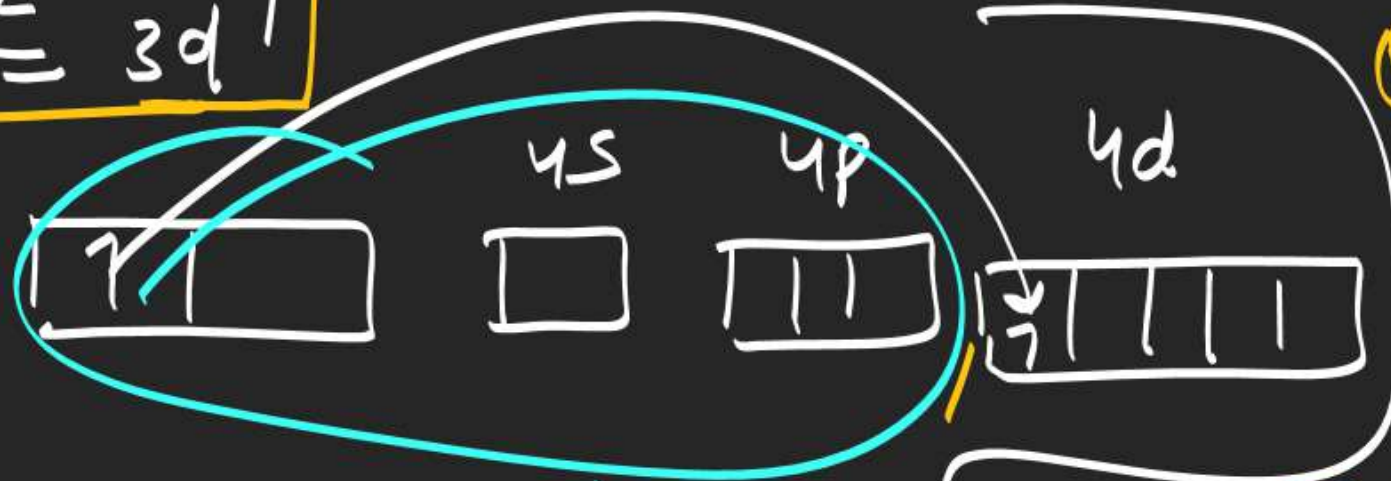
★

$d^4$  to  $d^7$  —

S.F.L	$\rightarrow$	$d^2sp^3$
W.F.L	$\rightarrow$	$sp^3d^2$

$$x + 6(-1) = -4 \quad \left[ \text{Co}(\text{NO}_2)_6 \right]^{-4}$$

$$x = \underline{\underline{+2}}$$



$d^2sp^3$   
Oct.  
 $\mu = 1.73$   
inner  
low spin

## Condition of transference

① Complex should have only one u.p.e

② Complex should have only s.f.l

③ Complex should have possibility of inner orbital complex compound.





When  $\text{Co}^{+2}$  surrounded by 6 S.F.L then

it always form  $d^2sp^3$  hyb. (inner orbital complex),  
and in such type of complex compound

u.p.e present in 4d orbital (higher energy)  
rather than 3d orbital.

u.p.e present in 4d orbital (higher energy level)

so easily remove and they act as R.A