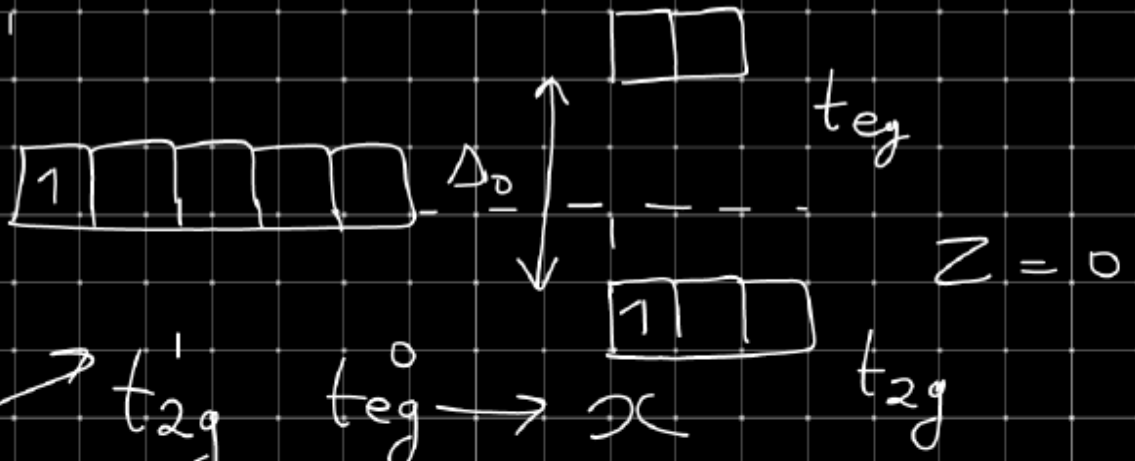
Calculation of C.F.S.E. :- (In octahedral field C.no. = 6)

$$C.F.S.E = x(+0.6\,\Delta_o) + y(-0.4\,\Delta_o) + Z.P$$

x = no. of e^-s in t_{eg} set
y = no. of e^-s in t_{2g} set
Z = no. of pairs
P = Pairing energy (energy required to pair up 2 e^-s)

Ex:-

(1) d^1

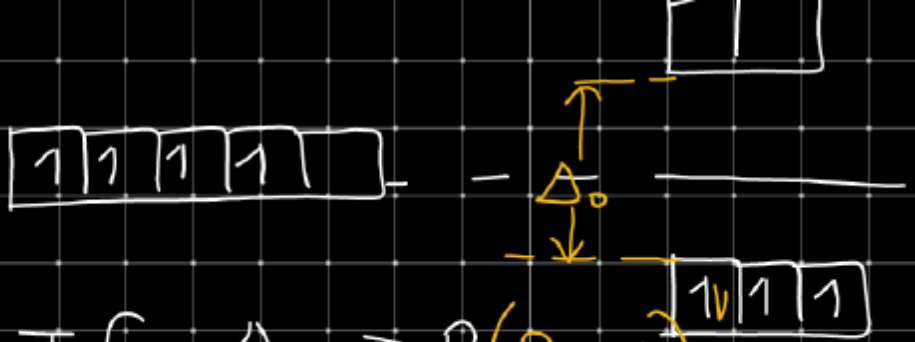


$y \rightarrow t_{2g}^{1} \quad t_{eg}^{0} \rightarrow x$

$$CFSE = 0(+0.6\Delta_0) + 1(-0.4\Delta_0) + 0 \cdot P$$

$$CFSE = -0.4\Delta_0$$

(2) d^4



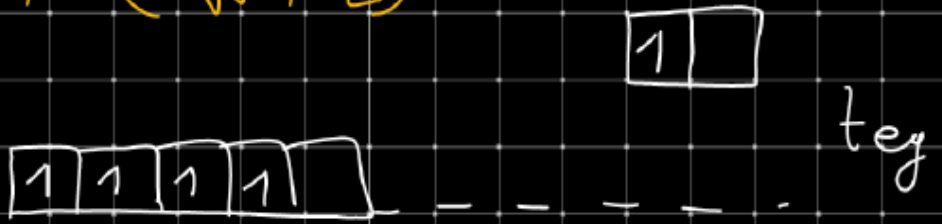
Case(I) If $\Delta_o > P$ (S.F.L)

$y \rightarrow t_{2g}^4 \qquad t_{eg}^0 \leftarrow x$

C.F.S.E $= 0(+0.6\Delta_o) + 4(-0.4\Delta_o) + 1P$

C.F.S.E. $= -1.6\Delta_o + P$

Case II: If $\Delta_o < P$ (W.F.L)



$$C.F.S.E = 1(+0.6\Delta_o) + 3(-0.4\Delta_o) + 0.P$$

$$= 0.6\Delta_o - 1.2\Delta_o$$

$$C.F.S.E. = -0.6\Delta_o$$

(2) Ques Find C.F.S.E in $[Fe(CN)_6]^{4-}$

$X = +2$

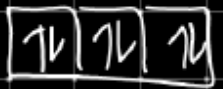
$Fe^{2+} \Rightarrow [Ar]\, 3d^6\, 4s^0$

S.F.L. (CN)

t_{eg}

t_{2g}

$Z = 3$



t_{2g}

$C.F.S.E = 0(+0.6\Delta_0) + 6(-0.4\Delta_0) + 3P$

$= -2.4\Delta_0 + 3P$

Explanation of Colour in Complex by C.F.T.

A/c to C.F.T Spliting of d-orbitals occurs in Complex the energy gap generally corresponds to the visible region and therefore most of the Complexes are in Coloured this is Called

d-d transition.

Ex:- (i) $[Ti(H_2O)_6]Cl_3$

VIBGYOR

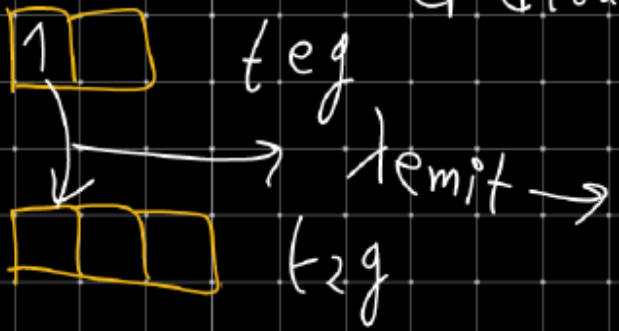
Violet ⇒ ↓

X = +3

C.N. = 6

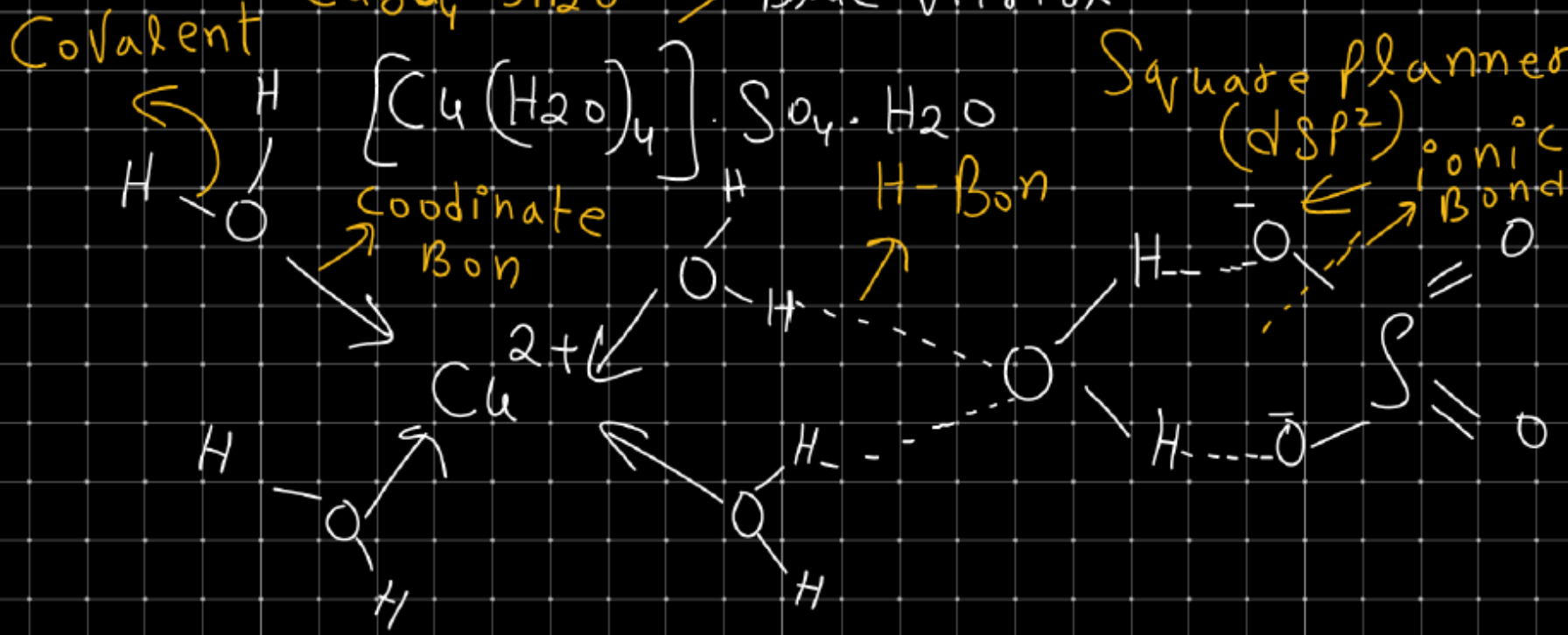
$Ti^{+3} \Rightarrow [Ar]\ 3d^1$

Colour observed due to emit ⇒ radiation ⇒

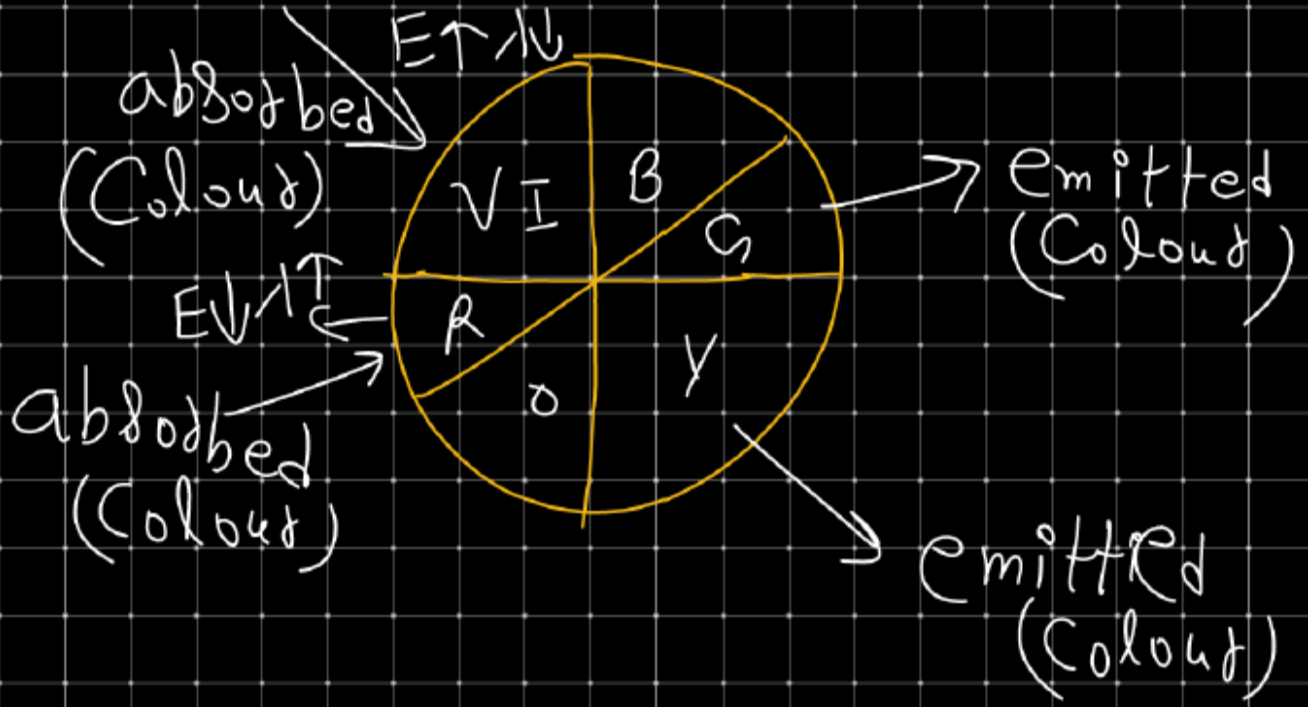


Ex:- $CuSO_4$ ⟶ Colourless

$CuSO_4 \cdot 5H_2O$ ⇒ Blue vitriol



Identification of Colour :-



Q. Match the following Complex with their appropriate Colour

		absorbed	Emitted
(1)	$[Ni^{+2}(H_2O)_6]Cl_2$	Blue	orange
(2)	$[Ni^{+2}(en)(H_2O)_4]Cl_2$	Violet	Yellow
(3)	$[Ni^{+2}(en)_3]Cl_2$	Green	red

(1) $\rightarrow$ 6O, C.no = 6

(2) $\rightarrow$ 2N, 4O, C.no = 6

(3) $\rightarrow$ 6N, C.no = 6

λ_{max}

Order of energy

$\Rightarrow (3) > (2) > (1)$

$\lambda \rightarrow (3) < (2) < (1)$

$\rightarrow$ emitted