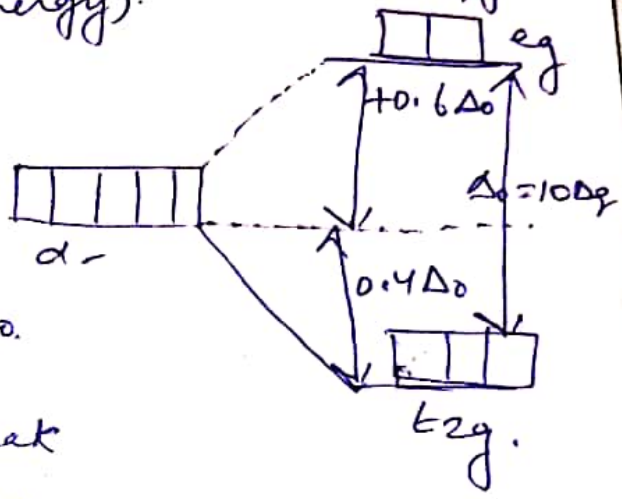
(3)

· When t_{2g} orbitals are occupied energy is emitted. When e_g orbitals are occupied absorption takes place. Total energy is CFSE (crystal field stabilization energy).

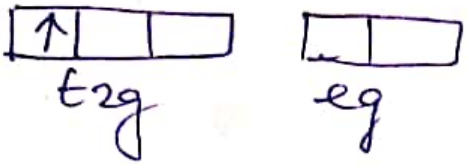
d^e in metal	t_{2g}	e_g	CFSE
1	↑		$-0.4\Delta_o$ weak
2	↑↓		strong $-0.4\Delta_o$
4	↑↑↑	↑	$-0.6\Delta_o$ weak
4	↑↓↑↑		$4x-1.4 = -1.6\Delta_o$ strong



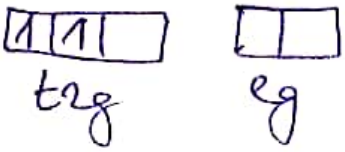
8 + π

π = pairing

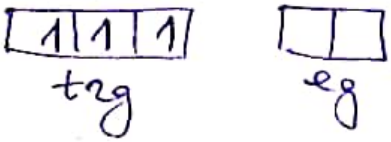
CFSE for various octahedral complexes:

d^1 

CFSE = $-4D_q$

d^2 

CFSE = $2x - 4 = -8D_q$
$= -0.8\Delta_o$.

d^3 

CFSE = $3x - 4 = -1.2\Delta_o$
$-12D_q$

d^4 — two possibilities

I) All four e⁻ occupy t_{2g} orbitals with one electron getting paired with t_{2g}

In this pairing energy is less than Δo $P < \Delta o$

Hence strong field complexes there are less number of unpaired electrons and called low spin complexes.

II) Three electron occupy t_{2g} orbitals and fourth e⁻ goes to one of the eg orbital $t_{2g}^3 e_g^1$

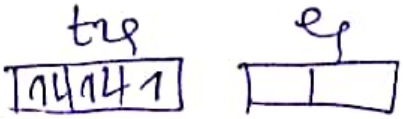
$\Delta o < P$ called weak field. Maximum no of e⁻ remain unpaired. complex is high spin complex.

strong field 

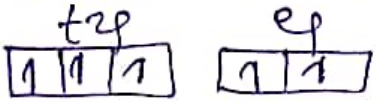
CFSE = $-0.4 \times 4 = -1.6\Delta o$

weak field 

CFSE = $-0.4 \times 3 + 0.6$
$= -1.2 + 0.6$
$= 0.6\Delta o$

d^5 strong field 

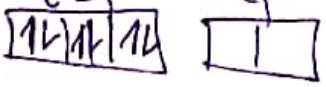
CFSE = $-0.4 \times 5 = 2.0\Delta o$

weak field 

CFSE = $-0.4 \times 3 + 2 \times 0.6$
$= -1.2 + 1.2 = 0\Delta o$

d^6

S.F



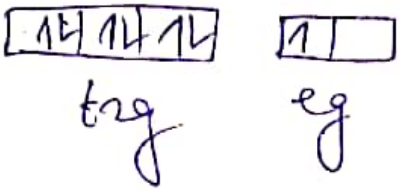
CFSE $= -6 \times 0.4 = -2.4\ \Delta_o$

W.F

CFSE $= -0.4 \times 4 + 2 \times 6$
$= -1.6 + 1.2$
$= -0.4\ \Delta_o$

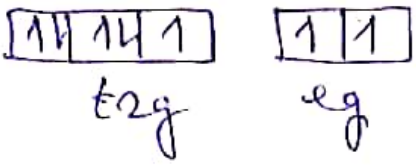
d^7

S.F



CFSE $= -0.4 \times 6 + 0.6$
$= -2.4 + 0.6$
$= -1.8\ \Delta_o$

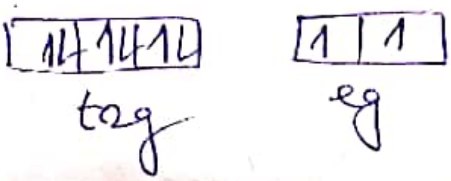
W.F



CFSE $= -0.4 \times 5 + 2 \times 0.6$
$= -2.0 + 1.2$
$= -0.8\ \Delta_o$

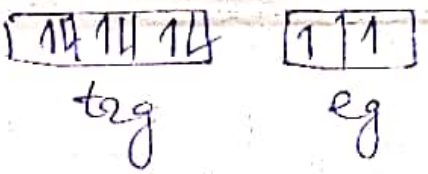
d^8

S.F



CFSE $= -0.4 \times 6 + 2 \times 0.6$
$= -2.4 + 1.2$
$= -1.2\ \Delta_o$

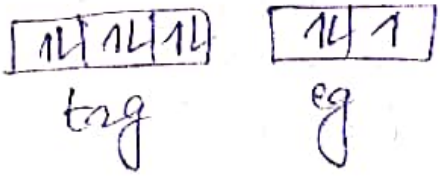
W.F



CFSE $= -0.4 \times 6 + 2 \times 0.6$
$= -2.4 + 1.2$
$= -1.2\ \Delta_o$

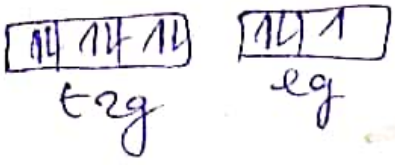
d^9

S.F



CFSE $= -0.4 \times 6 + 3 \times 0.6$
$= -2.4 + 1.8$
$= -0.6\ \Delta_o$

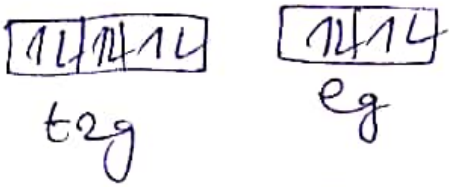
W.F



CFSE $= -0.4 \times 6 + 3 \times 0.6$
$= -2.4 + 1.8$
$= -0.6\ \Delta_o$

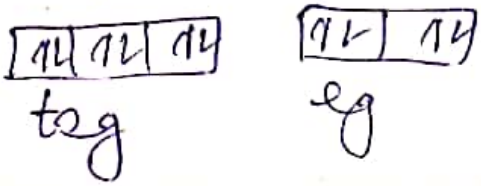
d^{10}

S.F



CFSE $= -0.4 \times 6 + 4 \times 0.6$
$= -2.4 + 2.4$
$= 0$

W.F



CFSE $= -0.4 \times 6 + 4 \times 0.6$
$= -2.4 + 2.4$
$= 0$