

# Crystal Field Stabilization Energy (CFSE)

The crystal field stabilization energy (CFSE) may be defined as the lowering in the energy of a transition metal ion in a given ligand environment due to crystal field effects. The splitting of d orbitals of a metal ion due to electrostatic crystal field potential of ligands and the consequences thereof are known as crystal field effects.

d<sup>2</sup> system

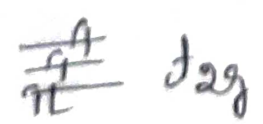
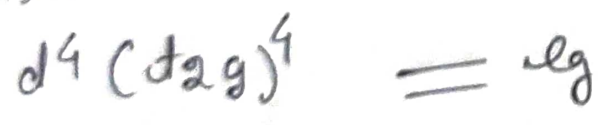
$$CFSE = 2 \times (-4Dq) = -8Dq$$

d<sup>3</sup> system

$$CFSE = 3 \times (-4Dq) = -12Dq$$

## pairing energy

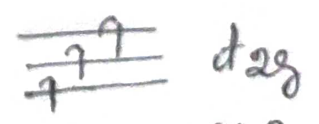
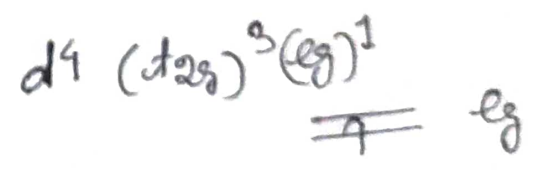
The energy required to pair the electrons with one another.



$$CFSE = 4 \times -4Dq = -16Dq$$

or  
 $-16Dq + P$

$\Delta_0 > P$   
 Strong field  
 Low spin complex



$$3 \times -4Dq + 1(6Dq)$$

$$= -6Dq$$

$P > \Delta_0$   
 weak field  
 High spin complex

d5

lg

99

111 tag

99

Strong field

$\Delta_0 \rangle P$

$$3(-4D_2) + 2(6) = 0$$

CASE 5  $5(-4D_2) = -20D_2$

or

Weak field

$P \rangle \Delta_0$

$$-20D_2 + 2P$$

$$P^2 - = (P^2 - ) \times 2 = 0$$

$$P^2 - = (P^2 - ) \times 2 = 0$$