The crystal field stabilisation energy (CFSE) of $[Fe(H_2O)_6]Cl_2$ and $K_2[NiCl_4]$, respectively, are

(2019 Main, 10 April II)

(a) $-0.4\,\Delta_o$ and $-1.2\,\Delta_t$ (b) $-0.4\,\Delta_o$ and $-0.8\,\Delta_t$

(c) $-2.4\,\Delta_o$ and $-1.2\,\Delta_t$ (d) $-0.6\,\Delta_o$ and $-0.8\,\Delta_t$

> **Key Idea** Crystal field stabilisation energy (CFSE) for octahedral complexes $= (-0.4x + 0.6y)\Delta_o$
>
> where, x = number of electrons occupying t_{2g} orbital.
>
> y = number of electrons occupying e_g orbital.
>
> CFSE for tetrahedral complexes
>
> $= (-0.6x + 0.4y)\Delta_t$
>
> where, x = number of electrons occupying e orbital.
>
> y = number of electrons occupying t orbital.

In $[Fe(H_2O)_6]Cl_2$, H_2O is a weak field ligand, so it is a high spin (outer orbital) octahedral complex of Fe^{2+}.

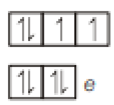
$Fe^{2+}(3d^6) =$

$\therefore$ CFSE $= (-0.4x + 0.6y)\Delta_o$

$= [-0.4 \times 4 + 0.6 \times 2]\Delta_o = -0.4\Delta_o$

In $K_2[NiCl_4]$, Cl^- is a weak field ligand, so it is a high spin tetrahedral complex of Ni^{2+}.

$Ni^{2+}(3d^8) =$



$\therefore$ CFSE $= (-0.6 \times 4 + 0.4 \times 4)\Delta_t = -0.8\Delta_t$