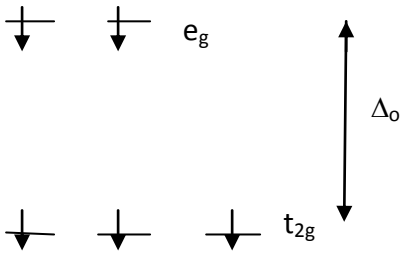
Answer on Question #77349, Chemistry / General Chemistry

Between the weak field octahedral complexes of d5 ion and d7 ion, which one will have a larger magnetic moment ?

Solution

Crystal field splitting diagram for d^5 ion (in weak field):



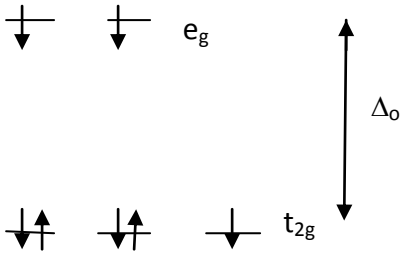
This complex is paramagnetic as it has five lone electrons.

The formula used to calculate the spin-only magnetic moment, based on the number of unpaired electrons n, is:

$$\mu_{so} = \sqrt{n(n+2)}\mu_B$$

For ion d^5 $\mu_{so} = \sqrt{5(5+2)} = \sqrt{35} = 5.92\ \mu_B$

Crystal field splitting diagram for d^7 ion (in weak field):



This complex is paramagnetic as it has three lone electrons.

The formula used to calculate the spin-only magnetic moment, based on the number of unpaired electrons n, is:

$$\mu_{so} = \sqrt{n(n+2)}\mu_B$$

For ion d^7 $\mu_{so} = \sqrt{3(3+2)} = \sqrt{15} = 3.87\ \mu_B$

So, the weak field octahedral complex of d^5 ion has a larger magnetic moment ($5.92\ \mu_B$) than the weak field octahedral complex of d^7 ion ($3.87\ \mu_B$).

Answer: the weak field octahedral complex of d^5 ion has a larger magnetic moment ($5.92\ \mu_B$) than the weak field octahedral complex of d^7 ion ($3.87\ \mu_B$).