

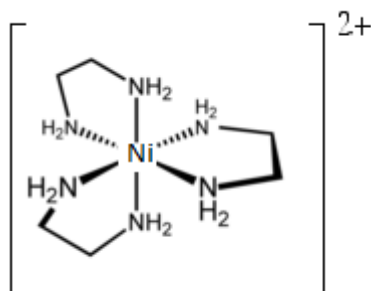
Answer on Question #77158, Chemistry / Inorganic Chemistry

Draw the structure of the following coordination compounds and determine the oxidation state, d orbital electronic configuration, ($t_{2g} e_g$ or $e_g t_{2g}$ configuration and the spin only magnetic moment of the metal atom.

$[\text{Ni}(\text{en})_3]^{2+}$, en = 1,2-diaminoethane

Solution

Structure of $[\text{Ni}(\text{en})_3]^{2+}$, en = 1,2-diaminoethane



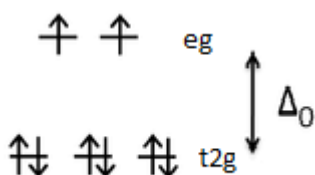
The electron configuration of Nickel is : $[\text{Ar}] 3d^8 4s^2$

Oxidation state of Nickel in $[\text{Ni}(\text{en})_3]^{2+}$ is Ni^{2+} , as en ligands are neutral.

Atom of Ni loses two electrons to become an ion Ni^{2+} therefore it's electronic configuration is d^8 .

The complex $[\text{Ni}(\text{en})_3]^{2+}$ has an octahedral shape, en is a strong field ligand, but the appropriate crystal field diagram shows that only one configuration is possible irrespective of the strength of the ligand field.

Splitting d-orbital diagram of $[\text{Ni}(\text{en})_3]^{2+}$ is: $t_{2g}^6 e_g^2$



This complex is paramagnetic as it has two lone electrons. To find the spin only magnetic moment of the metal atom we should use the formula, based on the number of unpaired electrons n:

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

For complex $[\text{Ni}(\text{en})_3]^{2+}$ $\mu_{so} = \sqrt{2(2+2)} = \sqrt{8} = 2.83 \mu_B$