The Coordination Bond

**Definition:**
The donation of an electron pair from a ligand to a metal

![Coordination Bond Diagram]

- a Lewis acid/base reaction where a Lewis base (electron donor, ligand) “donates” a pair of electrons to a Lewis acid (electron acceptor, metal)

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**The Chelate Effect**

Complexes of bidentate and polydentate ligands are more stable than those with unidentate ligands of similar strength

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\begin{align*}
\text{Ni}^{2+} + 6\text{NH}_3 & \rightleftharpoons \text{[Ni(NH}_3]_6^{2+}} \quad \log \beta = 8.61 \\
\text{Ni}^{2+} + 3\text{en} & \rightleftharpoons \text{[Ni(en)}_3^{2+}} \quad \log \beta = 18.28
\end{align*}
\]

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**The Macrocycle Effect**

Complexes of macrocyclic ligands are more stable than those with polydentate ligands of similar strength

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\begin{align*}
\text{[Zn(H}_2\text{O)}_6]^{2+} + \text{tdta} & \rightleftharpoons \text{[Zn(tdta)}]}^{2+} + 6\text{H}_2\text{O} \quad \log \beta = 11.2 \\
\text{[Zn(H}_2\text{O)}_6]^{2+} + \text{cyclam} & \rightleftharpoons \text{[Ni(cyclam)}]}^{2+} + 6\text{H}_2\text{O} \quad \log \beta = 15.3
\end{align*}
\]

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**Ligands**

A LIGAND is a neutral molecule or an ion having a lone pair of electrons that can be used to form a bond with a metal ion.

**Unidentate (Monodentate) ligand** – forms ONE bond

**Bidentate** ligand – can form TWO bonds

**Polydentate ligand** – can form MORE THAN TWO bonds

- tridentate
- tetradentate
- pentadentate
- hexadentate
- ...