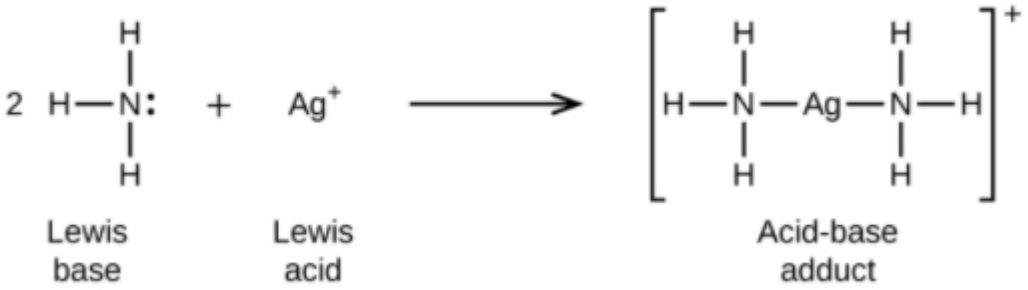
Lewis Acids and Bases

A **coordination bond** is a bond in which one atom supplies a pair of electrons to the bond.

Lewis acid-base reactions occur with coordination compounds, a **Lewis Base** being the species donating the electron pair and the **Lewis Acid** being the species accepting the electron pair. The product is a **Lewis acid-base adduct**.

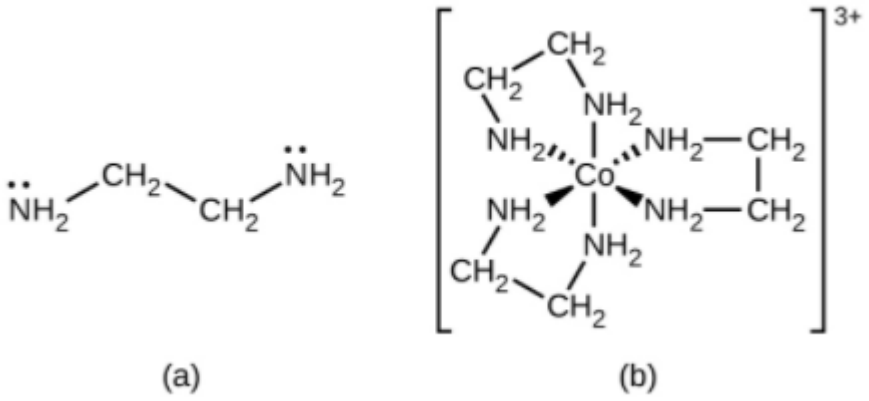


Transition metals typically compose the central portion of a lewis species, where the ions and molecules bound to them are **ligands** participating in a subfield of chemistry known as **coordination chemistry**.

The rates of coordination compound formation and dissociation can be described by K_f and K_d (formation and dissociation), with both being of the familiar $\frac{products}{reactants}$ format and $K_d = K_f^{-1}$

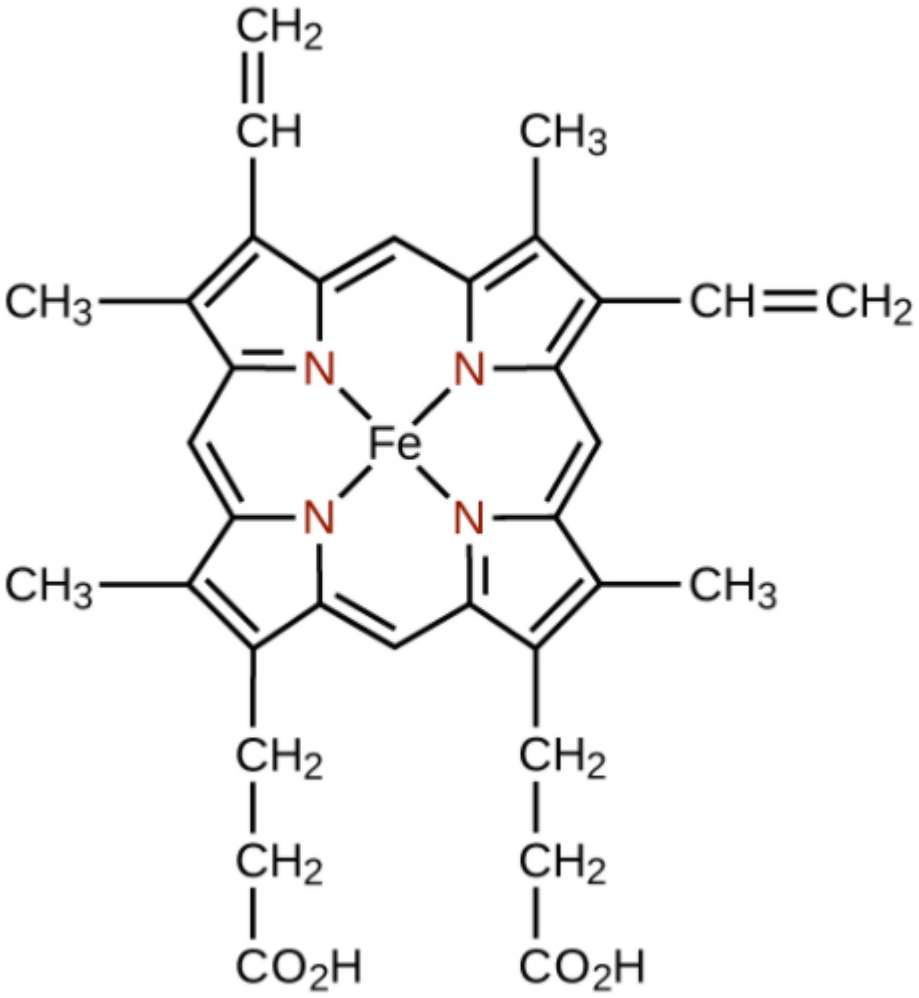
Coordination Chemistry

The **coordination sphere** consists of a metal ion and the ligands coordinating it. The **coordination number** of the central metal is the number of ligands that the metal is bound to. Ligands are refered to as dentate, signifying how many atoms they connect to the central metal with (monodentate,bidentate,tridentate, etc.).



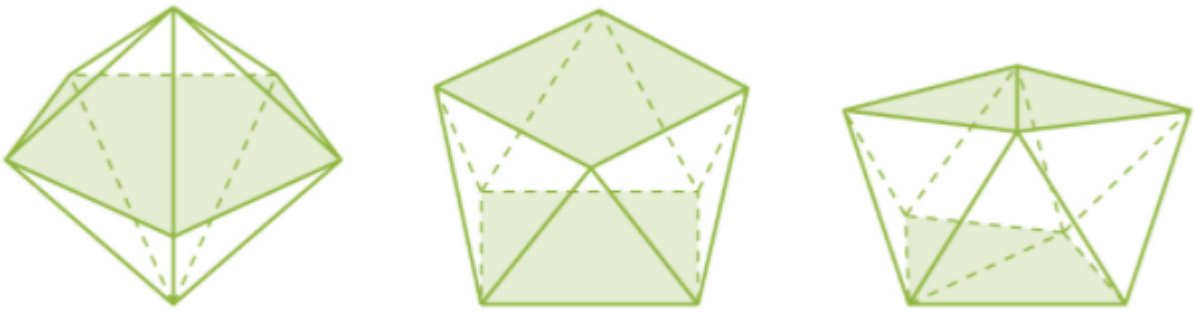
Bidentate ligand

Polydentate ligands can **chelate** an ion by forming many bonds with the central atom.



Heme chelation of iron

Coordination complexes can form complex structures based on how many ligands are bound to them, some examples are below.



Pentagonal bipyramid Square antiprism Dodecahedral

Coordination Numbers and Molecular Geometry

Coordination Number	Molecular Geometry	Example
2	linear	$[Ag(NH_3)_2]^+$
3	trigonal planar	$[Cu(CN)_3]^{2-}$
4	tetrahedral(d^0 or d^{10}), low oxidation states for M	$[Ni(CO)_4]$
4	square planar (d^8)	$[NiCl_4]^{2-}$
5	trigonal bipyramidal	$[CoCl_5]^{2-}$
5	square pyramidal	$[VO(CN)_4]^{2-}$
6	octahedral	$[CoCl_6]^{3-}$
7	pentagonal bipyramid	$[ZrF_7]^{3-}$
8	square antiprism	$[ReF_8]^{2-}$
8	dodecahedron	$[Mo(CN)_8]^{4-}$
9 and above	more complicated structures	$[ReH_9]^{2-}$