

COORDINATION COMPLEXES

The bond that forms between a Lewis base and a Lewis acid is sometimes called a dative bond or a coordinate bond. The term used for the donation of a Lewis base to a Lewis acid, without any other bonding changes, is coordination. Another term for Lewis acid-base complexes, especially used in the context of transition metal chemistry, is coordination complexes. Sometimes the Lewis base is referred to as a ligand; more generally, a ligand is just one molecule that binds to another.

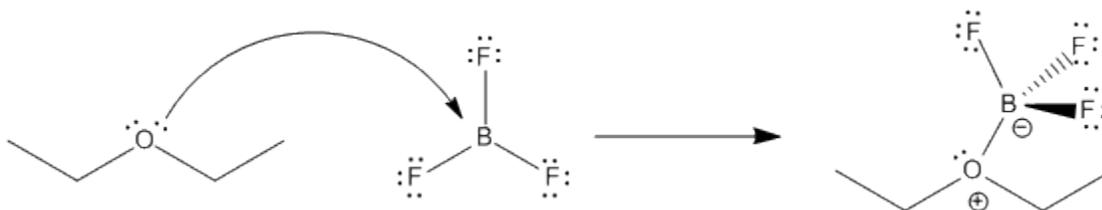


Figure AB6.1. Formation of a Lewis acid-base complex.

An example of a coordination complex is hexaaquo cobalt dichloride, $\text{Co}(\text{H}_2\text{O})_6\text{Cl}_2$. This compound contains a Co^{2+} ion. This electrophilic metal ion is coordinated by six nucleophilic water ligands. Because the water molecules are neutral, the complex still has a 2+ charge overall. There are two chloride counterions to balance the charge, but the chlorides are not attached to the complex ion.

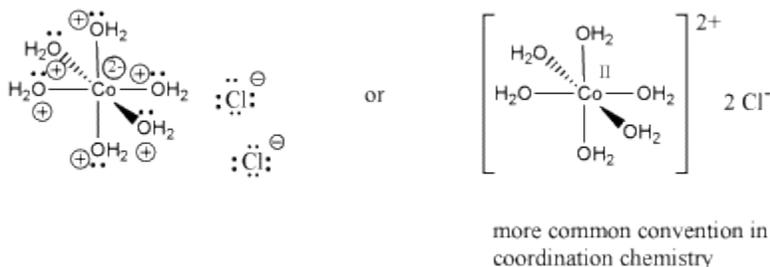


Figure AB6.2. Representations of a transition metal coordination complex.

Notice that the usual Lewis conventions are usually abandoned in drawing coordination complexes of transition metals. With so many different nucleophiles sticking to the Lewis acid, the number of formal charges that must be drawn becomes very cumbersome. Usually the oxidation state of the metal cation is denoted. The oxidation state essentially means the charge on the metal cation and it is written in Roman numerals beside the metal atom. In addition, the overall charge on the Lewis acid-base complex is given, with square brackets indicating that the charge belongs to the entire complex within the brackets. Exactly where that charge resides is up to the reader to consider.

Coordination complexes are frequently useful in mining and metallurgy. For example, nickel can be extracted from nickel ore by converting the nickel into $\text{Ni}(\text{CO})_4$ via addition of carbon monoxide. $\text{Ni}(\text{CO})_4$, or tetracarbonyl nickel, is a gas that can be easily separated from the solid ore. When removed from the presence of carbon monoxide, the coordination complex decomposes back into Ni and CO.

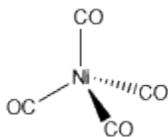


Figure AB6.3. Tetracarbonyl nickel.

Source : <http://employees.csbsju.edu/cschaller/Principles%20Chem/acidity/acid%20coordcx.htm>