3.5: Lewis Acids and Lewis Bases

The Brønsted-Lowry definition works well for the reactions we learned so far, however it also limits the scope of acid-base reactions in a way where the proton H^+ must be involved. Lewis acids and Lewis bases are defined in a more inclusive way that was first introduced by G. N. Lewis in 1923.

Lewis Acid: a species that can accept an electron pair;

Lewis Base: a species that can donate an electron pair.

All Brønsted-Lowry acids and bases fit into the Lewis definition, because the proton transfer process is essentially the reaction where the base uses its electron pair to accept a proton, as indicated by the mechanism arrow that we learned earlier. Therefore in the following reaction, the BL acid, H^+, is also the Lewis acid, and BL base, NH_3, also fits to the definition of the Lewis base.

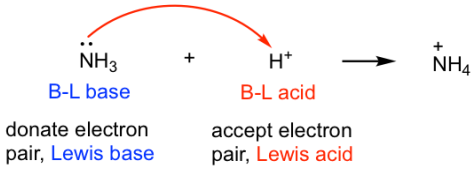


Figure 3.5a Lewis base & Lewis acid reaction

However, the Lewis definition is broader and covers more situations. For the following reaction, $B(CH_3)_3$ is the Lewis acid because boron has an incomplete octet, and the empty 2p orbital on boron is able to accept electrons. $(CH_3)_3N$ behaves as the Lewis base with the lone pair electron on N that is able to be donated.

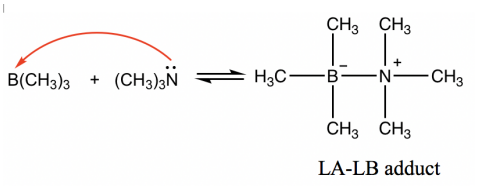


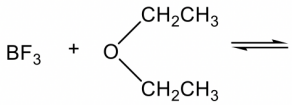
Figure 3.5b LA-LB adduct

The product between Lewis acids and Lewis bases is usually a species that has the acid and base joined together, and the product is called the “LA-LB adduct”.

Other examples of Lewis acids include electron-deficient species, such as H^+, M^+, M^{2+}, BH_3, BF_3, $AlCl_3$ etc. Lewis bases can be: amine, ether or other species that have lone pair electrons to donate.

Exercises 3.3

Show the product of the following LA-LB reaction:



Answers to Practice Questions Chapter 3