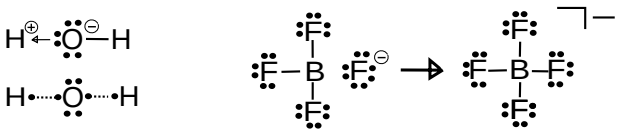
Lewis Acid-Base Theory

Skills to Develop

- Define Lewis acids and Lewis bases

Previously we said that an acid produces H^+ when dissolved in water, and a base produces OH^- when dissolved in water. Then the acid and base (meaning H^+ and OH^-) can react (without redox) to make water. This is a pretty good definition, but it is kind of small.

Lewis explained that in many reactions that form new bonds, both electrons in the new bond come from 1 atom (or 1 reactant) only, instead of 1 electron coming from each. He called all these reactions **acid-base reactions**. The picture shows water forming from the elements, in a redox process, and water forming from hydrogen ion and hydroxide ion, in an acid base process. It also shows how the tetrafluoroborate ion, BF_4^- can form from boron trifluoride and fluoride ion.



Left top, water forming by an acid-base reaction. Left bottom, water forming by a redox reaction. Right, a Lewis acid-base reaction.

In general, if we can draw a good Lewis structure by making two molecules or ions share an electron pair, it's likely that the reaction can happen. For instance, BH_3 can react with NH_3, because N has an extra lone pair, and B only has 6 electrons and 3 connected atoms. So a **Lewis acid** is something than can fit 2 more electrons from a different molecule. It can share another molecule's lone pair. A **Lewis base** is any molecule or ion with a lone pair to share. It's easy to see what can be a Lewis base just by drawing a Lewis structure. Lewis acids are usually cations, like H^+or Al^{3+}. Boron is a famous Lewis base because it often makes **electron-deficient** compounds, like BH_3, in which it only has 6 electrons. Try drawing Lewis structures for an acid-forming anhydride combination reaction. Is the anhydride a Lewis acid or base?

Contributors and Attributions

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