SECTION 2

Acid-Base Theories

OBJECTIVES

- Define and recognize *Brønsted-Lowry acids* and *bases.*
- Define a *Lewis acid* and a *Lewis base.*
- Name compounds that are acids under the Lewis definition but are not acids under the Brønsted-Lowry definition.

CHEMISTRY INTERACTIVE TUTOR

Module 8: Strong and Weakly Ionized Species, pH, and Titrations

For most uses, scientists found the Arrhenius definition of acids and bases to be adequate. However, as scientists further investigated acid-base behavior, they found that some substances acted as acids or bases when they were not in a water solution. Because the Arrhenius definition requires that the substances be aqueous, the definitions of acids and bases had to be revised.

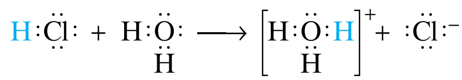
Brønsted-Lowry Acids and Bases

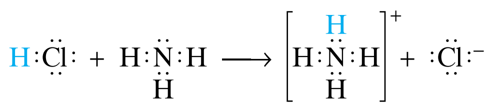
In 1923, the Danish chemist J. N. Brønsted and the English chemist T. M. Lowry independently expanded the Arrhenius acid definition. *A* **Brønsted-Lowry acid** *is a molecule or ion that is a proton donor.* Because H^+ is a proton, all acids as defined by Arrhenius donate protons to water and are Brønsted-Lowry acids as well. Substances other than molecules, such as certain ions, can also donate protons. Such substances are not Arrhenius acids but are included in the category of Brønsted-Lowry acids.

Hydrogen chloride acts as a Brønsted-Lowry acid when it reacts with ammonia. The HCl transfers protons to NH_3 much as it does in water.

$$HCl + NH_3 \longrightarrow NH_4^+ + Cl^-$$

A proton is transferred from the hydrogen chloride molecule, HCl, to the ammonia molecule, NH_3. The ammonium ion, NH_4^+, is formed. Electron-dot formulas show the similarity of this reaction to the reaction of HCl with water.





In both reactions, hydrogen chloride is a Brønsted-Lowry acid.

Water can also act as a Brønsted-Lowry acid. Consider, for example, the following reaction, in which the water molecule donates a proton to the ammonia molecule.

$$H_2O(l) + NH_3(aq) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$$