CHEMISTRY AT A GLANCE

Acid-Base Definitions

ARRHENIUS SYSTEM

Arrhenius Acid
- A hydrogen-containing compound that produces, in water, hydrogen ions (H^+ ions)
- Hydrogen ions (the acidic species) are produced through ionization.

IONIZATION: The process whereby, in aqueous solution, positive and negative ions are produced from a molecular compound.

Arrhenius Base
- A hydroxide-containing compound that produces, in water, hydroxide ions (OH^- ions)
- Hydroxide ions (the basic species) are produced through dissociation.

DISSOCIATION: The process whereby, in aqueous solution, positive and negative ions are released from an ionic compound.

BRØNSTED–LOWRY SYSTEM

Brønsted–Lowry Acid
- A substance that can donate a proton (H^+ ion) to some other substance

A proton donor

Brønsted–Lowry Base
- A substance that can accept a proton (H^+ ion) from some other substance

A proton acceptor

Brønsted–Lowry acid and Brønsted–Lowry base production must occur simultaneously. You cannot have one without the other.

Conjugate Acid–Base Pairs
- Every Brønsted–Lowry acid has a conjugate base and every Brønsted–Lowry base has a conjugate acid.
- The members of a conjugate acid–base pair differ from each other through the loss or gain of a proton.
- In general terms, the relationships are

$$\underbrace{HA}_{\text{Acid}} + \underbrace{B}_{\text{Base}} \rightleftharpoons \underbrace{HB^+}_{\text{Conjugate acid}} + \underbrace{A^-}_{\text{Conjugate base}}$$

Conjugate Base
- The species that remains when a proton is removed from a Brønsted–Lowry acid

H_2O is the conjugate base of H_3O^+.

Conjugate Acid
- The species formed when a proton is accepted by a Brønsted–Lowry base

H_3O^+ is the conjugate acid of H_2O.

Figure 10.4 The sour taste of limes and other citrus fruit is due to the citric acid present in the fruit juice.

Writing the formula for acetic acid as $HC_2H_3O_2$ instead of $C_2H_4O_2$ indicates that there are two different kinds of hydrogen atoms present. One of the hydrogen atoms is acidic, and the other three are not. When some hydrogen atoms are acidic and others are not, we write the acidic hydrogens first, thus separating them from the other hydrogen atoms in the formula. Citric acid, the principal acid in citrus fruits (see Figure 10.4), is another example of an acid that contains both acidic and nonacidic hydrogens. Its formula, $H_3C_6H_5O_7$, indicates that three of the eight hydrogen atoms present in a molecule are acidic.

10.4 STRENGTHS OF ACIDS AND BASES

Brønsted–Lowry acids vary in their ability to transfer protons and produce hydronium ions in aqueous solution. Acids can be classified as strong or weak on the basis of the extent to which proton transfer occurs in aqueous solution. A **strong acid** *is an acid that transfers 100%, or*