Compounds in Aqueous Solutions

SECTION 1

Objectives

- Write equations for the dissolution of soluble ionic compounds in water.
- Predict whether a precipitate will form when solutions of soluble ionic compounds are combined, and write net ionic equations for precipitation reactions.
- Compare dissociation of ionic compounds with ionization of molecular compounds.
- Draw the structure of the hydronium ion, and explain why it is used to represent the hydrogen ion in solution.
- Distinguish between strong electrolytes and weak electrolytes.

As you have learned, solid compounds can be ionic or molecular. In an ionic solid, a crystal structure is made up of charged particles held together by ionic attractions. In a molecular solid, molecules are composed of covalently bonded atoms. The solid is held together by noncovalent, intermolecular forces. When they dissolve in water, ionic compounds and molecular compounds behave differently.

Dissociation

When a compound that is made of ions dissolves in water, the ions separate from one another, as shown in **Figure 1.** *This separation of ions that occurs when an ionic compound dissolves is called* **dissociation.** For example, dissociation of sodium chloride and calcium chloride in water can be represented by the following equations. (As usual, (*s*) indicates a solid species, and (*aq*) indicates a species in an aqueous solution. Note that each equation is balanced for charge as well as for atoms.)

$$NaCl(s) \xrightarrow{H_2O} Na^+(aq) + Cl^-(aq)$$

$$CaCl_2(s) \xrightarrow{H_2O} Ca^{2+}(aq) + 2Cl^-(aq)$$

Notice the number of ions produced per formula unit in the equations above. One formula unit of sodium chloride gives two ions in solution, whereas one formula unit of calcium chloride gives three ions in solution.

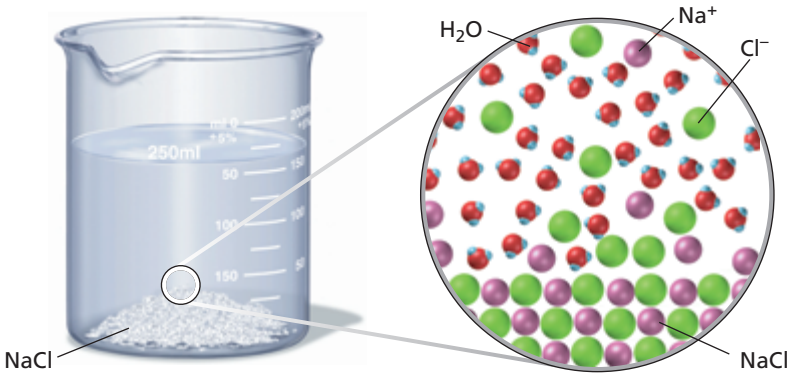

FIGURE 1 When NaCl dissolves in water, the ions separate as they leave the crystal.