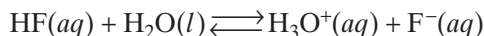


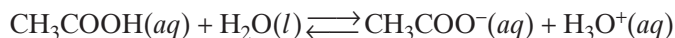
## Weak Electrolytes

Some molecular compounds form aqueous solutions that contain not only dissolved ions but also some dissolved molecules that are not ionized. Hydrogen fluoride, HF, dissolves in water to give an acidic solution known as hydrofluoric acid. However, the hydrogen-fluorine bond is much stronger than the bonds between hydrogen and the other halogens. When hydrogen fluoride dissolves, some molecules ionize. But the reverse reaction—the transfer of  $\text{H}^+$  ions back to  $\text{F}^-$  ions to form hydrogen fluoride molecules—also takes place.



Thus, the concentration of dissolved intact HF is much greater than the concentration of  $\text{H}_3\text{O}^+$  and  $\text{F}^-$  ions.

Hydrogen fluoride is an example of a *weak electrolyte*. A **weak electrolyte** is any compound whose dilute aqueous solutions conduct electricity poorly; this is due to the presence of a small amount of the dissolved compound in the form of ions. This is in contrast to a non-electrolyte, such as the molecular compound sucrose, which dissolves but does not produce any ions in solution. Another example of a weak electrolyte is acetic acid,  $\text{CH}_3\text{COOH}$ . Only a small percentage of the acetic acid molecules ionize in aqueous solution.



The description of an electrolyte as strong or weak must not be confused with the description of a solution as concentrated or dilute. Strong and weak electrolytes differ in the *degree of ionization or dissociation*. Concentrated and dilute solutions differ in the *amount of solute dissolved* in a given quantity of a solvent. Hydrochloric acid is always a strong electrolyte. This is true even in a solution that is 0.000 01 M—a very dilute solution. By contrast, acetic acid is always considered a weak electrolyte, even in a 10 M solution—a very concentrated solution.

## SECTION REVIEW

1. Write the equation for the dissolution of  $\text{Sr}(\text{NO}_3)_2$  in water. How many moles of strontium ions and nitrate ions are produced by dissolving 0.5 mol of strontium nitrate?
2. Will a precipitate form if solutions of magnesium acetate and strontium chloride are combined?
3. What determines whether a molecular compound will be ionized in a polar solvent?

4. Explain why HCl is a strong electrolyte and HF is a weak electrolyte.

### Critical Thinking

5. **PREDICTING OUTCOMES** For each of the following pairs, tell which solution contains the larger total concentration of ions.
  - a. 0.10 M HCl and 0.05 M HCl
  - b. 0.10 M HCl and 0.10 M HF
  - c. 0.10 M HCl and 0.10 M  $\text{CaCl}_2$