

# Acid-Base Reactions

## SECTION 3

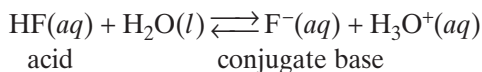
### OBJECTIVES

- Describe a conjugate acid, a conjugate base, and an amphoteric compound.
- Explain the process of neutralization.
- Define *acid rain*, give examples of compounds that can cause acid rain, and describe effects of acid rain.

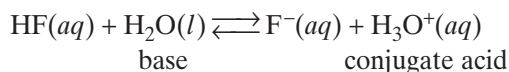
**I**n the previous sections, you learned about three acid-base theories: Arrhenius, Brønsted-Lowry, and Lewis. The Brønsted-Lowry theory is especially useful for describing acid-base reactions that take place in aqueous solutions. This section will use the Brønsted-Lowry description to explore reactions between acids and bases.

### Conjugate Acids and Bases

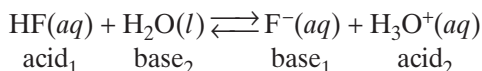
The Brønsted-Lowry definitions of acids and bases provide a basis for studying proton-transfer reactions. Suppose that a Brønsted-Lowry acid gives up a proton; the remaining ion or molecule can re-accept that proton and can act as a base. Such a base is known as a conjugate base. Thus, *the species that remains after a Brønsted-Lowry acid has given up a proton is the **conjugate base** of that acid.* For example, the fluoride ion is the conjugate base of hydrofluoric acid.



In this reaction, the water molecule is a Brønsted-Lowry base. It accepts a proton from HF to form  $\text{H}_3\text{O}^+$ , which is an acid. The hydronium ion is the conjugate acid of water. *The species that is formed when a Brønsted-Lowry base gains a proton is the **conjugate acid** of that base.*



In general, Brønsted-Lowry acid-base reactions are equilibrium systems meaning that both the forward and reverse reactions occur. They involve two acid-base pairs, known as conjugate acid-base pairs.



The subscripts designate the two conjugate acid-base pairs: (1) HF and  $\text{F}^-$  and (2)  $\text{H}_3\text{O}^+$  and  $\text{H}_2\text{O}$ . In every conjugate acid-base pair, the acid has one more proton than its conjugate base.