CHEMISTRY AT A GLANCE

Buffer Systems

BUFFER SOLUTION

- A solution that resists major change in pH when small amounts of strong acid or strong base are added
- A typical buffer system contains a weak acid and its conjugate base

Common biochemical buffer systems are
H_2CO_3/HCO_3^-
$H_2PO_4^-/HPO_4^{2-}$

Weak Acid

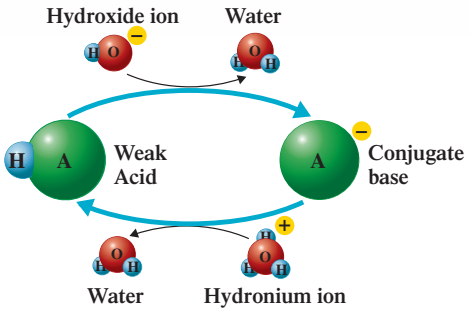
- The buffer component that reacts with added base
- Reaction converts it into its conjugate base

Conjugate Base of Weak Acid

- The buffer component that reacts with added acid
- Reaction converts it into its conjugate acid

DIAGRAMS OF BUFFER ACTION

$$HA \underset{H_3O^+}{\overset{OH^-}{\rightleftharpoons}} A^-$$



EXAMPLE 10.11

Calculating the pH of a Buffer Solution Using the Henderson–Hasselbalch Equation

What is the pH of a buffer solution that is 0.5 M in formic acid ($HCHO_2$) and 1.0 M in sodium formate ($NaCHO_2$)? The pK_a for formic acid is 3.74.

Solution

The concentrations for the buffering species are

$$HCHO_2 = 0.5\ M \qquad CHO_2^- = 1.0\ M$$

Substituting these values into the Henderson–Hasselbalch equation gives

$$pH = pK_a + \log\frac{[CHO_2^-]}{[HCHO_2]} = 3.74 + \log\frac{1.0}{0.5}$$

$$= 3.74 + \log 2 = 3.74 + 0.30$$

$$= 4.04$$

Practice Exercise 10.11

What is the pH of a buffer solution that is 0.6 M in acetic acid ($HC_2H_3O_2$) and 1.5 M in sodium acetate ($NaC_2H_3O_2$)? The pK_a for acetic acid is 4.74.

Answer: pH = 5.14

10.14 ELECTROLYTES

Aqueous solutions in which ions are present are good conductors of electricity, and the greater the number of ions present, the better the solution conducts electricity. Acids, bases, and soluble salts all produce ions in solution; thus they all produce solutions that conduct electricity. All three types of compounds are said to be electrolytes. An **electrolyte** *is a substance whose aqueous solution conducts electricity.* The presence of ions (charged particles) explains the electrical conductivity.