Acids and Bases in Solution

Key Concepts

- What kinds of ions do acids and bases form in water?
- What does pH tell you about a solution?
- What happens in a neutralization reaction?

Many acids have formulas that begin with hydrogen. The acids you will learn about are made of hydrogen ions and various kinds of negative ions in solution with water. A **hydrogen ion (H^+)** is an atom of hydrogen that has lost its electron. **An acid is any substance that produces hydrogen ions (H^+) in water.** Hydrogen ions cause the properties of acids.

Many bases are made of positive ions combined with hydroxide ions. The **hydroxide ion (OH^-)** is a negative ion made of oxygen and hydrogen. When bases dissolve in water, the positive ions and hydroxide ions separate. **A base is any substance that produces hydroxide ions (OH^-) in water.** Hydroxide ions are responsible for the bitter taste and slippery feel of bases. Hydroxide ions also turn red litmus paper blue.

Acids and bases may be strong or weak. Strength refers to how well an acid or base produces ions in water. In a strong acid, most of the molecules react to form ions in solution. In a weak acid, fewer molecules react. Similarly, strong bases produce more OH^- ions in solution than equal concentrations of weak bases.

Chemists use a numeric scale called pH to describe the concentration of hydrogen ions in a solution. The **pH scale** is a range of values from 0 to 14. It expresses the concentration of hydrogen ions in a solution. **A low pH tells you that the concentration of hydrogen ions is high. In contrast, a high pH tells you that the concentration of hydrogen ions is low.** A solution with a pH lower than 7 is acidic. A solution with a pH higher than 7 is basic. If the pH is exactly 7, the solution is neutral.

A reaction between an acid and a base is called **neutralization**. After neutralization, an acid-base mixture is not as acidic or basic as the individual starting solutions were.

A **salt** is any ionic compound that can be made from the neutralization of an acid with a base. A salt is made of the positive ion of a base and the negative ion of an acid. **In a neutralization reaction, an acid reacts with a base to produce a salt and water.**

Acids and Bases in Solution (pp. 274–279)

This section explains what kinds of ions acids and bases form in water. It also describes how the concentrations of ions are measured in a solution.

Use Target Reading Skills

As you read, complete the outline about acids and bases in solution. Use the red headings for the main ideas. Use the blue headings for subtopics where possible. If there are no blue headings, write your own subtopics.

Acids and Bases in Solution
I. Acids in Solution A. B. II. Bases in Solution A. B. III. A. B. IV. A. B.

Acids in Solution (pp. 274–275)

1. What is a hydrogen ion (H^+)?

_____

_____

2. What do acids in water separate into?

_____

3. Any substance that produces hydrogen ions (H^+) in water can be called a(n) _____.

Bases in Solution (p. 275)

4. What is a hydroxide ion (OH^-)?

_____

_____

5. Any substance that produces hydroxide ions (OH^-) in water can be called a(n) _____.

Strength of Acids and Bases (pp. 276–277)

6. Circle the letter of each sentence that is true about the strength of acids and bases.

a. A strong base produces more OH^- ions than a weak base.
b. A weak acid produces more OH^- ions than a strong acid.
c. A strong acid produces more H^+ ions than a weak acid.
d. A weak base produces more H^+ ions than a strong base.

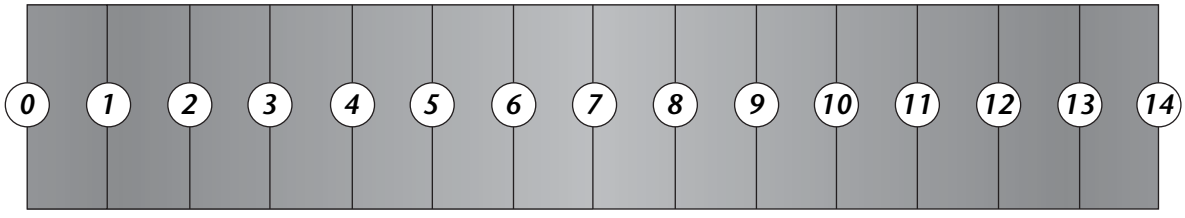
7. What is the pH scale?

_____

_____

_____

8. On the scale below, add labels to show the pH of these substances: milk, soap, water, vinegar, lemon, and ammonia.



9. Is the following sentence true or false? A strong acid is safe as long as it's in a dilute solution. _____

10. When the pH of a solution is low, is the concentration of hydrogen ions high or low? _____

11. Circle the letter of each sentence that is true about pH.

a. A pH lower than 7 is acidic.
b. A pH of 7 is neutral.
c. A pH lower than 7 is basic.
d. A pH higher than 7 is acidic.

Acids and Bases in Solution *(continued)*

Acid-Base Reactions (pp. 278–279)

12. A reaction between an acid and a base is called _____.

13. Is the following sentence true or false? An acid-base mixture is always more acidic than the starting solutions were. _____

14. What is a salt?

_____

_____

_____

15. What two substances does a neutralization reaction produce?

a. _____

b. _____