Chapter 6 Acids and Bases

What You Will Learn

In this chapter, you will learn how to...

- **name** and **write** formulas for acids and bases
- **explain** how the pH scale is used to classify aqueous solutions as acidic, basic, or neutral
- **discuss** chemical reactions that involve acids and bases

Why It Matters

Acids and bases represent a very important class of chemicals. There are numerous examples of common substances that can be classified as acids or bases. The properties of acids and bases have been used throughout history to address many technological problems, and they have numerous industrial applications.

Skills You Will Use

In this chapter, you will learn how to...

- **classify** common substances as acidic, basic, or neutral
- **investigate** reactions between acids and bases

Canada is an exceptionally fortunate country, with almost 10 percent of its total area being covered by fresh water. Ontario is particularly privileged, with access to the Great Lakes. Unfortunately, the Great Lakes region and other areas in Ontario have been harmed from pollution. One particular source of this pollution is atmospheric, in the form of acid precipitation. Understanding the chemistry and properties of acids and bases has been an essential component to knowing the effects of acid precipitation and striving to counter these effects.

Activity 6-1

Cabbage Detector

Many common substances can be classified as acidic or basic. Some of these examples are from your kitchen. How can acidic and basic substances be detected based on their properties?

Safety Precautions

- Wear safety goggles and a lab apron.

Materials

- 10 mL of red cabbage juice
- 2 test tubes
- test-tube rack
- lemon juice
- "natural" or Ivory™ soap shavings

Using these materials, you can explore the properties of acids and bases.

Procedure

1. Obtain about 10 mL of red cabbage juice from your teacher.
2. Place a small amount of cabbage juice into each of two test tubes. Add enough so that the height of the juice in each tube is about 2 cm.
3. Squeeze a few drops of lemon juice, which is acidic, into the cabbage juice of one test tube. Record your observations.
4. Drop a flake of soap, which is basic, into the cabbage juice in the second test tube. Record your observations.
5. Add a flake of soap to the tube from step 3. Record what happens after adding the soap.

Questions

1. How many colour changes did you observe?
2. Are the changes that you observed chemical changes or physical changes? Explain your answer.
3. What do you think the red cabbage juice is doing?

Study Toolkit

These strategies will help you use this textbook to develop your understanding of science concepts and skills.
To find out more about these and other strategies, refer to the Study Toolkit Overview, which begins on page 560.

Reading Graphic Text

Interpreting Tables

A table consists of cells organized into rows and columns. To interpret data in the cells of a table, scan the column or row headings and then look across the rows and down columns. For example, in the table below, the word *Blue* appears in the last row of the final column. The data can be interpreted as "Bromothymol blue changes from yellow to blue within a pH range of 6.0 to 7.6."

Indicator	Colour at Lower pH Values	pH Range in Which Colour Change Occurs	Colour Change as pH Increases
Methyl orange	Red	3.2–4.4	Yellow
Methyl red	Red	4.8–6.0	Yellow
Bromothymol blue	Yellow	6.0–7.6	Blue

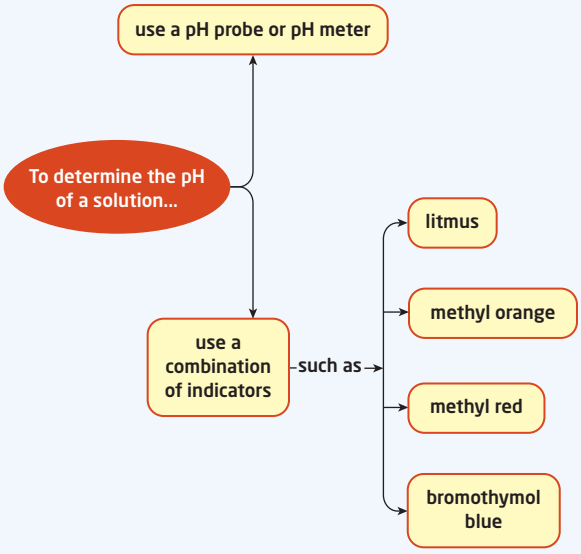
Use the Strategy

1. Find **Table 6.5** on page 234. Cover the table, and read only the title. Based on the title, explain what kind of data you expect to see in the cells.
2. Read the column and row headings carefully. Explain what they mean.
3. Choose any cell in the table. Interpret the contents of the cell by writing a complete sentence.

Organizing Your Learning

Using Graphic Organizers

Summarizing ideas in a visual format can help you understand and remember them better. In a **graphic organizer**, different shapes are sometimes used to show how ideas are related. Lines and arrows are used to show cause-and-effect or sequence relationships. The main ideas in the section titled "Determining the pH of a Solution" are summarized in the graphic organizer below.



Use the Strategy

Turn to the subsection titled "Causes of Acid Precipitation" on page 239. Use a graphic organizer to summarize the text in this subsection.

Word Study

Word Parts

The names of compounds are formed by combining different word parts. Knowing what these word parts indicate can help you determine the elements that a compound contains. For example, *hydrofluoric acid* contains the word parts *hydro* (indicating hydrogen), *fluor* (indicating fluorine), and the ending *-ic acid*.

From these word parts, you can translate *hydrofluoric acid* into its elements: hydrogen and fluorine.

Use the Strategy

Identify the word parts in *hydrobromic acid* and *hydrochloric acid*. What two elements form each acid?