Chapter 4 Properties of Elements and Compounds

What You Will Learn

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

- **identify** elements and compounds
- **describe** important physical and chemical properties of elements and compounds
- **explain** how properties of elements and compounds determine their practical uses

Why It Matters

Everything you eat, breathe, wear, and use is matter. A certain class of matter, called pure substances, is composed of elements and compounds. Understanding the properties of elements and compounds is essential for making good decisions about the products you use.

Skills You Will Use

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

- **investigate** the physical and chemical properties of compounds and elements
- **conduct** tests to identify common gases based on their chemical properties

The only thing protecting this person's hand from the flame is a layer of cloudy material. This amazing material, called aerogel, is 99.8 percent air. It holds the world record for the least dense solid, and it is 39 times better than other insulating materials at protecting objects from heat. Aerogel was first developed to use in space. It now has many applications on Earth that include insulation in winter coats and building materials. Knowing important physical and chemical properties allows scientists to develop an endless number of new materials with extraordinary applications.

Activity 4-1

Raising Underwater Artifacts

When archaeologists recover artifacts from a shipwreck, they use inflatable bags to raise the artifacts to the surface. The inflatable bags help to preserve the artifacts for future study. How can some common household chemicals be used to mimic this?

Recovering underwater artifacts relies on the properties of substances.

Safety Precautions

- Wear safety goggles and a lab apron.

Materials

- 50 mL water
- 400 mL beaker
- 100 mL graduated cylinder
- 150 mL vinegar
- 5 raisins
- 25 g baking soda
- electronic balance

Procedure

1. Make a table like the one below to record your observations. Be sure to include a title for your table.

	+ Vinegar	+ Raisins	+ Baking Soda	1 min	3 min	5 min
Observations						

2. Pour 50 mL of water into the 400 mL beaker.
3. Using the graduated cylinder, measure 150 mL of vinegar. Add the vinegar to the beaker of water. Record your observations.
4. Add the raisins to the beaker. Record your observations.
5. Slowly add 25 g of baking soda to the beaker. Immediately record your observations. Then describe any changes that occur at 1 min, 3 min, and 5 min intervals.

Questions

1. Name the different states of matter that you observed in this activity.
2. How do you think this activity is similar to using inflatable bags to raise underwater artifacts?

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 561.

Preparing For Reading

Previewing Text Features

Previewing text features can help you understand how a text is organized and predict its main ideas. Text features also help you distinguish the main body text from other text elements, such as key term definitions, activities, case studies, and sidebars. These elements are often boxed or set off in the margin. They may also have a coloured banner running along the top.

Use the Strategy

Browse through Chapter 4 and identify three different text features. How does each text feature differ from the main body text?

Word Study

Multiple Meanings

Your science textbook contains many words you may have seen before, such as *property*. Sometimes *property* refers to something that is owned by a person, but the word has a different meaning when it appears in text about chemistry. One strategy to help reinforce your understanding of a word's multiple meanings is to draw a **word map**, such as the one below. It shows the meaning of *element* in two different contexts.

Use the Strategy

Think about the word *model*. What does this word mean in these three contexts: a fashion magazine, a car dealership, and a science textbook? Draw a word map to show multiple meanings of the word *model*. Use a dictionary if you wish.

Organizing Your Learning

Summarizing

Often it is helpful to organize your learning in the form of a summary. This means restating the main ideas of a text in your own words. A summary can be in sentence or paragraph form, in point form, or in graphic form. For example, the table below shows how to create a summary of the paragraph on page 136.

Use the Strategy

Read the two paragraphs on page 139. Fill in a table like the one below, writing a summary sentence for each paragraph. Then, combine the two summary sentences into one. Compare your table and sentences with a partner and revise as necessary.

Section of Text	Main Topic	What the Text Says about the Main Topic	Supporting Details
page 136, paragraph	the properties of elements and compounds	**1.** Aerogel is an example of a substance with interesting properties. **2.** Knowing the properties of elements and compounds will help us develop new materials.	**1.** Aerogel is almost all air, holds the world record for least dense solid, and is one of the best insulators available. **2.** Scientists use physical and chemical properties as a basis for developing new materials.
Summary sentence: Knowing more about important properties of elements and compounds supports the development of new products.			