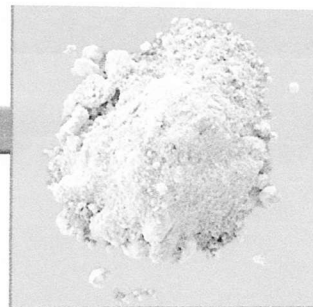


## CONCEPTUAL PROBLEM 2.2

### Classifying Materials

When the blue-green solid in the photograph is heated, a colorless gas and a black solid form. All three materials are substances. Is it possible to classify these substances as elements or compounds?



#### 1 Analyze Identify the relevant concepts.

List the known facts and relevant concepts.

- A blue-green solid is heated.
- A colorless gas and a black solid appear.
- A compound can be broken down into simpler substances by a chemical change, but an element cannot.
- Heating can cause a chemical change.

#### 2 Solve Apply concepts to this situation.

Determine if the substances are elements or compounds. Before heating, there was one substance. After heating there were two substances. The blue-green solid must be a compound. Based on the information given, it isn't possible to know if the colorless gas or black solid are elements or compounds.

### Practice Problems

18. Liquid A and Liquid B are clear liquids. They are placed in open containers and allowed to evaporate. When evaporation is complete, there is a white solid in container B, but no solid in container A. From these results, what can you infer about the two liquids?
19. A clear liquid in an open container is allowed to evaporate. After three days, a solid is left in the container. Was the clear liquid an element, a compound, or a mixture? How do you know?



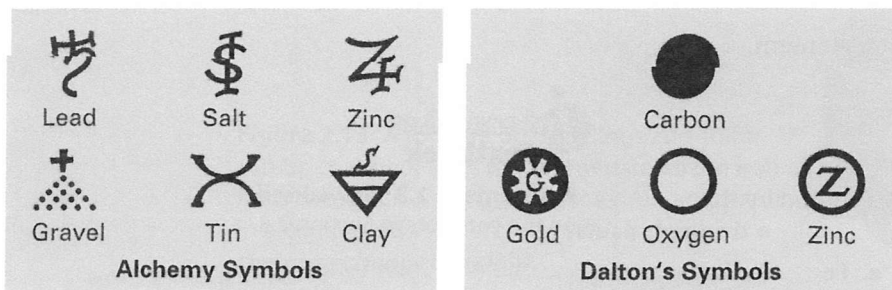
**Problem Solving 2.19** Solve Problem 19 with the help of an interactive guided tutorial.

with ChemASAP

## Symbols and Formulas

The common names water and table salt do not provide information about the chemical composition of these substances. Also, words are not ideal for showing what happens to the composition of matter during a chemical change. **Chemists use chemical symbols to represent elements, and chemical formulas to represent compounds.**

Using symbols to represent different kinds of matter is not a new idea. Figure 2.12 shows some symbols that were used in earlier centuries. The symbols used today for elements are based on a system developed by a Swedish chemist, Jöns Jacob Berzelius (1779–1848). He based his symbols on the Latin names of elements. Each element is represented by a one- or two-letter **chemical symbol**. The first letter of a chemical symbol is always capitalized. When a second letter is used, it is lowercase.



**Figure 2.12** The symbols used to represent elements have changed over time. Alchemists and the English chemist John Dalton (1766–1844) both used drawings to represent chemical elements. Today, elements are represented by one- or two-letter symbols.

## Reviewing Content

## 2.1 Properties of Matter

35. Describe the difference between an extensive property and an intensive property and give an example of each.
36. List three physical properties of copper.
37. Name two physical properties that can be used to distinguish between water and alcohol.
38. Classify the following changes as physical or chemical changes.
- a. Water boils.      b. Salt dissolves in water.  
c. Milk turns sour.      d. A metal rusts.
39. According to the law of conservation of mass, when is mass conserved?

Explain your answer.

41. Compare the arrangements of individual particles in solids, liquids, and gases.
42. Use Table 2.1 to identify four substances that undergo a physical change if the temperature is reduced from 50°C to -50°C. What is the physical change that takes place in each case?
43. Explain why sharpening a pencil is a different type of physical change than freezing water to make ice cubes.

## 2.2 Mixtures

44. What is the difference between homogeneous mixtures and heterogeneous mixtures?
45. How many phases does a solution have? Explain your answer.
46. Classify each of the following as homogeneous or heterogeneous mixtures.
- a. chocolate-chip ice cream  
b. green ink  
c. cake batter  
d. cooking oil
47. What is the goal of a distillation? Describe briefly how this goal is accomplished.

## Writing Activity

**Compare and Contrast Paragraph** Compare and contrast elements and compounds. Compare them by saying how they are alike. Contrast them by describing how they are different.

Pg. 52

five  
ok2.3 Test yourself  
problems in Section 2.3.

item ASAP

Pg. 55

mercury is Hg from the Greek word *hymeros*, meaning "sea."  
Use the symbols W and Hg to explain the system of symbols for elements.

52. What does the formula H<sub>2</sub>O tell you about the composition of water?

## 2.4 Chemical Reactions

53. Use the word equation to explain how a chemical change differs from a physical change.
- iron + sulfur  $\xrightarrow{\text{heat}}$  iron sulfide
54. Classify each of the following as a physical or chemical change. For any chemical change, list at least one clue to support your answer.
- a. A copper wire is bent.  
b. Charcoal burns in a grill.  
c. Bread dough rises when yeast is added.  
d. Sugar dissolves in water.
55. Which type of property cannot be observed without changing the composition of a substance?
56. When ammonium nitrate (NH<sub>4</sub>NO<sub>3</sub>) explodes, the products are nitrogen, oxygen, and water. When 40 grams of ammonium nitrate explode, 14 grams of nitrogen and 8 grams of oxygen form. How many grams of water form?