Physical and Chemical Changes

5.2

Every day, you experience changes in matter. Cooking eggs, burning leaves, freezing water, and mixing oil and vinegar to make salad dressing involve changes in matter. Understanding and categorizing these changes are an important first step in learning how to use them.

TRY THIS: BRAINSTORM CHANGES

Skills Focus: observing, communicating, recording

1. In a small group, brainstorm a list of changes in matter. Use a different action word for each change. For example, concrete *hardens*, wood *rots*, snow *melts*, paper *yellows*, and fireworks *explode*.
2. Which changes do you think result in a new substance being formed? Indicate these with a check mark (✔).
3. Which changes do you think add materials to the air? Indicate these changes with an asterisk (*).

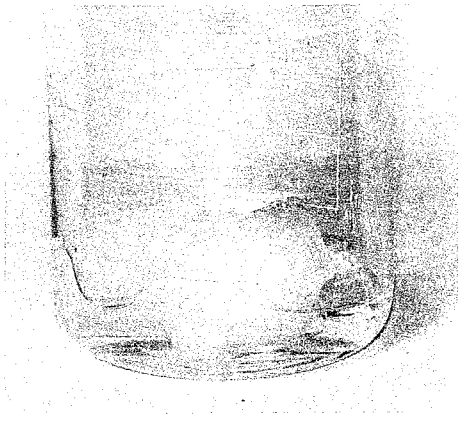
Brainstorm Changes

wood burns *

Physical Changes

In a **physical change,** the substance that is involved remains the same, even though its form or state may change. A piece of wood cut into pieces is still wood (**Figure 1(a)**). When ice melts, it is still ice (**Figure 1(b)**). Changes of state—melting, freezing, evaporation, condensation, and sublimation—are physical changes.

a) Chopping wood



b) Melting ice

Figure 1
Physical changes

In a physical change, the particles of a substance may move closer together or farther apart, or they may mix with particles of other substances. However, no new kinds of particles are produced. Dissolving is a physical change. When you dissolve sugar in water, the sugar particles spread out and mix with the water particles, but they are still there. You can reverse the process by evaporating the water and collecting the sugar.

Changes that can be reversed are called **reversible changes.** Physical changes are often reversible, but not always. You can reverse the physical change that occurs when you melt ice by cooling the water until it freezes again. You cannot reverse the physical change that occurs when wood is sawed into pieces. Changes that cannot be reversed are called **non-reversible changes.**

Chemical Changes

In a **chemical change,** the original substance is changed into one or more different substances with different properties. When a candle burns, it becomes shorter. Some wax may melt down the side of the candle, but some seems to disappear. Where does the wax go? As the wax burns, some wax particles react with oxygen in the air to produce water vapour, carbon dioxide gas, heat, and light. The wax particles that seem to disappear are actually changing into other substances.

Burning a log and frying an egg are also chemical changes (**Figure 2**). When you fry an egg, the liquid egg white part of the egg changes colour and becomes solid. The cooked egg has properties that are different from the properties of the uncooked egg. When you burn a log, you can see it getting smaller. You can feel the heat and see the light given off. You can also see new materials, such as ash and smoke.

Chemical changes always involve the production of new substances. Most chemical changes are difficult to reverse.

a) Burning wood

b) Cooking eggs

Figure 2
Chemical changes

The Importance of Chemical Changes

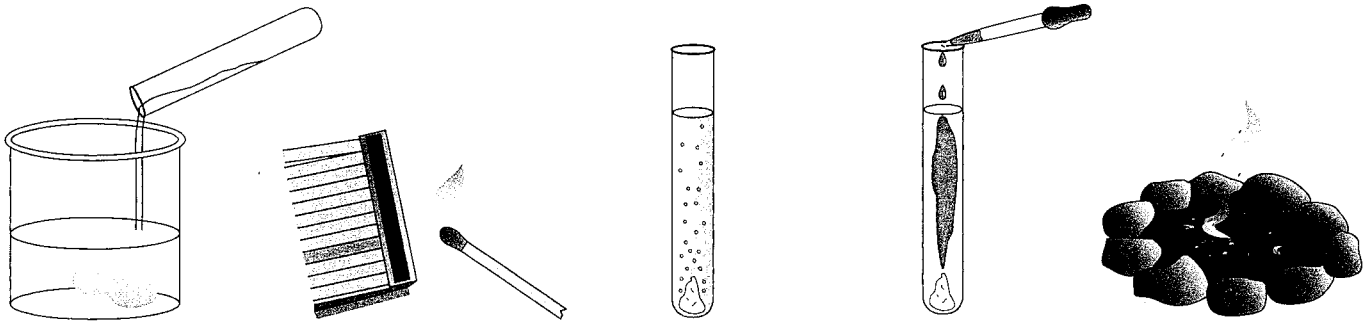
You rely on chemical changes to survive. The clothes you wear and the food you eat are the results of chemical changes. There are millions of chemical changes going on around you. Some are even happening in your body. Plants use energy from the Sun to combine water and carbon dioxide, which react to form sugar and oxygen. When you eat these plants and inhale oxygen from the air, the sugar and oxygen react in your cells to produce water, carbon dioxide, and energy. You need the energy from this reaction for your daily activities.

Determining Whether a Change Is Physical or Chemical

LEARNING TIP

Make notes on evidence of chemical change in a five-column chart. Copy the illustrations and captions from **Figure 3** as the column headings. Add examples under each heading.

You cannot see the chemical change in wax by looking at a burning candle. You can often see the results of a chemical change, however. You can see the light from a candle, and the colour and firmness of a cooked egg. So, how can you tell if a chemical change has occurred? How can you tell the difference between a chemical change and a physical change? **Figure 3** shows five clues that a chemical change has occurred.



A new colour appears.

Heat, light, or sound is given off (or absorbed).

Bubbles of gas are formed. A new odour may be noticed.

A solid material (called a precipitate) forms in a liquid.

The change is difficult or impossible to reverse.

Figure 3
Evidence of a chemical change

When classifying changes, do not jump to conclusions too quickly. The clues in **Figure 3** suggest that a new substance has been produced, but any one of them could also accompany a physical change. You must consider several clues in order to determine what type of change has taken place.