

2

States of Matter

The Big Idea

Matter exists in various physical states, which are determined by the movement of the matter's particles.

SECTION

- 1 Three States of Matter 32
- 2 Behavior of Gases 36
- 3 Changes of State 40

About the PHOTO

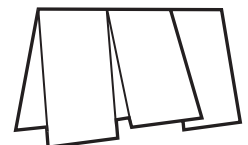
This beautiful glass creation by artist Dale Chihuly is entitled "Mille Fiori" (A Thousand Flowers). The pieces that form the sculpture were not always solid and unchanging. Each individual piece started as a blob of melted glass on the end of a hollow pipe. The artist worked with his assistants to quickly form each shape before the molten glass cooled and became a solid again.

PRE-READING ACTIVITY



Three-Panel Flip Chart

Before you read the chapter, create the FoldNote entitled "Three-Panel Flip Chart" described in the **Study Skills** section of the Appendix. Label the flaps of the three-panel flip chart with "Solid," "Liquid," and "Gas." As you read the chapter, write information you learn about each category under the appropriate flap.





START-UP ACTIVITY



Vanishing Act

In this activity, you will use isopropyl alcohol (rubbing alcohol) to investigate a change of state.

Procedure

1. Pour **rubbing alcohol** into a **small plastic cup** until the alcohol just covers the bottom of the cup.
2. Moisten the tip of a **cotton swab** by dipping it into the alcohol in the cup.
3. Rub the cotton swab on the palm of your hand. Make sure there are no cuts or abrasions on your hands.
4. Record your observations.
5. Wash your hands thoroughly.

Analysis

1. Explain what happened to the alcohol after you rubbed the swab on your hand.
2. Did you feel a sensation of hot or cold? If so, how do you explain what you observed?
3. Record your answers.

Three States of Matter

You've just walked home on one of the coldest days of the year. A fire is blazing in the fireplace. And there is a pot of water on the stove to make hot chocolate.

The water begins to bubble. Steam rises from the pot. You make your hot chocolate, but it is too hot to drink. You don't want to wait for it to cool down. So, you add an ice cube. You watch the ice melt in the hot liquid until the drink is at just the right temperature. Then, you enjoy your hot drink while warming yourself by the fire.

The scene described above has examples of the three most familiar states of matter: solid, liquid, and gas. The **states of matter** are the physical forms in which a substance can exist. For example, water commonly exists in three states of matter: solid (ice), liquid (water), and gas (steam).

Particles of Matter

Matter is made up of tiny particles called *atoms* and *molecules* (MAHL i kyoolz). These particles are too small to see without a very powerful microscope. Atoms and molecules are always in motion and are always bumping into one another. The particles interact with each other, and the way they interact with each other helps determine the state of the matter. **Figure 1** describes three states of matter—solid, liquid, and gas—in terms of the speed and attraction of the particles.

What You Will Learn

- Describe the properties shared by particles of all matter.
- Describe three states of matter.
- Explain the differences between the states of matter.

Vocabulary

states of matter
solid
liquid
surface tension
viscosity
gas

READING STRATEGY

Paired Summarizing Read this section silently. In pairs, take turns summarizing the material. Stop to discuss ideas that seem confusing.

Figure 1 Models of a Solid, a Liquid, and a Gas



Particles of a solid do not move fast enough to overcome the strong attraction between them. So, they are close together and vibrate in place.



Particles of a liquid move fast enough to overcome some of the attraction between them. The particles are close together but can slide past one another.



Particles of a gas move fast enough to overcome almost all of the attraction between them. The particles are far apart and move independently of one another.

Solids

Imagine dropping a marble into a bottle. Would anything happen to the shape or size of the marble? Would the shape or size of the marble change if you put it in a larger bottle?

Solids Have Definite Shape and Volume

Even in a bottle, a marble keeps its original shape and volume. The marble's shape and volume stay the same no matter what size bottle you drop it into because the marble is a solid. A **solid** is the state of matter that has a definite shape and volume.

The particles of a substance in a solid state are very close together. The attraction between them is stronger than the attraction between the particles of the same substance in the liquid or gaseous state. The particles in a solid move, but they do not move fast enough to overcome the attraction between them. Each particle vibrates in place. Therefore, each particle is locked in place by the particles around it.

There Are Two Kinds of Solids

There are two kinds of solids—*crystalline* (KRIS tuhl in) and *amorphous* (uh MAWR fuhs). Crystalline solids have a very orderly, three-dimensional arrangement of particles. The particles of crystalline solids are in a repeating pattern of rows. Iron, diamond, and ice are examples of crystalline solids.

Amorphous solids are made of particles that do not have a special arrangement. So, each particle is in one place, but the particles are not arranged in a pattern. Examples of amorphous solids are glass, rubber, and wax. **Figure 2** shows a photo of quartz (a crystalline solid) and glass (an amorphous solid).

✓ Reading Check How are the particles in a crystalline solid arranged? (See the Appendix for answers to Reading Checks.)

states of matter the physical forms of matter, which include solid, liquid, and gas

solid the state of matter in which the volume and shape of a substance are fixed

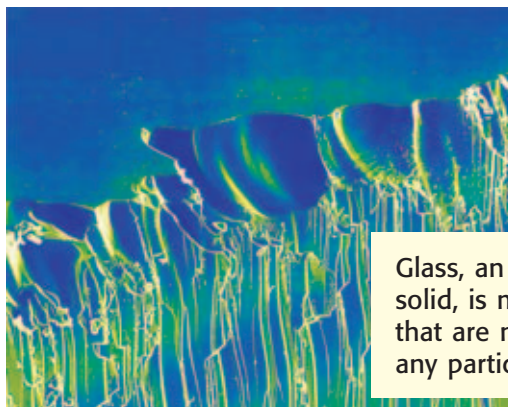
CONNECTION TO Physics

Is Glass a Liquid? At one time, there was a theory that glass was a liquid. This theory came about because of the observation that ancient windowpanes were often thicker at the bottom than at the top. People thought that the glass had flowed to the bottom of the pane, so glass must be a liquid. Research this theory. Present your research to your class in an oral presentation.

ACTIVITY

Figure 2 Crystalline and Amorphous Solids

The particles of crystalline solids, such as this quartz crystal, have an orderly three-dimensional pattern.



Glass, an amorphous solid, is made of particles that are not arranged in any particular pattern.

Figure 3 Although their shapes are different, the beaker and the graduated cylinder each contain 350 mL of juice.



liquid the state of matter that has a definite volume but not a definite shape

surface tension the force that acts on the surface of a liquid and that tends to minimize the area of the surface

viscosity the resistance of a gas or liquid to flow

gas a form of matter that does not have a definite volume or shape



Figure 4 Water forms spherical drops as a result of surface tension.

Liquids

What do you think would change about orange juice if you poured the juice from a can into a glass? Would the volume of juice be different? Would the taste of the juice change?

Liquids Change Shape but Not Volume

The only thing that would change when the juice is poured into the glass is the shape of the juice. The shape changes because juice is a liquid. **Liquid** is the state of matter that has a definite volume but takes the shape of its container. The particles in liquids move fast enough to overcome some of the attractions between them. The particles slide past each other until the liquid takes the shape of its container.

Although liquids change shape, they do not easily change volume. A can of juice contains a certain volume of liquid. That volume stays the same if you pour the juice into a large container or a small one. **Figure 3** shows the same volume of liquid in two different containers.

Liquids Have Unique Characteristics

A special property of liquids is surface tension. **Surface tension** is a force that acts on the particles at the surface of a liquid. Surface tension causes some liquids to form spherical drops, like the beads of water shown in **Figure 4**. Different liquids have different surface tensions. For example, gasoline has a very low surface tension and forms flat drops.

Another important property of liquids is viscosity. **Viscosity** is a liquid's resistance to flow. Usually, the stronger the attractions between the molecules of a liquid, the more viscous the liquid is. For example, honey flows more slowly than water. So, honey has a higher viscosity than water.

 **Reading Check** What is viscosity?

Gases

Would you believe that one small tank of helium can fill almost 700 balloons? How is this possible? After all, the volume of a tank is equal to the volume of only about five filled balloons. The answer has to do with helium's state of matter.

Gases Change in Both Shape and Volume

Helium is a gas. **Gas** is the state of matter that has no definite shape or volume. The particles of a gas move quickly. So, they can break away completely from one another. There is less attraction between particles of a gas than between particles of the same substance in the solid or liquid state.

The amount of empty space between gas particles can change. Look at **Figure 5**. The particles of helium in the balloons are farther apart than the particles of helium in the tank. The particles spread out as helium fills the balloon. So, the amount of empty space between the gas particles increases.



Figure 5 Many balloons can be filled from one tank of helium because the particles of helium gas in a balloon are far apart.

SECTION Review

Summary

- The three most familiar states of matter are solid, liquid, and gas.
- All matter is made of tiny particles called atoms and molecules that attract each other and move constantly.
- A solid has a definite shape and volume.
- A liquid has a definite volume but not a definite shape.
- A gas does not have a definite shape or volume.

Using Key Terms

1. Use each of the following terms in a separate sentence: *viscosity* and *surface tension*.

Understanding Key Ideas

2. One property that all particles of matter have in common is they
 - a. never move in solids.
 - b. only move in gases.
 - c. move constantly.
 - d. None of the above
3. Describe solids, liquids, and gases in terms of shape and volume.

Critical Thinking

4. **Applying Concepts** Classify each substance according to its state of matter: apple juice, bread, a textbook, and steam.
5. **Identifying Relationships** The volume of a gas can change, but the volume of a solid cannot. Explain why this is true.

Interpreting Graphics

Use the image below to answer the questions that follow.



6. Identify the state of matter shown in the jar.
7. Discuss how the particles in the jar are attracted to each other.

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Topic: Solids, Liquids, and Gases
SciLinks code: HSM1420

Behavior of Gases

Suppose you are watching a parade that you have been looking forward to for weeks. You may be fascinated by the giant balloons floating high overhead.

You may wonder how the balloons were arranged for the parade. How much helium was needed to fill all of the balloons? What role does the weather play in getting the balloons to float?

What You Will Learn

- Describe three factors that affect how gases behave.
- Predict how a change in pressure or temperature will affect the volume of a gas.

Vocabulary

temperature
volume
pressure
Boyle's Law
Charles's Law

READING STRATEGY

Reading Organizer As you read this section, make a table comparing the effects of temperature, volume, and pressure on gases.

temperature a measure of how hot (or cold) something is; specifically, a measure of the movement of particles.

Describing Gas Behavior

Helium is a gas. Gases behave differently from solids or liquids. Unlike the particles that make up solids and liquids, gas particles have a large amount of empty space between them. The space that gas particles occupy is the gas's volume, which can change because of temperature and pressure.

Temperature

How much helium is needed to fill a parade balloon, like the one in **Figure 1**? The answer depends on the outdoor temperature. **Temperature** is a measure of how fast the particles in an object are moving. The faster the particles are moving, the more energy they have. So, on a hot day, the particles of gas are moving faster and hitting the inside walls of the balloon harder. Thus, the gas is expanding and pushing on the walls of the balloon with greater force. If the gas expands too much, the balloon will explode. But, what will happen if the weather is cool on the day of the parade? The particles of gas in the balloon will have less energy. And, the particles of gas will not push as hard on the walls of the balloon. So, more gas must be used to fill the balloons.

Figure 1 To properly inflate a helium balloon, you must consider the temperature outside of the balloon.




Volume

Volume is the amount of space that an object takes up. But because the particles of a gas spread out, the volume of any gas depends on the container that the gas is in. For example, have you seen inflated balloons that were twisted into different shapes? Shaping the balloons was possible because particles of gas can be compressed, or squeezed together, into a smaller volume. But, if you tried to shape a balloon filled with water, the balloon would probably explode. It would explode because particles of liquids can't be compressed as much as particles of gases.

Pressure

The amount of force exerted on a given area of surface is called **pressure**. You can think of pressure as the number of times the particles of a gas hit the inside of their container.

The balls in **Figure 2** are the same size, which means they can hold the same volume of air, which is a gas. Notice, however, that there are more particles of gas in the basketball than in the beach ball. So, more particles hit the inside surface of the basketball than hit the inside surface of the beach ball. When more particles hit the inside surface of the basketball, the force on the inside surface of the ball increases. This increased force leads to greater pressure, which makes the basketball feel harder than the beach ball.

 **Reading Check** Why is the pressure greater in a basketball than in a beach ball? (See the Appendix for answers to Reading Checks.)

volume a measure of the size of a body or region in three-dimensional space

pressure the amount of force exerted per unit area of a surface

INTERNET ACTIVITY

For another activity related to this chapter, go to go.hrw.com and type in the keyword **HP5STAW**.

Figure 2 Gas and Pressure

High pressure



The basketball has a higher pressure because there are more particles of gas in it, and they are closer together. The particles collide with the inside of the ball at a faster rate.

Low pressure



The beach ball has a lower pressure because there are fewer particles of gas, and they are farther apart. The particles in the beach ball collide with the inside of the ball at a slower rate.

Gas Behavior Laws

Scientists found that the temperature, pressure, and volume of a gas are linked. Changing one of the factors changes the other two factors. The relationships between temperature, pressure, and volume are described by gas laws.

Boyle's Law

Imagine that a diver 10 m below the surface of a lake blows a bubble of air. When the bubble reaches the surface, the bubble's volume has doubled. The difference in pressure between the surface and 10 m below the surface caused this change.

The relationship between the volume and pressure of a gas was first described by Robert Boyle, a 17th-century Irish chemist. The relationship is now known as Boyle's law. **Boyle's law** states that for a fixed amount of gas at a constant temperature, the volume of the gas is inversely related to the pressure. So, as the pressure of a gas increases, the volume decreases by the same amount, as shown in **Figure 3**.

Boyle's law the law that states that the volume of a gas is inversely proportional to the pressure of a gas when temperature is constant

Charles's law the law that states that the volume of a gas is directly proportional to the temperature of a gas when pressure is constant

Charles's Law

If you blow air into a balloon and leave it in the hot sun, the balloon might pop. **Charles's law** states that for a fixed amount of gas at a constant pressure, the volume of the gas changes in the same way that the temperature of the gas changes. So, if the temperature increases, the volume of gas also increases by the same amount. Charles's law is shown by the model in **Figure 4**.

 **Reading Check** State Charles's law in your own words.

Figure 3 Boyle's Law

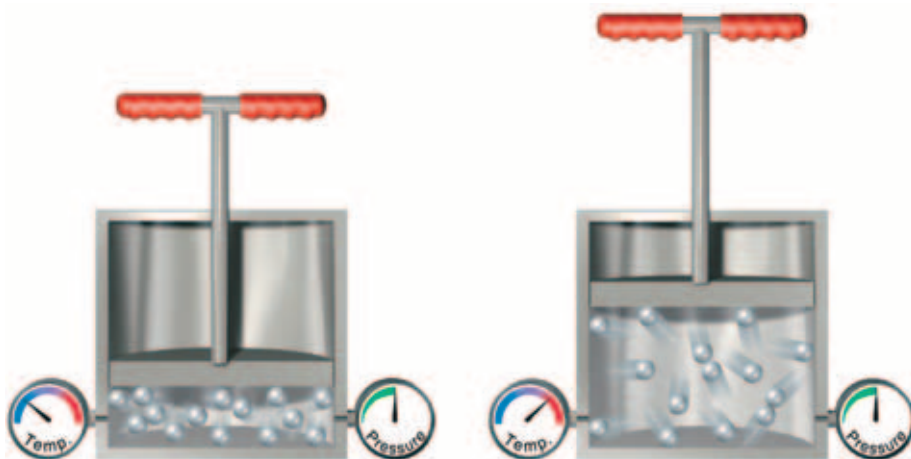


Lifting the piston lets the particles of gas spread far apart. The volume of the gas increases as the pressure decreases.

Releasing the piston allows the particles of gas to return to their original volume and pressure.

Pushing the piston forces the gas particles close together. The volume of the gas decreases as the pressure increases.

Figure 4 Charles's Law



Decreasing the temperature of the gas causes the particles to move more slowly. The gas particles hit the piston less often and with less force. So, the volume of the gas decreases.

Increasing the temperature of the gas causes the particles to move more quickly. The gas particles hit the piston more often and with greater force. So, the volume of the gas increases.

SECTION Review

Summary

- Temperature measures how fast the particles in an object are moving.
- Gas pressure increases as the number of collisions of gas particles increases.
- Boyle's law states that if the temperature doesn't change, the volume of a gas increases as the pressure decreases.
- Charles's law states that if the pressure doesn't change, the volume of a gas increases as the temperature increases.

Using Key Terms

1. Use each of the following terms in the same sentence: *temperature, pressure, volume, and Charles's law.*

Understanding Key Ideas

2. Boyle's law describes the relationship between
 - a. volume and pressure.
 - b. temperature and pressure.
 - c. temperature and volume.
 - d. All of the above
3. What are the effects of a warm temperature on gas particles?

Math Skills

4. You have 3 L of gas at a certain temperature and pressure. What would the volume of the gas be if the temperature doubled and the pressure stayed the same?

Critical Thinking

5. **Applying Concepts** What happens to the volume of a balloon that is taken outside on a cold winter day? Explain.
6. **Making Inferences** When scientists record a gas's volume, they also record its temperature and pressure. Why?
7. **Analyzing Ideas** What happens to the pressure of a gas if the volume of gas is tripled at a constant temperature?

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Topic: Gas Laws

SciLinks code: HSM0637

Changes of State

It can be tricky to eat a frozen juice bar outside on a hot day. In just minutes, the juice bar will start to melt. Soon the solid juice bar becomes a liquid mess.

As the juice bar melts, it goes through a change of state. In this section, you will learn about the four changes of state shown in **Figure 1** as well as a fifth change of state called *sublimation* (SUHB luh MAY shuhn).

What You Will Learn

- Describe how energy is involved in changes of state.
- Describe what happens during melting and freezing.
- Compare evaporation and condensation.
- Explain what happens during sublimation.
- Identify the two changes that can happen when a substance loses or gains energy.

Vocabulary

change of state	boiling
melting	condensation
evaporation	sublimation

READING STRATEGY

Mnemonics As you read this section, create a mnemonic device to help you remember the five changes of state.

change of state the change of a substance from one physical state to another

Energy and Changes of State

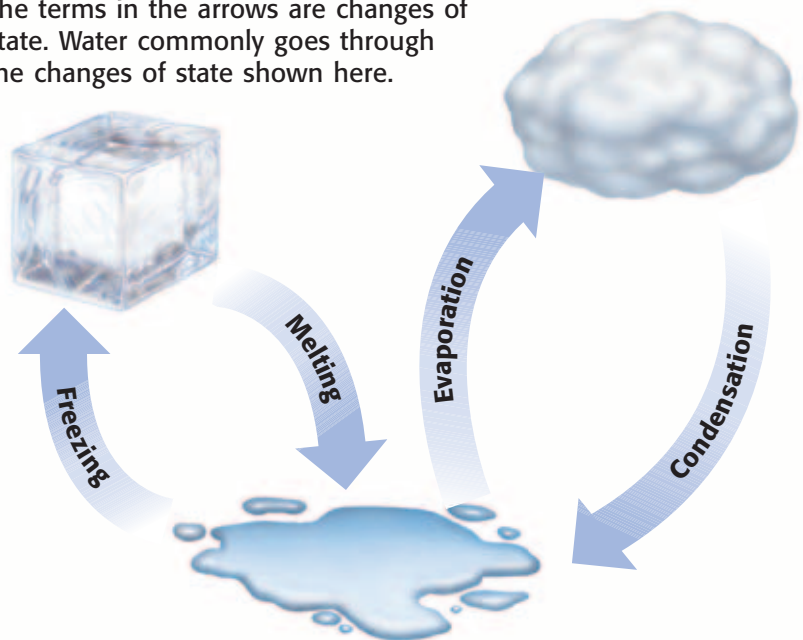
A **change of state** is the change of a substance from one physical form to another. All changes of state are physical changes. In a physical change, the identity of a substance does not change. In **Figure 1**, the ice, liquid water, and steam are all the same substance—water.

The particles of a substance move differently depending on the state of the substance. The particles also have different amounts of energy when the substance is in different states. For example, particles in liquid water have more energy than particles in ice. But particles of steam have more energy than particles in liquid water. So, to change a substance from one state to another, you must add or remove energy.

Reading Check What is a change of state? (See the Appendix for answers to Reading Checks.)

Figure 1 Changes of State

The terms in the arrows are changes of state. Water commonly goes through the changes of state shown here.



Melting: Solid to Liquid

One change of state that happens when you add energy to a substance is melting. **Melting** is the change of state from a solid to a liquid. This change of state is what happens when ice melts. Adding energy to a solid increases the temperature of the solid. As the temperature increases, the particles of the solid move faster. When a certain temperature is reached, the solid will melt. The temperature at which a substance changes from a solid to a liquid is the *melting point* of the substance. Melting point is a physical property. Different substances have different melting points. For example, gallium melts at about 30°C . Because your normal body temperature is about 37°C , gallium will melt in your hand! This is shown in **Figure 2**. Table salt, however, has a melting point of 801°C , so it will not melt in your hand.



Figure 2 Even though gallium is a metal, it would not be very useful as jewelry!

Adding Energy

For a solid to melt, particles must overcome some of their attractions to each other. When a solid is at its melting point, any energy added to it is used to overcome the attractions that hold the particles in place. Melting is an *endothermic* (EN doh THUHR mik) change because energy is gained by the substance as it changes state.

melting the change of state in which a solid becomes a liquid by adding energy

Freezing: Liquid to Solid

The change of state from a liquid to a solid is called *freezing*. The temperature at which a liquid changes into a solid is the liquid's *freezing point*. Freezing is the reverse process of melting. Thus, freezing and melting occur at the same temperature, as shown in **Figure 3**.

Removing Energy

For a liquid to freeze, the attractions between the particles must overcome the motion of the particles. Imagine that a liquid is at its freezing point. Removing energy will cause the particles to begin locking into place. Freezing is an *exothermic* (EK so THUHR mik) change because energy is removed from the substance as it changes state.



Figure 3 Liquid water freezes at the same temperature at which ice melts— 0°C .

If energy is added at 0°C , the ice will melt.

If energy is removed at 0°C , the liquid water will freeze.

Evaporation: Liquid to Gas

One way to experience evaporation is to iron a shirt using a steam iron. You will notice steam coming up from the iron as the wrinkles disappear. This steam forms when the liquid water in the iron becomes hot and changes to gas.

Boiling and Evaporation

evaporation the change of a substance from a liquid to a gas

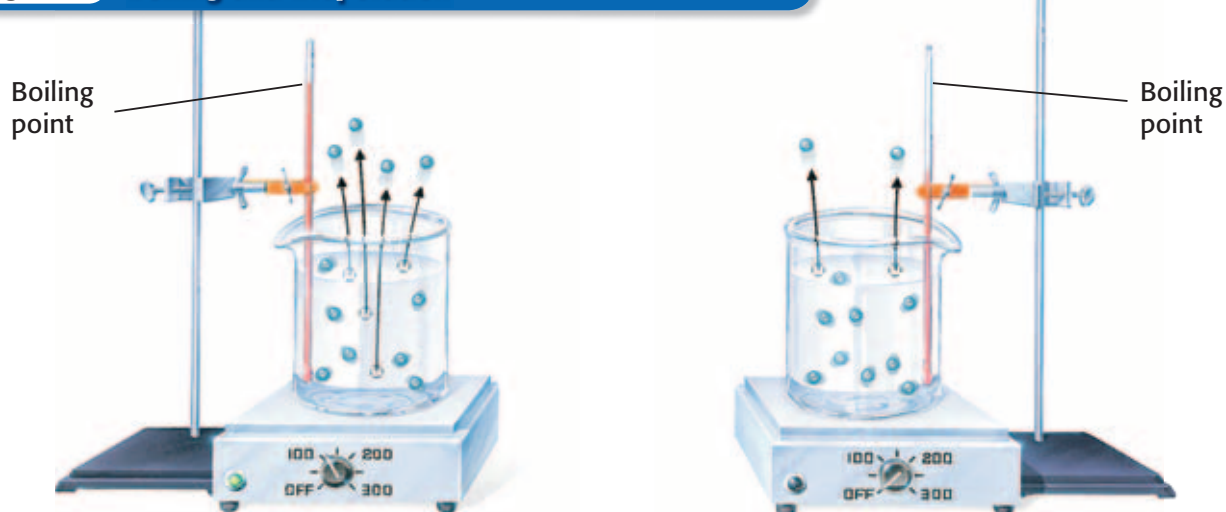
boiling the conversion of a liquid to a vapor when the vapor pressure of the liquid equals the atmospheric pressure

Evaporation (ee VAP uh RAY shuhn) is the change of a substance from a liquid to a gas. Evaporation can occur at the surface of a liquid that is below its boiling point. For example, when you sweat, your body is cooled through evaporation. Your sweat is mostly water. Water absorbs energy from your skin as the water evaporates. You feel cooler because your body transfers energy to the water. Evaporation also explains why water in a glass on a table disappears after several days.

Figure 4 explains the difference between boiling and evaporation. **Boiling** is the change of a liquid to a vapor, or gas, throughout the liquid. Boiling occurs when the pressure inside the bubbles, which is called *vapor pressure*, equals the outside pressure on the bubbles, or atmospheric pressure. The temperature at which a liquid boils is called its *boiling point*. No matter how much of a substance is present, neither the boiling point nor the melting point of a substance change. For example, 5 mL and 5 L of water both boil at 100°C.

 **Reading Check** What is evaporation?

Figure 4 Boiling and Evaporation



Boiling occurs in a liquid at its boiling point. As energy is added to the liquid, particles throughout the liquid move faster. When they move fast enough to break away from other particles, they evaporate and become a gas.

Evaporation can also occur in a liquid below its boiling point. Some particles at the surface of the liquid move fast enough to break away from the particles around them and become a gas.

Effects of Pressure on Boiling Point

Earlier, you learned that water boils at 100°C . In fact, water boils at 100°C only at sea level, because of atmospheric pressure. Atmospheric pressure is caused by the weight of the gases that make up the atmosphere.

Atmospheric pressure varies depending on where you are in relation to sea level. Atmospheric pressure is lower at higher elevations. The higher you go above sea level, the fewer air particles there are above you. So, the atmospheric pressure is lower. Imagine boiling water at the top of a mountain. The boiling point would be lower than 100°C . For example, Denver, Colorado, is 1.6 km above sea level. In Denver, water boils at about 95°C .

Condensation: Gas to Liquid

Look at the dragonfly in **Figure 5**. Notice the beads of water that have formed on the wings. They form because of condensation of gaseous water in the air. **Condensation** is the change of state from a gas to a liquid. Condensation and evaporation are the reverse of each other. The *condensation point* of a substance is the temperature at which the gas becomes a liquid. And the condensation point is the same temperature as the boiling point at a given pressure.

For a gas to become a liquid, large numbers of particles must clump together. Particles clump together when the attraction between them overcomes their motion. For this to happen, energy must be removed from the gas to slow the movement of the particles. Because energy is removed, condensation is an exothermic change.

CONNECTION TO Language Arts

WRITING SKILL **Cooking at High Altitudes** Many times, cake mixes and other prepared foods will have special instructions for baking and cooking at high altitudes. Even poaching an egg at a high altitude requires a different amount of cooking time. Imagine that you got a letter from a cousin in Denver. He is upset that a cake he made turned out poorly, even though he followed the recipe. Do research on cooking at high altitudes. Write a letter to your cousin explaining why he may have had problems baking the cake.

condensation the change of state from a gas to a liquid



Figure 5 Beads of water form when water vapor in the air contacts a cool surface, such as the wings of this dragonfly.



Figure 6 Dry ice changes directly from a solid to a gas. This change of state is called sublimation.

sublimation the process in which a solid changes directly into a gas

Sublimation: Solid to Gas

The solid in **Figure 6** is dry ice. Dry ice is carbon dioxide in a solid state. It is called *dry ice* because instead of melting into a liquid, it goes through sublimation. **Sublimation** is the change of state in which a solid changes directly into a gas. Dry ice is much colder than ice made from water.

For a solid to change directly into a gas, the particles of the substance must move from being very tightly packed to being spread far apart. So, the attractions between the particles must be completely overcome. The substance must gain energy for the particles to overcome their attractions. Thus, sublimation is an endothermic change because energy is gained by the substance as it changes state.

Change of Temperature Vs. Change of State

When most substances lose or gain energy, one of two things happens to the substance: its temperature changes or its state changes. The temperature of a substance is related to the speed of the substance's particles. So, when the temperature of a substance changes, the speed of the particles also changes. But the temperature of a substance does not change until the change of state is complete. For example, the temperature of boiling water stays at 100°C until it has all evaporated. In **Figure 7**, you can see what happens to ice as energy is added to the ice.

 **Reading Check** What happens to the temperature of a substance as it changes state?

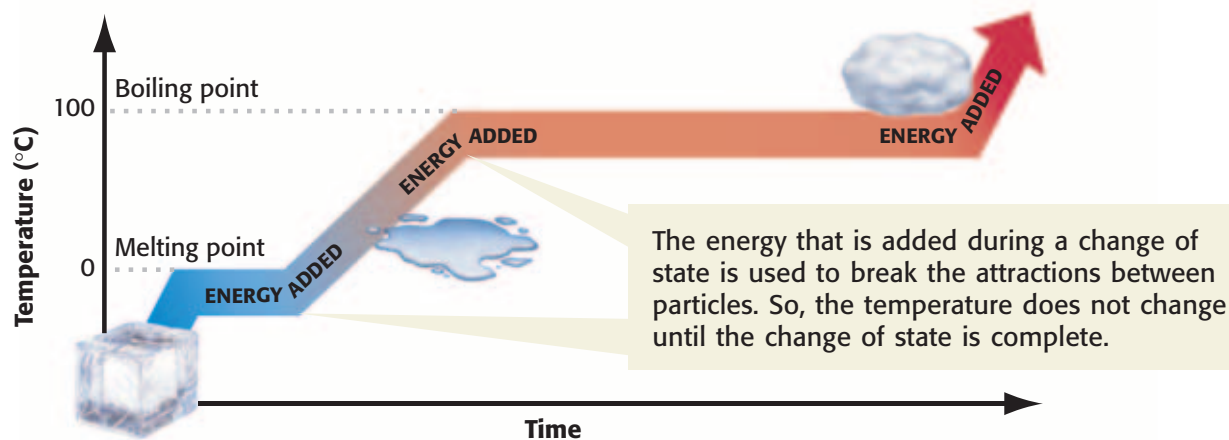
QUICK LAB



Boiling Water Is Cool

1. Remove the cap from a **syringe**.
2. Place the tip of the syringe in the **warm water** that is provided by your teacher. Pull the plunger out until you have 10 mL of water in the syringe.
3. Tighten the cap on the syringe.
4. Hold the syringe, and slowly pull the plunger out.
5. Observe any changes you see in the water. Record your observations.
6. Why are you not burned by the water in the syringe?

Figure 7 Changing the State of Water



SECTION Review

Summary

- A change of state is the conversion of a substance from one physical form to another.
- Energy is added during endothermic changes. Energy is removed during exothermic changes.
- The freezing point and the melting point of a substance are the same temperature.
- Both boiling and evaporation result in a liquid changing to a gas.
- Condensation is the change of a gas to a liquid. It is the reverse of evaporation.
- Sublimation changes a solid directly to a gas.
- The temperature of a substance does not change during a change of state.

Using Key Terms

For each pair of terms, explain how the meanings of the terms differ.

1. *melting* and *freezing*
2. *condensation* and *evaporation*

Understanding Key Ideas

3. The change from a solid directly to a gas is called
 - a. evaporation.
 - b. boiling.
 - c. melting.
 - d. sublimation.
4. Describe how the motion and arrangement of particles in a substance change as the substance freezes.
5. Explain what happens to the temperature of an ice cube as it melts.
6. How are evaporation and boiling different? How are they similar?

Math Skills

7. The volume of a substance in the gaseous state is about 1,000 times the volume of the same substance in the liquid state. How much space would 18 mL of water take up if it evaporated?

Critical Thinking

8. **Evaluating Data** The temperature of water in a beaker is 25°C. After adding a piece of magnesium to the water, the temperature increases to 28°C. Is this an exothermic or endothermic reaction? Explain your answer.
9. **Applying Concepts** Solid crystals of iodine were placed in a flask. The top of the flask was covered with aluminum foil. The flask was gently heated. Soon, the flask was filled with a reddish gas. What change of state took place? Explain your answer.
10. **Predicting Consequences** Would using dry ice in your holiday punch cause it to become watery after several hours? Why or why not?

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Topic: **Changes of State**
SciLinks code: **HSM0254**