



ESSENTIAL QUESTION

# What Are Solids, Liquids, and Gases?



## Engage Your Brain

As you read the lesson, look for the answer to the following question and record it here.

**Bottled water and the snow from this snow machine are both water. How are these forms of water different?**

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## ACTIVE READING

### Lesson Vocabulary

List the terms. As you learn about each one, make notes in the Interactive Glossary.

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## Compare and Contrast

Many ideas in this lesson involve comparisons and contrasts—how things are alike and different. Active readers stay focused on comparisons and contrasts when they ask themselves, How are these things alike? How are they different?



# What's the Matter?

This book is made of matter, and so are you. You might think that matter can be seen and felt. But did you know that air is matter also? What is matter?



The large pencil has more matter than the smaller pencils. It has more mass and more volume.

**ACTIVE READING** As you read these two pages, draw two lines under each main idea.

**B**reathe in and out. Can you feel air hitting your hand? You can't see air, and you can't grab it. Yet air is **matter** because it has mass and it has volume. Matter cannot be created or destroyed. It might change form, but it is still matter.

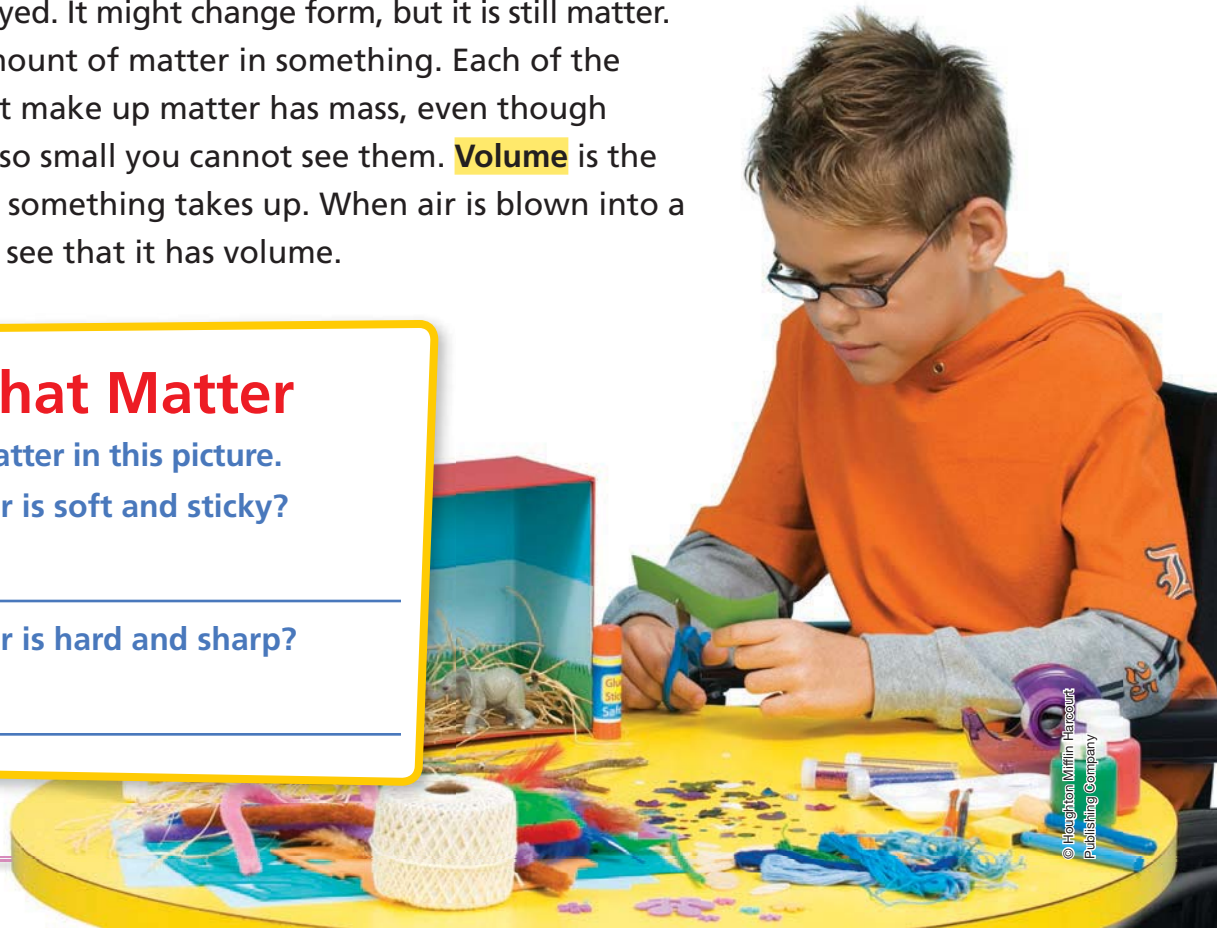
*Mass* is the amount of matter in something. Each of the tiny particles that make up matter has mass, even though the particles are so small you cannot see them. **Volume** is the amount of space something takes up. When air is blown into a balloon, you can see that it has volume.

## Name That Matter

Look at the matter in this picture.

1. What matter is soft and sticky?

2. What matter is hard and sharp?







**Odor**



**Texture**



## Matter Has Properties

You might say that apple juice is gold in color, tastes sweet, and pours easily. These are properties of the juice, which means they are characteristics used to describe or identify it. All matter has properties.

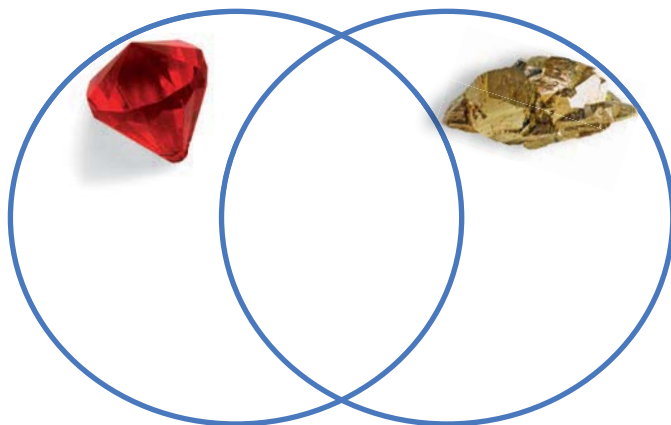
All the properties shown on this page are physical properties. You can observe a physical property without changing the matter into a new substance. For example, texture is how something feels. In observing that sandpaper has a rough texture, you don't change the sandpaper.

**Color**



## Comparing Stones

Complete the Venn diagram by comparing and contrasting the properties of the two stones.





# More Properties

Color, texture, and odor are just a few physical properties. What are some other properties of matter?

**ACTIVE READING** As you read these two pages, circle common, everyday words that have a different meaning in science.



## Temperature

**Temperature** is a measure of the energy of motion of the particles in matter. Melted glass has a very high temperature. Temperature can be measured by using a thermometer.

## Volume

The food in the small bowl has less volume than the food in the large bowl because it takes up less space. Many tools can be used to measure volume.







## Mass

A bowling ball and a basketball have about the same volume. The bowling ball has a greater mass because it contains more matter. Mass can be measured by using a balance.



## Density

Density is found by dividing the mass of an object by its volume. The density of the gas in this balloon is less than the density of the air around it. That is why the balloon "floats" in air.



## DO THE MATH

### Use Division

Use the data to find the density of each of these foods.

Determining Densities of Foods			
Food	Mass (g)	Volume (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )
gelatin	75	100	
pudding	90	100	
whipped cream	50	100	

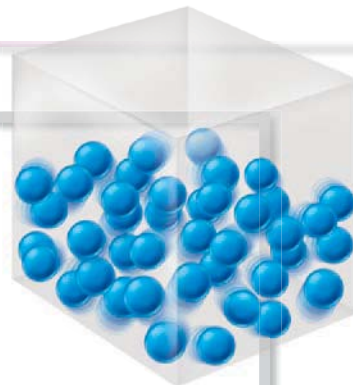






## Liquids

A **liquid** is a substance that has a definite volume but does not have a definite shape. The particles in a liquid move slower than the particles in a gas, and they slide by each other.



# States of Matter

Another physical property of matter is its state. Solid, liquid, and gas are the most common states of matter on Earth.

**ACTIVE READING** As you read these two pages, draw boxes around the names of the three things that are being compared.

## Gases

A **gas** is a substance that does not have a definite shape or volume. The particles in a gas move very quickly and are far apart from each other.



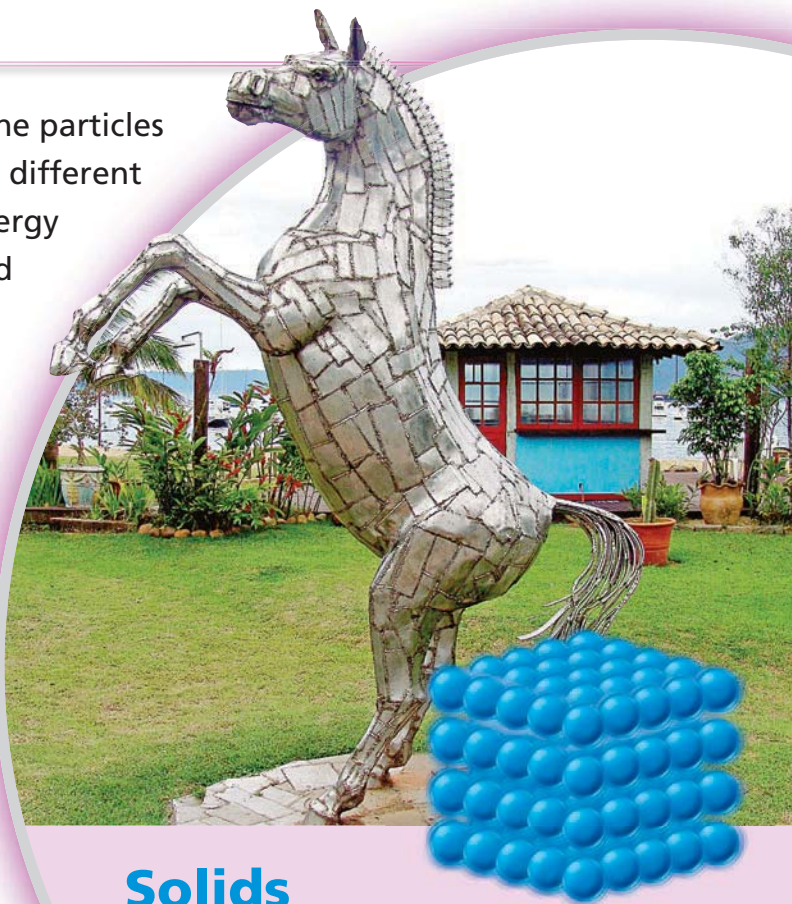


**M**atter is made of tiny particles. The particles in solids, liquids, and gases have different amounts of energy. The amount of energy affects how fast the particles move and how close together they are.

The shape and volume of something depends on its state. Because each particle in a gas is affected little by the other particles, gas particles are free to move throughout their container. Gases take both the shape and the volume of their container.

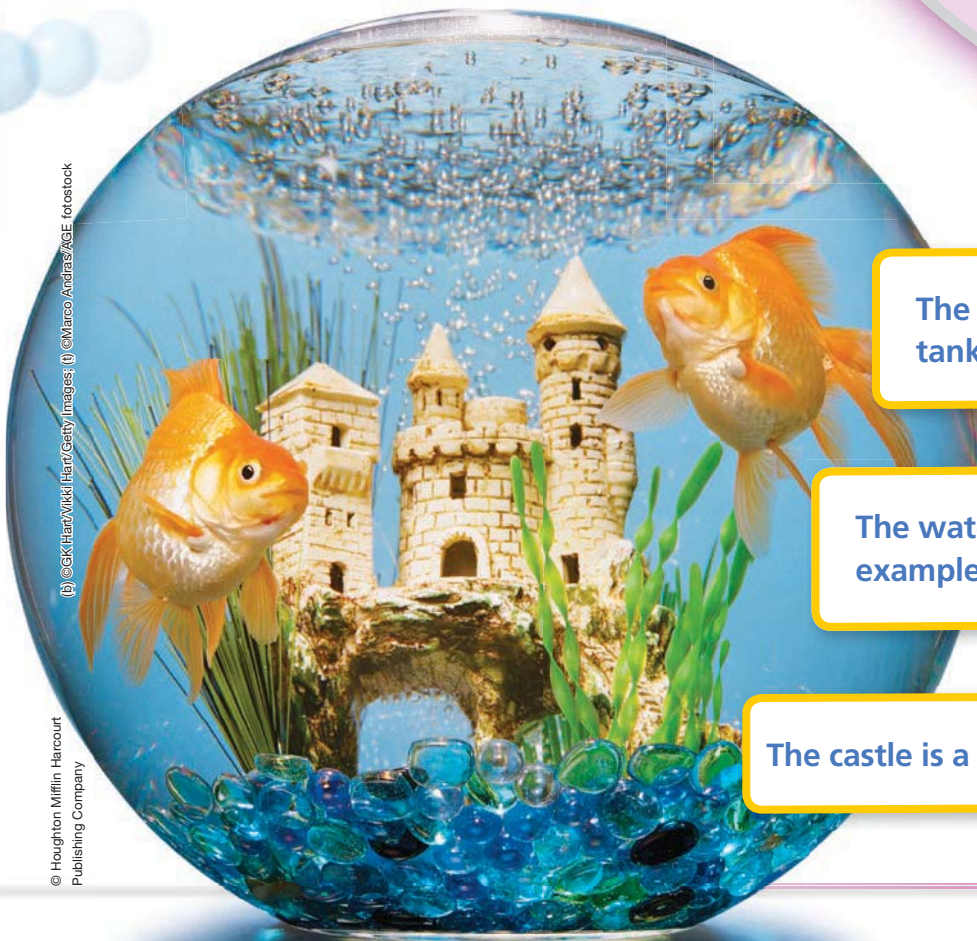
Particles in a liquid cannot move as freely. A sample of a liquid keeps the same volume no matter what container it is in. However because the particles slide by each other, a liquid takes the shape of its container.

The particles in a solid do not move from place to place, so solids keep the same shape and volume.



## Solids

A **solid** is a substance with a definite shape and volume. The particles in a solid are very close to each other. They don't move from place to place. They just vibrate where they are.



The bubbles in the tank are a \_\_\_\_\_.

The water is an example of a \_\_\_\_\_.

The castle is a \_\_\_\_\_.





# A Matter of Temperature



On a hot day, an ice cube melts. This change is caused by a change in temperature. When matter changes state, the type of matter is not changed.

**ACTIVE READING** As you read these two pages, draw one line under a cause. Draw two lines under the effect.



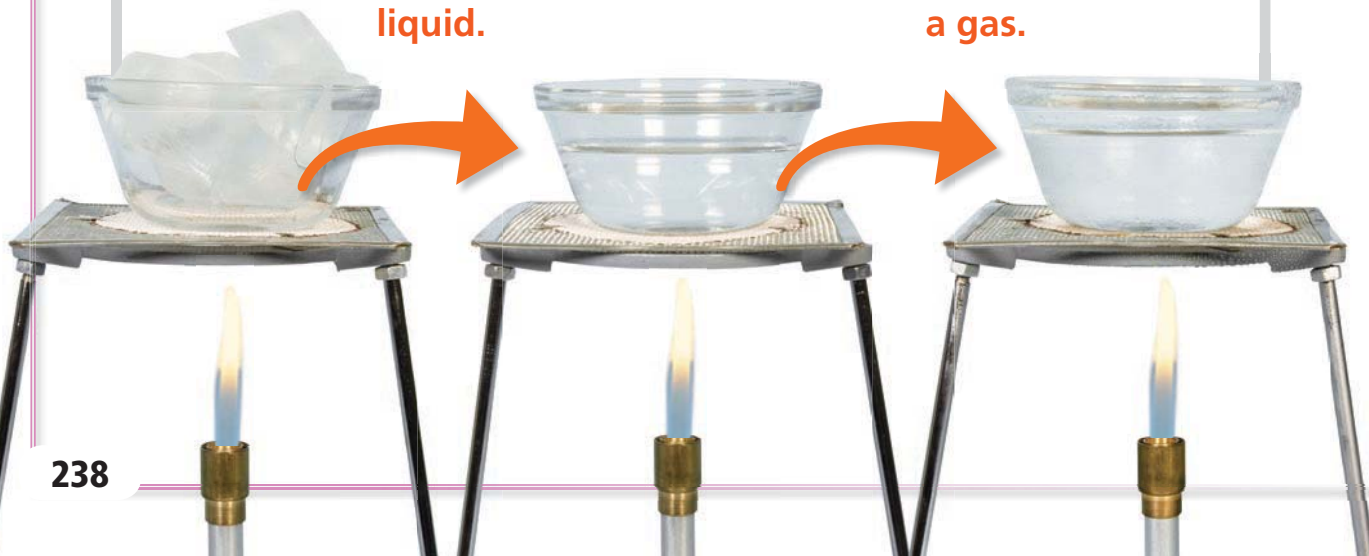
**W**hen matter takes in or releases energy, its temperature changes. When enough energy is taken in or released, matter can change state.

When a gas releases energy, its temperature goes down until it *condenses*, or changes to a liquid. When a liquid releases energy, its temperature goes down until it *freezes*, or changes to a solid.

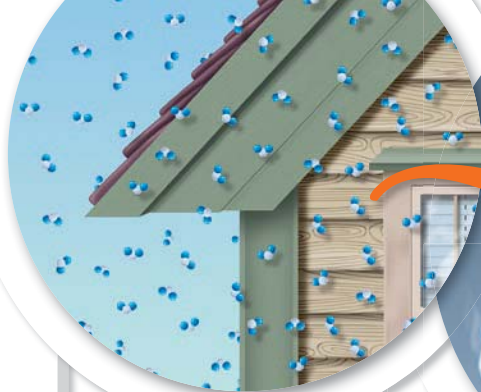
When a solid takes in energy, its temperature rises until it *melts*, or changes to a liquid. When a liquid takes in energy, its temperature rises until it *evaporates*, or changes to a gas. Evaporation and boiling are similar—both turn liquids into gases. Evaporation is slower and happens only at a liquid's surface. Boiling is faster and happens throughout the liquid.

When a solid absorbs enough energy, the solid melts, changing to a liquid.

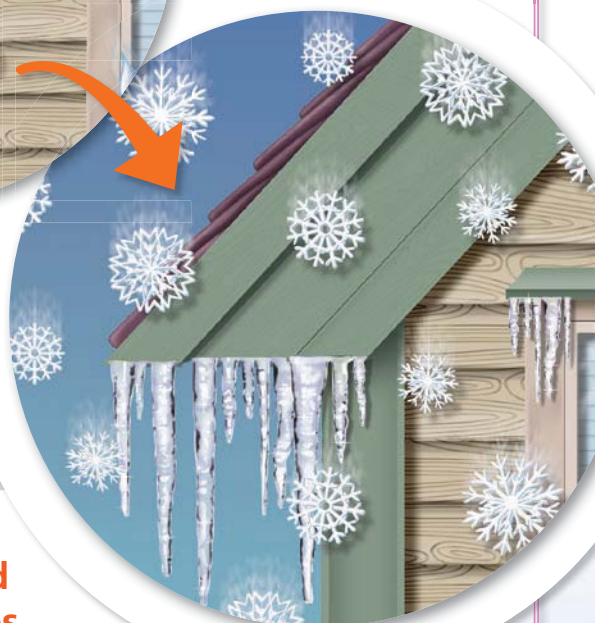
When a liquid absorbs enough energy, the liquid boils, or rapidly changes to a gas.







**When a gas releases enough energy, the gas condenses, changing to a liquid. Particles of water vapor condense and form raindrops and dew.**



**When a liquid releases enough energy, the liquid freezes, changing to a solid. Dripping water that freezes can form icicles.**

The temperature at which a certain type of matter freezes or melts is the same. The temperature at which a type of matter condenses or boils is also the same. For water, the melting and freezing points are  $0^{\circ}\text{C}$ . The condensation and boiling points are  $100^{\circ}\text{C}$ . Evaporation can happen at temperatures below the boiling point.



**Lava is hot, melted rock that erupts from a volcano. Lava releases energy as it cools and becomes solid rock.**

► **Complete this graphic organizer.**

**As a solid takes in energy, its temperature \_\_\_\_\_. Eventually, it will \_\_\_\_\_, changing to a \_\_\_\_\_.**



**If the liquid takes in enough \_\_\_\_\_, it will \_\_\_\_\_, changing to a \_\_\_\_\_.**



# Properties of Solids, Liquids, and Gases

Each different material has its own unique properties. However, properties can change depending on the state of the material.

**ACTIVE READING** As you read these two pages, find and underline facts about each state of matter.

**E**ach state of matter has different physical properties. Liquids and gases both flow, moving from place to place. Gases can expand, taking up more space, or compress, taking up less space. Solids have definite textures.



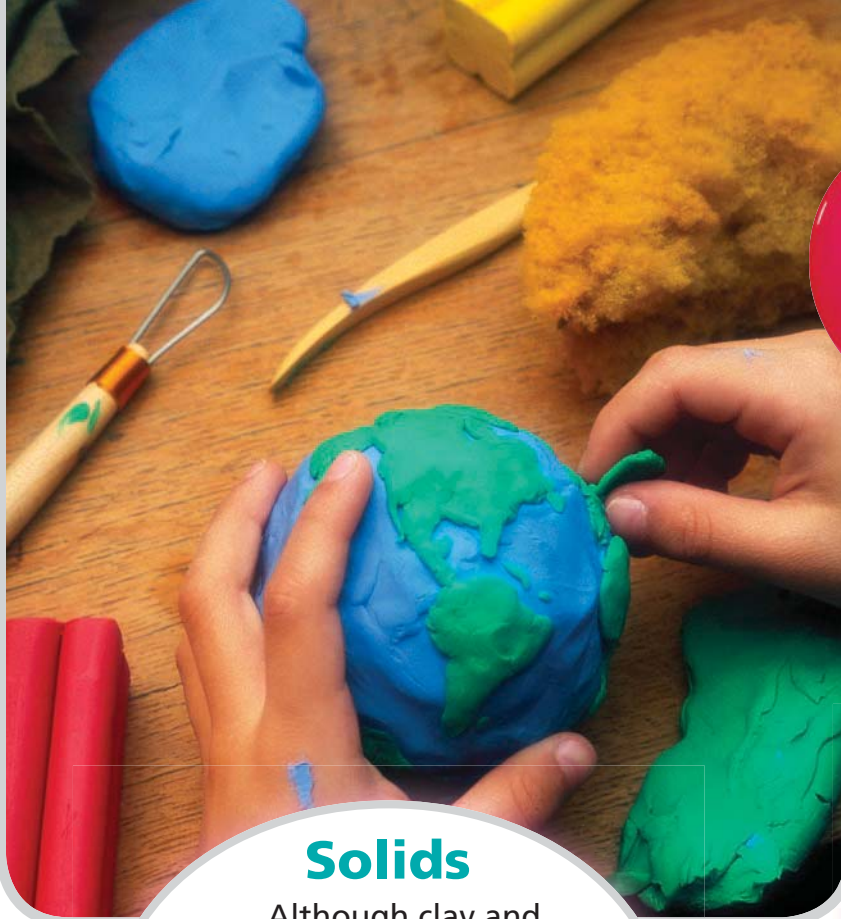
Liquid water flows much more quickly than honey.

## Liquids

All liquids flow from one place to another. Different liquids may flow at different rates.







## Solids

Although clay and a wooden table are both solids, each one feels different. All solids have a shape, but the shape of some solids can be changed easily.



## Gases

A lot of gas has been compressed in this tank. It is under high pressure. Compressed gas from the tank expands, filling many balloons.



► Complete this main-idea-and-details graphic organizer.

Main Idea		
<b>Liquids</b> Motor oil and milk _____ at different rates.	<b>Gases</b> When you push on the sides of a balloon, the gas inside is _____.	_____ Glass and sandpaper have different _____.