

Physical Science

Matter and Energy

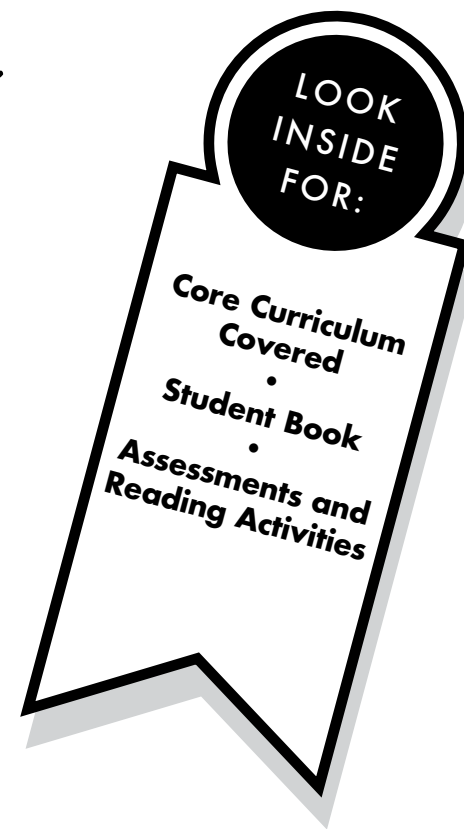
On Level

All About Matter

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All About Matter

What are some of the properties of matter?

CORE CURRICULUM STATEMENTS

Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

Matter takes up space and has mass. Two objects cannot occupy the same place at the same time.

Matter has properties (color, hardness, odor, sound, taste, etc.) that can be observed through the senses.

Objects have properties that can be observed, described, and/or measured: length, width, volume, size, shape, mass or weight, temperature, texture, flexibility, reflectiveness of light.

Measurements can be made with standard metric units and nonstandard units.

The material(s) an object is made up of determine some specific properties of the object (sink/float, conductivity, magnetism). Properties can be observed or measured with tools such as hand lenses, metric rulers, thermometers, balances, magnets, circuit testers, and graduated cylinders.



On Level

Physical Science

Matter and Energy

Student Book

All About Matter

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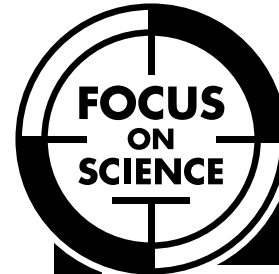
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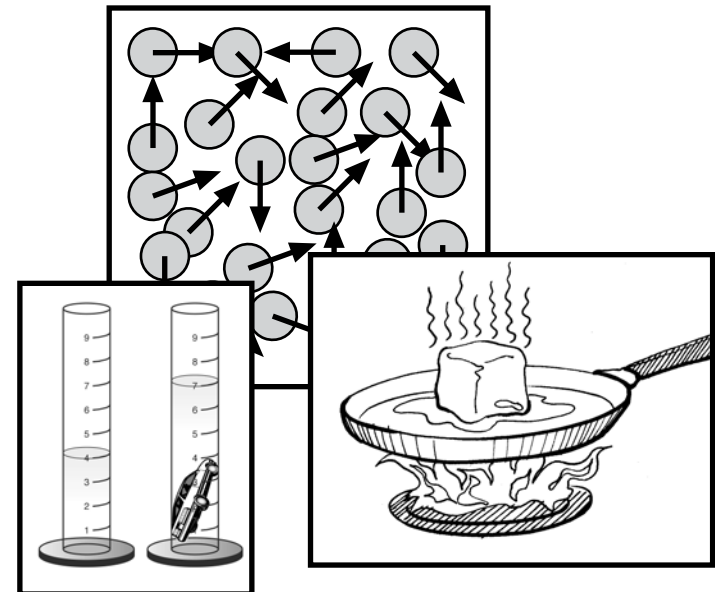


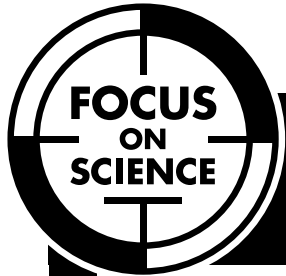
Physical Science

Matter and Energy

All About Matter

by Laura Portalupi





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Curriculum materials for **your** content standards

Table of Contents

Introduction:

What Is Matter?4

Chapter 1:

States of Matter.....5

Chapter 2:

Physical Properties8

Chapter 3:

Conductivity15

Chapter 4:

Categorize.....20

Glossary22

To Find Out More.....23

Index 24

– Predict –

*What do you think you will
learn from reading this book?*

What Is Matter?

Imagine you are holding a balloon on a stick. The balloon and the stick are both made of matter. What about the air inside of the balloon? That is matter, too. If you carefully put a hole in the balloon with a pin and put your hand in front of the hole, you will feel the air, or matter, escaping.

Everything in the universe is made of matter. Matter is anything that takes up space and has **mass**. Mass is the amount of material in an object. Matter comes in all shapes, sizes, and textures. Sometimes you can see it and sometimes you can't.

mass: the amount of material in an object

States of Matter

Matter can be found in three states—solid, liquid, or gas.

Solid—Matter that is solid has a certain shape. It does not change shape unless something forces it to change. A brick is an example of a solid.

Liquid—Matter that is liquid does not have a certain shape. It flows to take the shape of its container. Water and honey are examples of liquids.

Gas—Matter that is gas does not have a certain shape, either. It expands to fill whatever space it is in. Air is a gas.

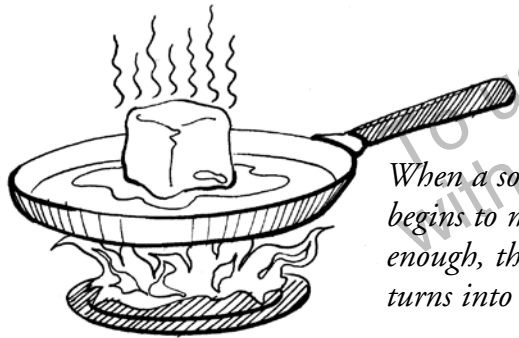
Matter can change from one state to another. Heat can cause a solid to become a liquid. Heat can also cause a liquid to become a gas. Water is a good example.

– Describe –
How are liquids different from gases?

When water is a liquid, you can drink it or wash with it. If you fill cups with liquid water, you will see that it takes the shape of each cup.

When water is a solid, we call it ice. If you put ice cubes into a cup, they do not change shape.

When water is a gas, it is called water vapor. If you take a hot shower, some of the water might **evaporate** into water vapor. The vapor will fill the room and expand to the hallway when you open the door.

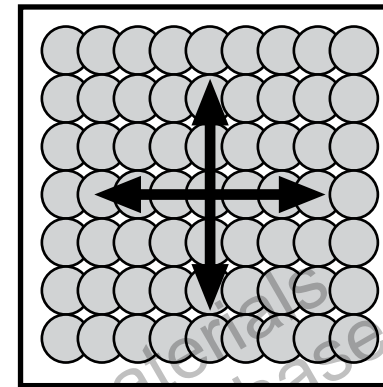


When a solid is heated, it begins to melt. If heated enough, the melted liquid turns into gas or vapor.

– Hypothesize –

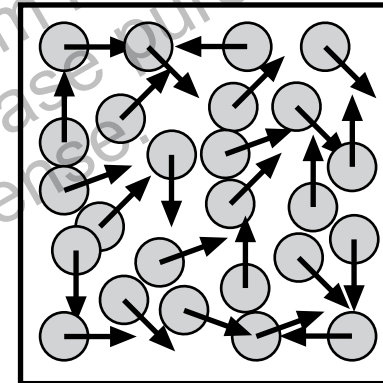
How could you turn water vapor back into liquid water?

evaporate: change from a solid or liquid into a gas, or vapor



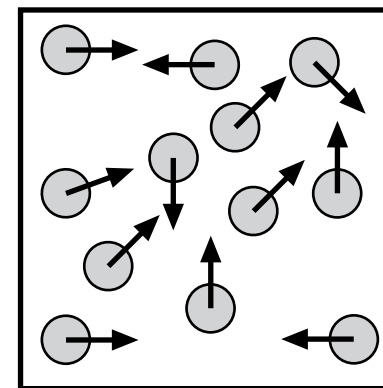
Solids

Solids have packed particles. They cannot move around very much.



Liquids

The particles in liquids are able to move around more.



Gases

In gases, particles are farthest apart. They can move in all directions.

Physical Properties

When water goes from one state to another, it changes size and shape. But the substance is still the same. This is called a physical change. A **physical change** is when matter has changed, but not permanently. For example, you can easily change ice back into liquid water by heating it.

In some physical changes, the properties of the object change. A **physical property** is something that you can detect with your five senses.

When you look at an ice cube, you could describe it as solid and hard. You could describe water as liquid and shapeless. The substance is still water, but it looks and feels different.

physical change: a change in the properties of matter without becoming a new substance

physical property: a quality that you can detect with your five senses

Shape

When you look at an object, what do you see? One thing you will notice is its shape. Shape is a physical property of matter.

Shape can tell us about the purpose of an object. For example, a ball is round so that it can roll easily. A glass is shaped so that it can hold a drink.

Sometimes a solid can change shape without becoming a liquid or gas. If you mold clay into a ball, it is round. If you flatten the clay like a pancake, it is round but flat. If you roll it into a rope, it is long and thin. It is still a solid, but its shape has changed.

– Recall –

What are the five senses we use to determine the physical properties of something?

Size

Size is another way to describe matter.

Gigantic, big, small, and tiny are all words that describe size. Sometimes we compare two objects using size. For example, if your friend said, “That snowman is as big as a car,” you would picture a big snowman. If your friend said, “That snowman is as small as a cat,” you would picture a small snowman.

Color

We use color to describe matter every day. Imagine two football teams are playing a game. An easy way to tell them apart is by the color of their uniforms.

All states of matter may or may not have color. A banana is yellow and tomato juice is red. Water is usually colorless or clear unless you add something to it. Have you seen exhaust from a car? Exhaust is a gas, and it might look gray.

Texture

Texture is another property of matter. It is the way something feels. *Rough, smooth, soft, and bumpy* are words that describe texture.

Mass

Everything that is matter has mass. Objects with a lot of mass are heavy, while objects with very little mass are light. A rock has more mass than an empty plastic bottle, even though it may be smaller in size. A good way to measure the mass of an object is by weighing it on a scale.

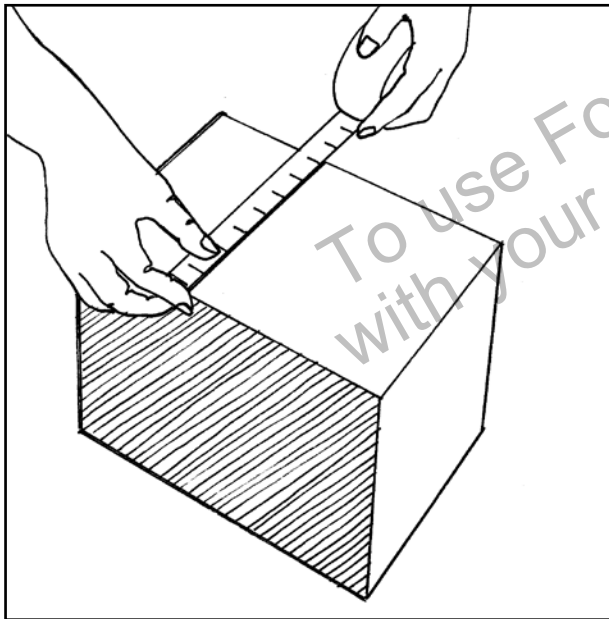
You can measure the mass of liquid matter, too. Weigh an empty glass. Then fill it with lemonade and weigh the glass again. Subtract the weight of the empty glass and you will have the weight of the lemonade.

– Extend –

Can you think of any other physical properties used to describe matter?

Volume

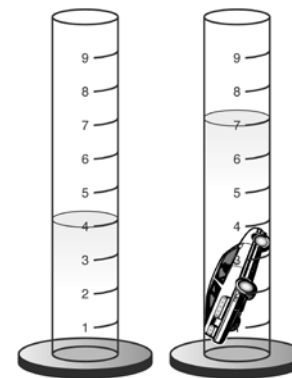
Volume is the amount of space that matter takes up. You can use a ruler or tape measure to find the volume of a solid. Perhaps you want to know how much a box can hold. Find the length, width, and height of the box. Then multiply these numbers. The answer is the volume of the box.



volume: the amount of space that matter takes up

Liquid is measured in the U.S. customary system using fluid ounces (oz) and gallons (gal). When we use the metric system we measure liquids in milliliters (mL) and liters (l). A graduated cylinder will give you the volume of a liquid.

It can also give you the volume of a solid. Fill the graduated cylinder halfway with water. Record the height of the water. Add a toy car to the water, and the water goes up. Record this new height. Subtract the first height from the second height. The result is the volume of the toy car.



*The volume of the toy car is
 $7 \text{ mL} - 4 \text{ mL} = 3 \text{ mL}$.*

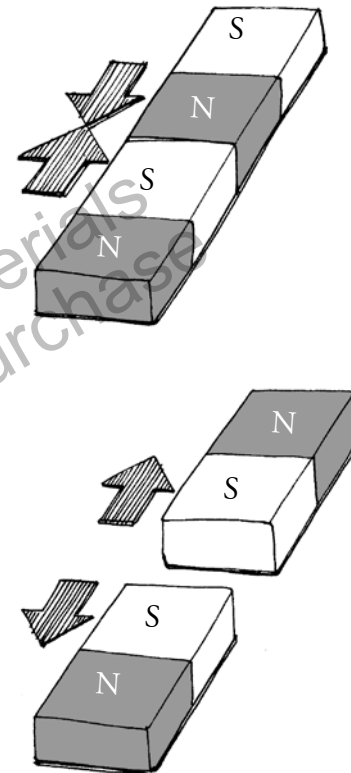
*– Apply –
Which has a greater volume, a toy car or a real car?*

Magnetism

Some materials are magnetic. They have a pulling force on some metals. To find out whether a substance is attracted to a magnet, move it close to a magnet. If you feel the magnet being pulled towards the substance, then it is magnetic. The magnet might even stick if the attraction is strong enough.

Magnets have north and south poles. Similar magnetic poles repel each other, while unlike poles attract. To attract magnets, place a north and south pole near each other. To **repel** magnets, place similar ends near each other.

magnetism: the ability to attract metals such as iron
repel: drive or push away



The south poles are marked with an “S”. The north poles are marked with a “N”. What would happen if you placed the north poles near each other?

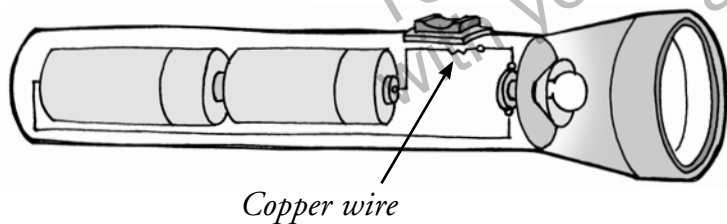
– Experiment –

Test whether different objects around your home are attracted to a magnet. Record your findings in a chart.

Conductivity

Conductivity is the ability to transfer electricity, heat, or sound. Some materials have high conductivity. Others have low conductivity.

For example, electricity can be conducted through some metals. Silver is the best **conductor** of electricity, but copper is almost as good and it costs less. The wires inside electric appliances are usually made of copper.

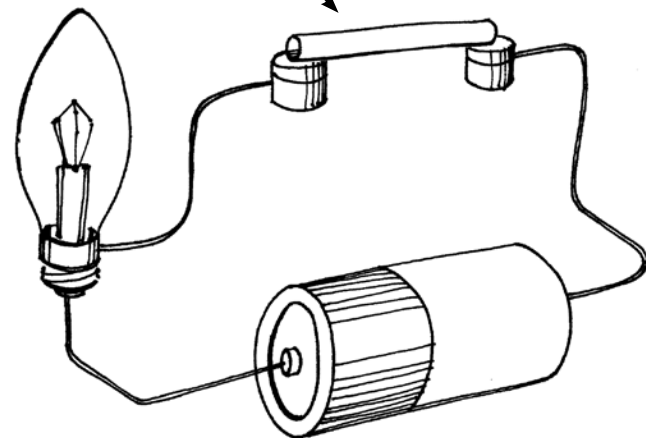


conductivity: the ability to transfer electricity, heat or sound
conductor: a material that transfers heat or electricity

Testing for Conductivity

Let's test the electrical conductivity of an object. Look at the diagram below. First, we connect a wire from the battery to an object, say a paper straw. Then, we connect another wire from the straw to the light bulb. We connect a third wire from the light bulb to the other end of the battery. If the bulb lights up, the straw is a conductor.

This paper straw is being tested as a conductor.



– Hypothesize –

Is a paper straw a good conductor of electricity?

Heat can also be conducted or transferred. Think about cooking. If you are preparing soup using a stove, you do not want to touch the pot with your bare hands. A cooking pot conducts heat.

You can stir the soup with a wooden spoon and not get burned. This is because wood has low **thermal conductivity**. The heat moves slowly through the material.

thermal conductivity: the ability to transfer heat

Insulation

A material that keeps heat from transferring is an **insulator**. It has very low thermal conductivity. Air and feathers are two insulators. If you wear a feather-filled coat during winter, it will keep you warm. The feathers keep your body heat in.

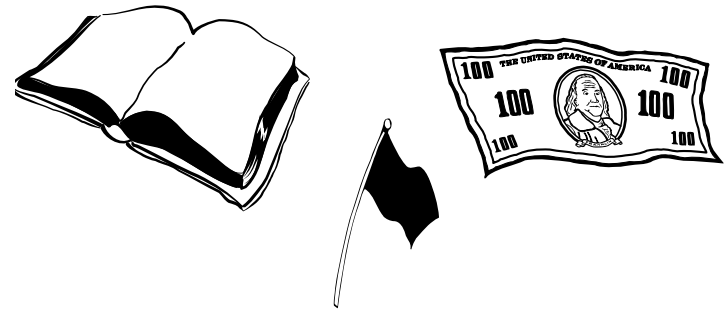
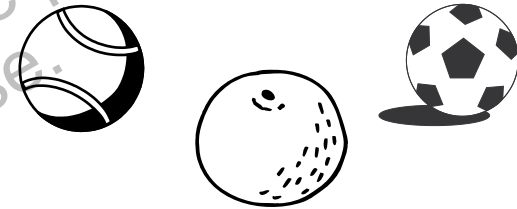
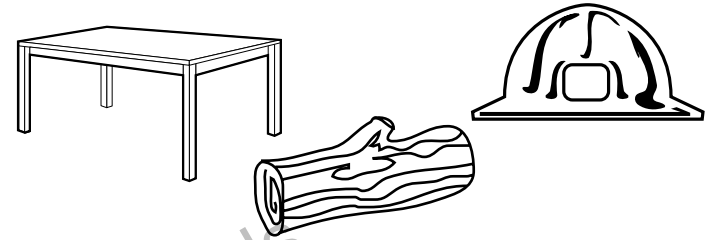
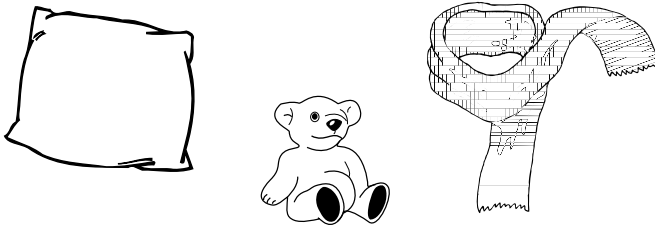
Another example of an insulator is rubber. Rubber has low electrical conductivity. Electricity does not flow well through it. Rubber is used as an insulator around copper wire. That is why you do not get shocked when you touch an extension cord plugged into an electric outlet.

insulator: a material that keeps heat or electricity from transferring

Categorize Properties

Physical properties allow us to categorize matter. To categorize is to group items together. For example, if you were to categorize by color, you could put a green shirt, a green leaf, and a green frog in the same group. Even though these things are different from each other, they are all the same color. If you were to categorize by size, you could put a paper clip, a quarter, and a stamp in the same group. What are some other ways you might categorize matter?

What physical property do the items in each group share?



Glossary

conductivity—the ability to transfer heat, sound, or electricity

conductor—a material that transfers heat or electricity

evaporate—change from a solid or liquid into a gas, or vapor

insulator—a material that keeps heat or electricity from transferring

magnetism—the ability to attract metals such as iron

mass—the amount of material in an object

physical change—a change in the properties of matter without becoming a new substance

physical property—a quality that you can detect with your five senses

repel—drive or push away

thermal conductivity—the ability to transfer heat

volume—the amount of space that matter takes up

To Find Out More . . .

Want to learn more about matter?

Try these books

States of Matter by Robert Snedden. Reed Educational and Professional Publishing, 2001.

Solids, Liquids, and Gases by Carol Ballard. Heinemann, 2004.

Access these Web sites

Chem4Kids

<http://www.chem4kids.com>

BrainPOP

<http://www.brainpop.com/science/matter/>

Write for more information

Odyssey Magazine: Adventures in Science
Cobblestone Publishing Company
30 Grove Street, Suite C
Peterborough, NH 03458

Index

color, 10
conductivity, 15–19
electricity, 16, 18–19
heat, 5, 18, 19
magnetism, 14
mass, 4, 11
physical change, 8
shape, 5–6, 8, 9
size, 8, 10
texture, 11
volume, 12, 13

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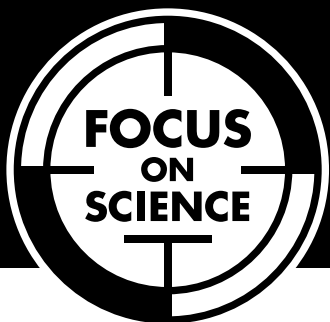
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On Level

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Matter and Energy

Assessments

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Print pages 20–22 of this PDF for the assessments.

Check Understanding

Shade the circle next to the correct answer.

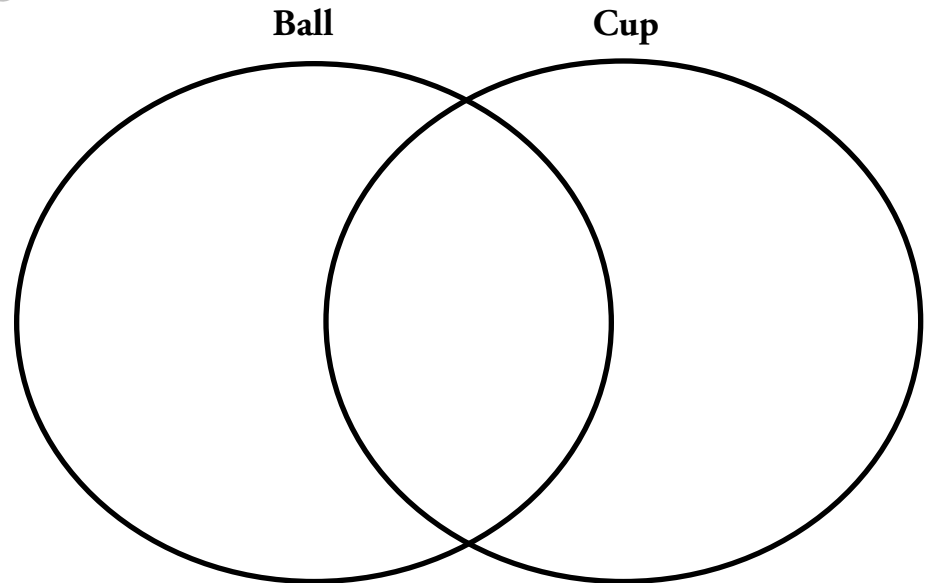
- Which statement correctly describes a material that is an insulator?
 - The material easily transfers heat.
 - The material keeps heat from transferring.
 - The material repels materials containing iron.
 - The material attracts materials containing iron.
- Lucy comes home from school, takes the milk carton out of the fridge, and pours herself a glass. Which list best shows the physical properties she could use to describe the milk?
 - liquid, white, smooth, cold
 - liquid, magnetic, smooth, cold
 - liquid, huge, smooth, cold
 - liquid, white, smooth, warm

Record your answer in the space provided.

- Some properties of a ball and cup are listed below.

Ball	Cup
rubber	smooth
green	50 grams
50 grams	glass
smooth	cylinder
sphere	clear

Complete the Venn diagram below to compare and contrast the ball and cup. Use all the properties listed above.



Check Understanding

Record your answer on the lines provided.

Base your answers to questions 4 through 6 on the data table below and on your knowledge of science. The data table shows four properties of five different objects. The properties are labeled *A*, *B*, *C*, and *D*. Properties *A* and *B* are identified.

Object	Property			
	A Color	B Texture	C _____	D _____
1	green	rough	24 mL	cube
2	orange	smooth	16 mL	sphere
3	black	smooth	10 mL	cylinder
4	red	rough	35 mL	sphere
5	purple	rough	6 mL	cube

4. Identify Property C. _____

5. Identify Property D. _____

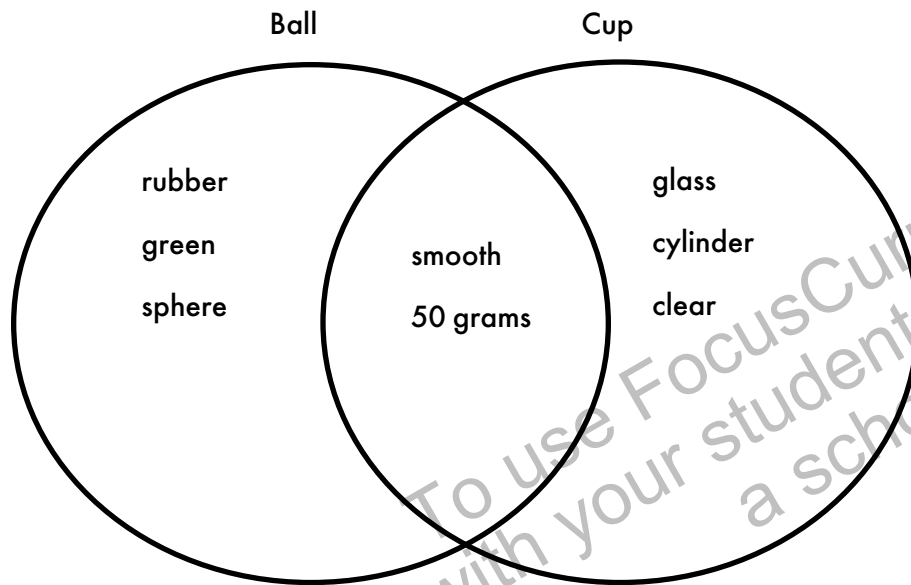
6. Which two objects are both rough cubes?

Object number: _____

Object number: _____

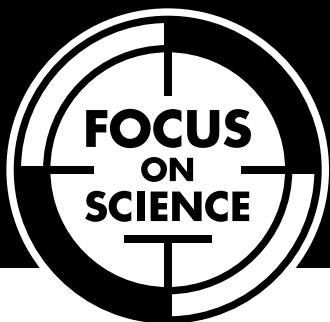
Assessment Scoring Guidelines

1. Answer B is the correct answer.
2. Answer A is the correct answer.
- 3.



4. Volume
5. Shape
6. Object 1
Object 5

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English Language Arts Activities

All About Matter

Print pages 24–28 of this PDF for the reading activities.

Make Inferences

TRY THE SKILL

According to *All About Matter*, matter can be a solid, liquid, or gas. Solids have a certain shape. Liquids flow to take the shape of their container. Gases expand to fill whatever space they are in.

Read each name and circle the word that tells whether it is a solid, liquid, or gas.

1. a sweater

solid liquid gas

2. the air in a hot air balloon

solid liquid gas

3. salad dressing

solid liquid gas

4. a sponge

solid liquid gas

5. blood

solid liquid gas

6. your breath

solid liquid gas

7. an iceberg

solid liquid gas

8. a tree trunk

solid liquid gas

9. clay

solid liquid gas

10. glass

solid liquid gas

11. a cell phone

solid liquid gas

12. fur

solid liquid gas

13. orange juice

solid liquid gas

14. the atmosphere

solid liquid gas

15. the smell of a rotten egg

solid liquid gas

16. seawater

solid liquid gas

Author's Purpose

TRY THE SKILL

An author has a purpose when writing a text. Think about the difference between writing a postcard and writing a report. Or think about the difference between writing a recipe and writing a newspaper article. Each text is unique. Thinking about the author's intended purpose can help you understand the text better. Here are some examples of different purposes for text.

Informational text gives facts about something.

Matter can change from one state to another. Applying heat can cause a solid to become a liquid. Applying heat can also cause a liquid to become a gas. This is how the states of matter are connected.

Biographical text tells about a person's life.

John Dalton was an English chemist. He was born in 1766. He was the first scientist to suggest that matter is made of atoms. He developed something called the atomic theory.

Instructional text explains how to do something.

First, gather a stone, a sponge, and a block of wood. Then, fill a large bowl with water. Next, put the stone in the water. Record what happens. Does it sink or float? Repeat with the sponge and the block of wood.

On the line following each paragraph, indicate whether it is an informational, biographical, or instructional text.

1. First, take a bottle of perfume. Then, go into a room with a friend. Close all the windows and doors. Next, ask your friend to stand at the other end of the room. Spray the perfume once into the air. How long does it take for your friend to smell the perfume?

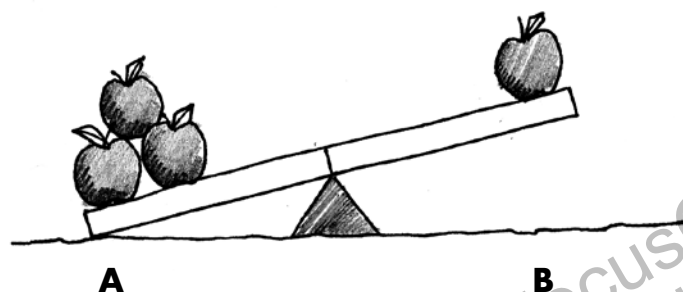
2. When water goes from one state to another, it is changing size and shape. But the matter is still the same. You can easily change ice back into liquid water. This is called a physical change, which means the object has changed, but not permanently.

3. Scottish engineer James Watt was born in 1736. He did experiments with steam. He created a model for the steam engine, which powered machines, boats, and carriages. James Watt is considered a great inventor.

Interpret Graphics

TRY THE SKILL

Authors often explain things by using graphics along with words. If you study a graphic, you can learn more about the topic. Look at the graphic below showing a balance beam.



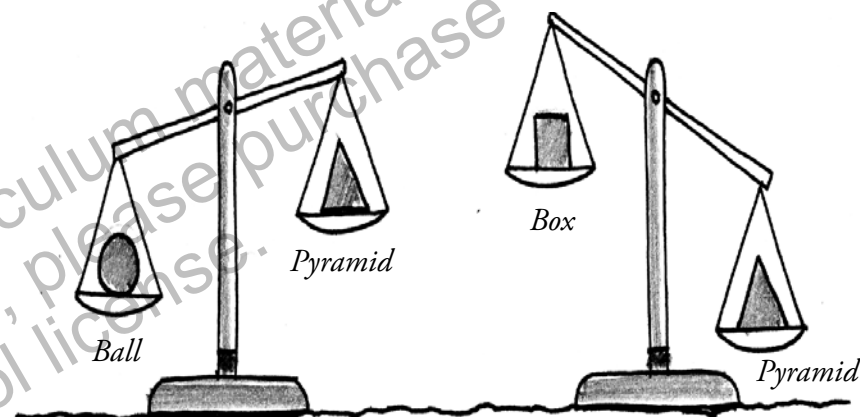
What is an observation you could make by looking at this diagram?

Side A has more mass than side B.

How can the four apples on the balance beam be rearranged on the beam so Side A and Side B will balance?

You could move one apple from Side A to Side B to be balanced. There would then be the same amount of mass on both sides.

Look at the diagram below of two pan balances. Using the diagram, you can compare the masses of the box, ball, and pyramid.



List the three objects in order from the least mass to the greatest mass.

1. least mass _____
2. _____
3. greatest mass _____

Locate Information

TRY THE SKILL

Nonfiction books, such as this one, begin with a table of contents. This table lists the titles of the chapters and any subtitles. Titles tell you which topics the book covers. Subtitles tell you more specific information about the title.

Look at the table of contents below. Use this table of contents to answer the questions.

Introduction: What Is Matter?	4
Chapter 1: States of Matter	5
Chapter 2: Physical Properties	8
Shape	9
Size	10
Color	10
Texture	11
Mass	11
Volume	12
Magnetism	14
Chapter 3: Conductivity	15
Chapter 4: Categorizing	20

Which chapter would you read to learn about color?

Chapter 2, because one of the subtitles is “Color.”

Look at the table of contents at the left. Use it to answer the questions below.

- Which of these is not a main topic in the book?
 - how to categorize
 - how magnetism works
 - the differences between states of matter
 - the sense of smell
- Which chapter might you expand to include more information about conducting heat?
 - 1
 - 2
 - 3
 - 4
- In which chapter are you most likely to find information on how to sort matter into groups?
 - 1
 - 2
 - 3
 - 4

Answer Key

Make Inferences

1. solid
2. gas
3. liquid
4. solid
5. liquid
6. gas
7. solid
8. solid
9. solid
10. solid
11. solid
12. solid
13. liquid
14. gas
15. gas
16. liquid

Author's Purpose

1. instructional
2. informational
3. biographical

Interpret Graphics

1. ball
2. pyramid
3. box

Locate Information

1. D
2. C
3. D

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