الملف دليل المعلم الوحدة السادسة باللغة الإنجليزية

روابط مواقع التواصل الاجتماعي بحسب الصف الرابع



روابط مواد الصف الرابع على تلغرام

التربية الاسلامية	اللغة العربية	اللغة الانجليزية	الرياضيات

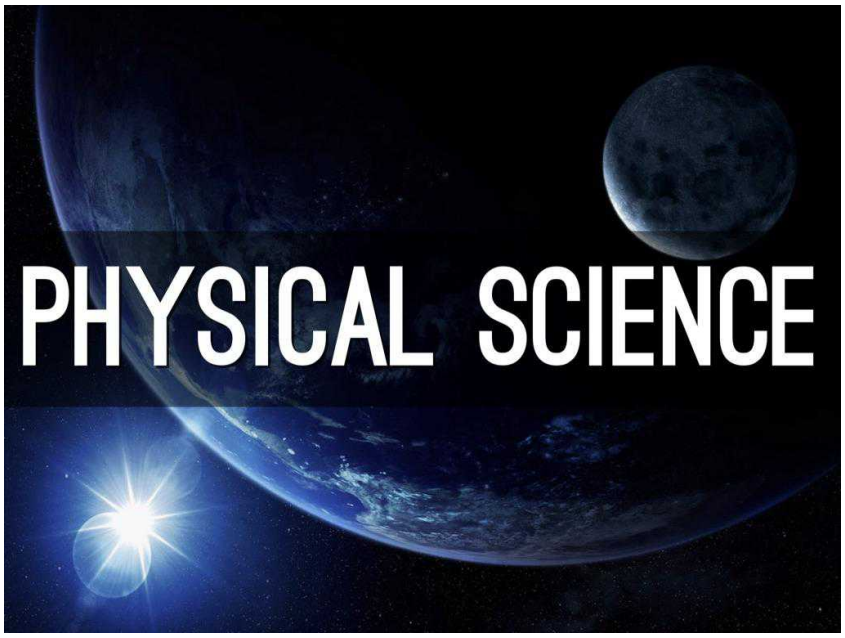
المزيد من الملفات بحسب الصف الرابع والمادة علوم في الفصل الثاني

1	كل مايخص الاختبار التكويني لمادة العلوم للصف الرابع يوم الثلاثاء 11/2/2020
2	أسئلة الامتحانات التكوينية الأولى
3	تحميل دليل المدرس pdf
4	مطوية الطقس
5	جميع أوراق عمل الفصل الثاني

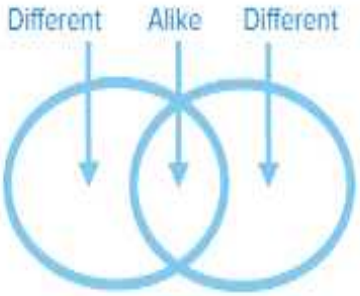
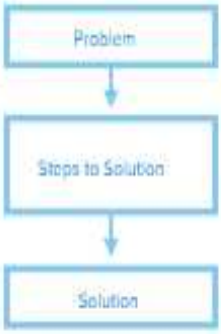
CHAPTER 6

TG G4 SEM 2

- **Describing matter**
- **Measurement**
- **Properties of Water**



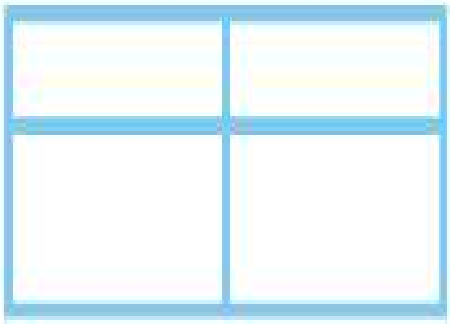
CHAPTER 6 Planner

Lesson	OBJECTIVES AND READING SKILLS	VOCABULARY
1 Describing Matter PACING: 2 days *FAST TRACK:* 1 day	▪ Define and describe the three states of matter. ▪ Compare and contrast properties of matter.  **Reading Skill** Compare and Contrast	matter property mass volume buoyancy solid liquid gas
2 Measure-ment PACING: 2 days *FAST TRACK:* 1 day	▪ Describe some properties of matter that can be measured. ▪ Measure properties of matter using correct units.  **Reading Skill** Problem and Solution	metric system length area density weight gravity

3 Properties of Water

- Explain the physical properties of water.
- Compare and contrast the three states of water.

molecule
cohesive
water vapor
specific heat



PACING: 2 days
FAST TRACK: 1 day

Reading Skill
Classify

Activity Planner

EXPLORE Activities

Explore

PACING: 20 minutes

Objective Distinguish between a solid and a liquid.

Skills observe, interpret data, infer

Materials bowls, cornstarch, water, coins, paper towels

PLAN Have newspapers or other materials available to protect desk surfaces. Students should wear safety goggles.

Explore

PACING: 20 minutes

Objective Use rulers to compare the size of different shapes.

Skills measure, use numbers, observe, communicate

Materials shapes labeled A, B, and C; rulers; pencils

PLAN Prepare copies of the figures for students.

Explore

PACING: 15 minutes

Objective Explore how different containers affect water's properties.

Skills measure, interpret data

Materials ice cubes, ruler, balances, 100 mL graduated cylinder, bowl, 150 mL beaker, aluminum pan, pitcher of water

PLAN Make the ice cubes ahead of time and check that they will fit into each container.

QUICK LAB Activities

Quick Lab

PACING: 15 minutes

Objective Observe a solid change to a liquid.

Skills observe

Materials ice cubes, pan, clock or timer, heating element

SAFETY Be prepared for water spills. Students should wear safety goggles.

Quick Lab

PACING: 15 minutes

Objective Observe how liquids of different densities interact when poured together.

Skills predict, measure

Materials transparent cups or glasses, metric measuring cups or graduated cylinders, water, oil, syrup, small common object, such as crayon, pasta, or craft stick

SAFETY Be prepared for spills. Students should wear safety goggles.

Quick Lab

PACING: 15 minutes

Objective Determine if objects are more or less dense than water.

Skills infer

Materials several small waterproof objects with varying densities, large tub of water

SAFETY Make sure that students have a designated area to work with water.

CHAPTER 6

Language Acquisition Support

Academic Language

When learning, students need help in building their understanding of the academic language used in daily instruction and science activities. The following strategies will help to increase students' language proficiency and comprehension of content and instruction words.

Strategies to Reinforce Academic Language

- **Use Context** Academic language should be explained in the context of the task. Use gestures, expressions, and visuals to support meaning.
- **Use Visuals** Use charts, transparencies, and graphic organizers to explain key labels to help students to understand classroom language.
- **Model** Use academic language as you demonstrate the task to help students to understand instruction.

Academic Language Vocabulary Chart

The following chart shows chapter vocabulary and inquiry skills. **Vocabulary** words help students to comprehend the main ideas. **Inquiry Skills** help students to develop questions and perform investigations.

Vocabulary	Inquiry Skills
matter mass property volume buoyancy solid liquid gas metric system area length density weight gravity molecule cohesive water vapor specific heat	observe interpret data infer measure use numbers communicate

Vocabulary Routine

Use the routine below to discuss the meaning of each word on the vocabulary chart. Use gestures and visuals to model all words.

Define An object's *length* is the number of units that fit along the edge of an object.

Example *Length* is often measured with a ruler.

Ask What is the *length* of a piece of notebook paper?

Students may respond to questions according to proficiency level with gestures, one-word answers, or phrases.

Vocabulary Activities

Students explore the length of various items.

BEGINNING Explain that *length* refers to how long something is. Have a student measure the length of the board. Write on the board and say: *The length of the board is [2 meters].* Have students measure the lengths of classroom objects, such as a pencil, a desk, or a book, and then say the lengths.

INTERMEDIATE Explain that the length of something can be referred to in two ways: *The length of this ruler is 30 centimeters. This ruler is 30 centimeters long.* Choose a variety of classroom objects and have students describe the lengths of each one using the two ways mentioned.

ADVANCED Have students write a definition of *length* together. Have a volunteer measure the length of the chalkboard. Ask: *What else can you measure on the chalkboard?* height, width Have students work in pairs to measure three classroom objects and make comparison statements: *The pencil is longer than the crayon. The desk is wider than the chair.*

CHAPTER 6

Matter

THE BIG IDEA What are properties of matter?

Chapter Preview Have students look at the essential questions, vocabulary words, and pictures and predict what the lessons will be about.

Vocabulary

- Have a volunteer read the **Vocabulary** words aloud to the class. Ask students to find one or two words in the chapter by using the given page references. Add these words and their definitions to a class Word Wall.
- Encourage students to use the glossary in the Student Edition's reference section.

Differentiated Instruction

Instructional Plan

Chapter Concept Properties are used to describe matter.

EXTRA SUPPORT Students who need to know the basic properties and states of matter should review them in Lesson 1 before continuing with the rest of the chapter.

ON LEVEL Students who know the basic properties of objects and states of matter might do the Lesson 1 Review and then go to Lesson 2 to explore how mass and volume are used to describe the density of a substance.

ENRICHMENT Students who are ready to go further can look at Lesson 3 for an in depth study of the properties of water.

Assess Prior Knowledge

Before reading the chapter, create a **KWL** chart with students. Read the Big Idea question and then ask:

- Which properties are used to describe matter?
- Which tools can be used to measure matter?
- What are the physical properties of water?

Answers shown represent sample student responses.

Before reading this chapter, write down what you already know in the first column. In the second column, write down what you want to learn. After you have completed this chapter, write down what you learned in the third column.

Matter		
What We Know	**What We Want to Know**	**What We Learned**
Matter can be described by making observations.	What is a property?	
A ruler is used to measure length.	Which tools are used to measure matter?	
Water is a liquid at room temperature.		

Here to

Plan Your Lesson

Lesson 1 Describing Matter

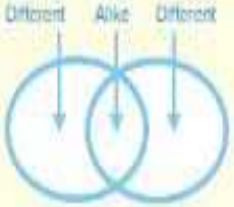
Essential Question

How do we explain what matter is?

Objectives

- Define and describe the three states of matter.
- Compare and contrast properties of matter.

Reading Skill Compare and Contrast



You will need a compare-and-contrast graphic organizer.

FAST TRACK

Lesson Plan When time is short, follow the Fast Track and use the essential resources.

1 Introduce
Look and Wonder

2 Teach
Use the Visuals
Develop Vocabulary

3 Close
Think, Talk, and Write

Teacher Notes

ENGAGE EXPLORE EXPLAIN EVALUATE EXTEND

Lesson 1 Describing Matter

Objectives

- Define and describe the three states of matter.
- Compare and contrast properties of matter.

1 Introduce

▶ Assess Prior Knowledge

Have students describe some classroom objects. List the characteristics of the objects on the board or whiteboard. For example, the characteristics of a piece of chalk include a white or yellow color, a short or long length, and being soft enough to break in half. Ask:

- How is your textbook different from a piece of chalk? Possible answers: The textbook is bigger; the textbook is harder; the textbook is more colorful; the textbook is heavier.
- Would you classify the chalk and the textbook as solids, liquids, or gases? Both are solids.

Warm Up

Start with a Demonstration

Place several ice cubes in a transparent pot in a heat-proof beaker, then place the container on a heated hot plate.

Be Careful! Make sure that students do not approach the heated hot plate. Students should wear safety goggles to protect their eyes from the boiling water. Ask:

- What was added to the ice and liquid water to cause it to change?
- What happens when the ice melts?
- What happens when the liquid water boils?

ENGAGE EXPLORE EXPLAIN EVALUATE EXTEND

Look and Wonder

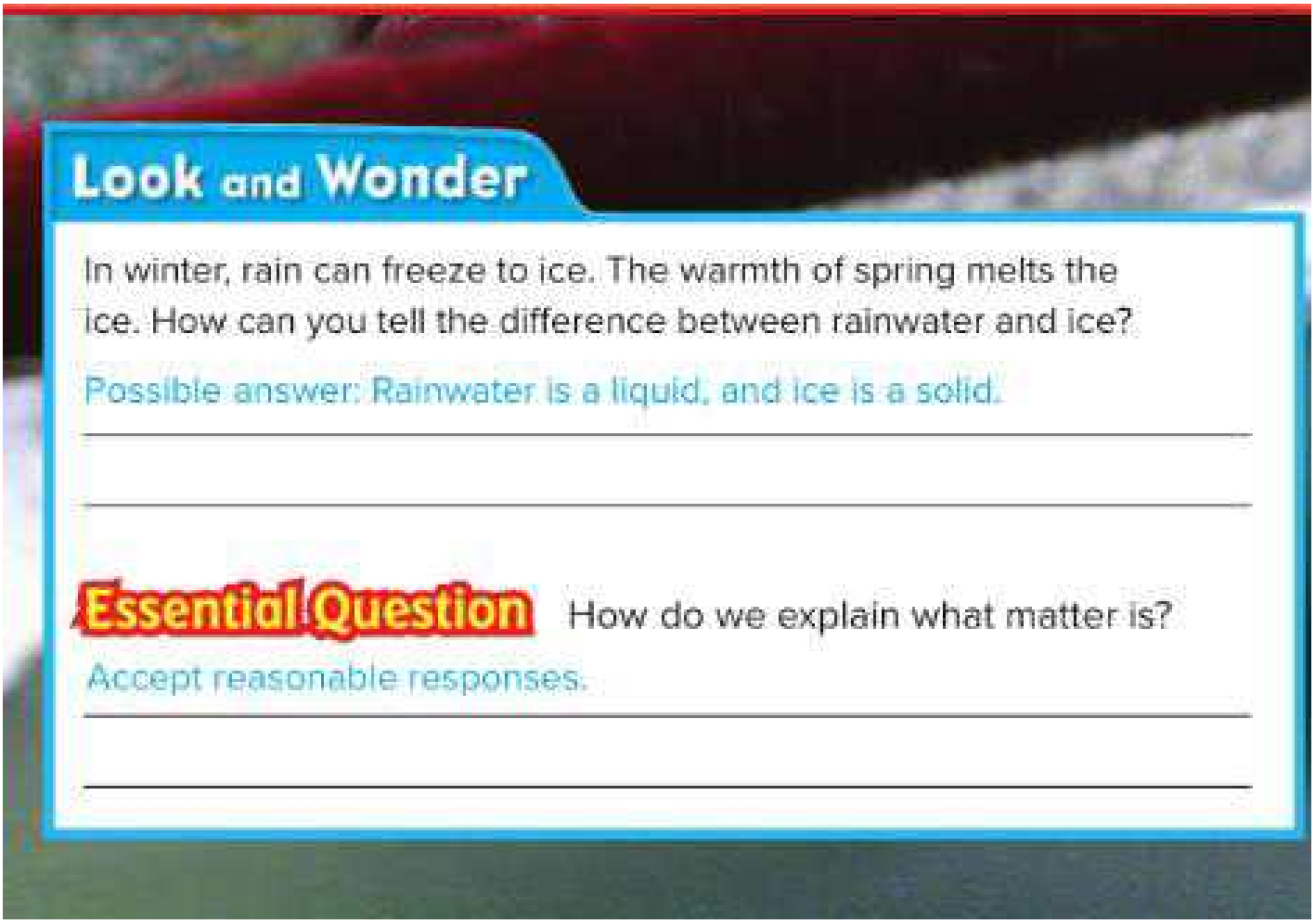
Invite students to share their responses to the Look and Wonder statement and question:

- **How can you tell the difference between rainwater and ice?**

Write ideas on the board and note any misconceptions that students may have. Address these misconceptions as you teach the lesson.

Essential Question

Have students read the Essential Question. Tell them to think about it as they read through the lesson. Advise students that they will return to this question at the end of the lesson.



Look and Wonder

In winter, rain can freeze to ice. The warmth of spring melts the ice. How can you tell the difference between rainwater and ice?

Possible answer: Rainwater is a liquid, and ice is a solid.

Essential Question How do we explain what matter is?

Accept reasonable responses.

Explore

Plan Ahead Have newspaper available to cover desk surfaces. Measure about 250 grams of cornstarch for each group. Students should wear smocks and safety goggles and will need to wash their hands after the activity.

Purpose Students examine the properties of a solid, a liquid, and a mixture.

Structured Inquiry

2. To get the proper consistency, mix about 343 grams of cornstarch to 120 mL of water. The top of the mixture should not splash.

6. **Interpret Data** The mixture can be made into clumps like a solid, but it can also be poured like a liquid. Small objects sink into it, as in a liquid.

7. **Infer** Students may think of the mixture as either a solid or a liquid since it has properties of both.

How can you tell if something is a solid or a liquid?

Make a Prediction

What is a solid? A liquid? Write a definition of each. If you mix cornstarch and water, will you have a solid or a liquid? Make a prediction.

Answers will vary. Possible prediction:

The mixture will be a liquid.

- 250 grams of cornstarch
- 200 milliliters of water
- bowl
- coin
- paper towels

Test Your Prediction

1. Pour the cornstarch and water into the bowl.
2. Use your fingers to mix the cornstarch and water together.
3. **Observe.** Use your senses to observe the new substance. How does it feel? What does it look like? Record your description.

   Possible answer: The mixture is softer than a solid but firmer than a liquid.
4. Tap the surface of the substance with your finger. Does it splash out of the bowl?

   Possible answer: No, it does not splash out of the bowl.
5. Place a small object such as a coin on the surface. Does it stay on top or sink?

   The coin will slowly sink into the mixture.

Draw Conclusions

6 **Interpret Data.** Compare your observations to your definitions. How is the new substance like a solid? How is it like a liquid?

It is like a solid because it can be made into clumps and broken into pieces. It is like a liquid because it can be poured and small objects will sink into it.

7 **Infer.** Is the mixture of cornstarch and water a solid or a liquid? Explain.

Possible answer: It is a liquid because it has the properties of a liquid.

8 Do your results support your prediction? Why or why not?

Possible answer: Yes. I predicted that if there were more water than cornstarch, it would be a liquid. This is what happened.

Explore More

What would happen to this substance if you added more water? What if you let it dry out overnight? Make a prediction. Try it! Then report your results.

Possible answer: If more water were added, it would splash. If it dried out, it would be a solid.

Open Inquiry

What will happen to the dried cornstarch and water if it is tapped with a rubber mallet?

Answers will vary.

2 Teach

Read and Respond

Main Idea Have students do a picture tour of the lesson. Ask them what they think this lesson is about. Then have them list solids, liquids, and gases from the pictures.

Vocabulary Have students read aloud the vocabulary words. Ask students to use each word in a sentence.

Reading Skill **Compare and Contrast**

Graphic Organizer Have students fill in a Compare and Contrast graphic organizer as they read through the lesson. They can use the Quick Check questions to identify each comparison.

What is matter?

► Discuss the Main Idea

Discuss the meanings of the vocabulary words shown. Ask:

- How can you tell that the rock and feather both have volume? They both take up space.
- What are some properties of salt? Possible answers: white color, salty taste, hard, a crystal
- How is mass different from volume? Mass tells you how much matter an object has. Volume is how much space an object takes up.

Read and Respond

What is matter?

When you mix cornstarch and water, you get a thick gooey substance. You can see and touch it. It takes up space in the container. Like many things, this substance is matter. ***Matter*** is anything that has mass and takes up space.

Most things are made of matter. The air you breathe and the book you are reading are made of matter. Light and heat are not matter, however. They do not take up space.

One way to describe matter is by its properties (PRAH•pur•teez). A ***property*** is a characteristic that you can observe. Color, shape, and size are some properties of matter.

Circle the names of the units used to measure mass.

Matter Has Mass

One very important property of matter is mass. ***Mass*** is the amount of matter making up an object. Mass is often measured in units called *grams* or *kilograms*. To measure mass, you use a tool called a *balance* (BA•luns).

Read a Photo

Which has more mass—the rock or the feather? How can you tell?

The rock has more mass because its balance pan is lower.

Matter Has Volume

Another property of matter is volume (VAHL•yum). ***Volume*** is how much space an object takes up. We measure volume by counting the number of cubic units in an object. We can also measure volume with tools like graduated cylinders.

Some Properties Are Unseen

Properties that cannot be seen can still be measured. Take magnetism, for example. This is the ability of matter to attract certain metal objects.

Another unseen property is the ability of matter to dissolve in a liquid. When a substance *dissolves*, it blends in and seems to disappear. Sugar and salt will dissolve in water. Sand will not.

Useful Properties

Properties help people choose the right kinds of matter for different jobs. When strength is needed, iron is a good choice. Wood is better when you need a light material that can easily be shaped.

Buoyancy (BOY•un•see) is a property that helps us build boats. ***Buoyancy*** is the upward force of a liquid or gas on an object. All objects are buoyant. Some objects are so buoyant that they float.

Quick Check

1. How do you know that your desk is matter?

The desk has mass and volume in addition to other properties of matter, such as color, hardness, and shape.

Develop Vocabulary

matter *Scientific vs. Common Use* Remind students of a common use of *matter* as a verb: "to be of importance." Relate this to the importance of the word *matter* in science.

property *Scientific vs. Common Use* Point out that a common use of *property* means "something owned." Ask students to list things that they consider to be their property, such as a CD or a shirt. Ask volunteers to describe the properties of a few of these items.

mass *Scientific vs. Common Use* Describe how mass can refer to a large group of people. Discuss how a mass of people has more mass than a single person. Relate this to how much matter is present.

volume *Scientific vs. Common Use* Discuss with students how *volume* can refer to a book, such as "Volume A" of an encyclopedia. Relate the amount of space taken up by a book volume to the scientific meaning of *volume*.

buoyancy Show students a picture of an ocean buoy and ask them to explain why the name *buoy* was given to the object.

Use the Visuals

Refer students to the visual. Ask:

- What are some other properties of the objects shown? Possible answer: colors, shapes, mass
- What other property can you infer about the objects that float and sink in water? Possible answer: Objects that float have less mass than an equal volume of the water they float on. Objects that sink have more mass than an equal volume of the water they sink in.

Differentiated Instruction

Leveled Activities

EXTRA SUPPORT Have students draw pictures of objects that are identical except for one property. For example, students could draw a red apple and a green apple, or two cardboard boxes of different dimensions.

ENRICHMENT Ask students to choose several objects and predict whether the objects will dissolve. If students predict that the objects will not dissolve, have them predict whether the objects will float in water. Have them test their predictions. Encourage students to share their results with the rest of the class.

What are the states of matter?

Discuss the Main Idea

Write the three forms of matter as headings on the board. Ask students to volunteer details for each form and write them under each heading. Direct students to look at the figures on this page. Ask:

- Which form of matter has the least amount of space between its particles? solid
- Which property of liquids enables them to be poured? The particles in liquids can move more than particles in solids. They can move past one another and are farther apart.

Develop Vocabulary

solid *Word Origin* The word solid comes from the Latin solidus, which means "whole." Have students relate this meaning to the fact that solids do not spread out or break up into parts.

liquid *Word Origin* The word liquid comes from the Latin root word liquidus, which means "liquid." Have students list several different liquids, based on their being wet.

gas *Word Origin* The word gas comes from the Latin word chaos, which is Latin for the Greek word khaos. Khaos originally meant "abyss" or "vast emptiness." Have students hypothesize possible reasons why the word gas may have originally meant an "emptiness." Possible answer: Gases can be invisible and odorless.

Explore the Main Idea

ACTIVITY Have students use magazines, newspapers, or approved Internet sites to find pictures of matter in each form. Ask small groups to assemble the pictures on posters labeled "Forms of Matter." Have groups include descriptions of each type of matter on their posters.

Differentiated Instruction

Leveled Activities

EXTRA SUPPORT Which form of matter can change its shape but keep the same volume? liquid

ENRICHMENT How does energy change the particles in a liquid? When energy is added to a liquid, the particles move faster and faster, and the liquid becomes a gas.

Quick Lab

States of Matter

See the Quick Labs in the back of the book.

Objective Observe a solid change into a liquid.

Materials ice cubes, pan, clock or timer, heating element

1. The ice cubes in the pan represent the solid state of matter.
2. The ice cubes have melted and represent the liquid state of matter. Some ice may remain in the pan.
4. After heating, the ice will completely melt into a liquid. The liquid water will change into a gas as more heat is applied.

Address Misconceptions

A common misconception is that the particles of solids are fixed and do not move.

FACT **The particles that make up solids do move.** All particles in solids, liquids, and gases are always in motion. The particles in solids are packed more efficiently and tightly in the space they occupy than particles in liquids and gases. They move much less.

Gases

Helium (HEE•lee•um) is an example of a gas. A ***gas*** does not have a definite shape. In that way, it is like a liquid.

Unlike a liquid, a gas does not take up a definite amount of space. It fills the shape and space of its container. The helium in a balloon takes the shape of the balloon. If the balloon bursts, the helium will spread out into the air.

In a gas, the particles of matter move about freely. The particles move farther apart from one another to fill the space around them. If there is less space to fill, the particles are closer together. A gas always spreads out to fill its container.

Quick Check

2. How are solids, liquids, and gases the same? How are they different?

All states of matter have mass.
Solids and liquids keep the same volume, but gases do not.Solids keep the same shape, but liquids and gases do not. Particles in gases move about freely.

Inside these balloons is a gas. Gas particles move about freely and spread far apart.

3. A cornstarch and water mixture has both liquid and solid properties. How would you classify it?

It can be classified as both because it has properties of a liquid and a solid.

FACT The particles that make up solids do move

LA Support

Use Pictures Clarify the meanings of all three states of matter: solid, liquid, and gas. Write the terms on the board and have students say them after you. Display pictures that depict states of matter and have students identify each one as a solid, a liquid, or a gas.

BEGINNING Ask students to name the three states of matter.

INTERMEDIATE Students can use phrases and short sentences to describe any of the three states of matter.

ADVANCED Students can compare and contrast all three states of matter by using complete sentences.

What happens to the matter we use?

▶ Discuss the Main Idea

Have students discuss different types of matter that they reuse and recycle. Ask:

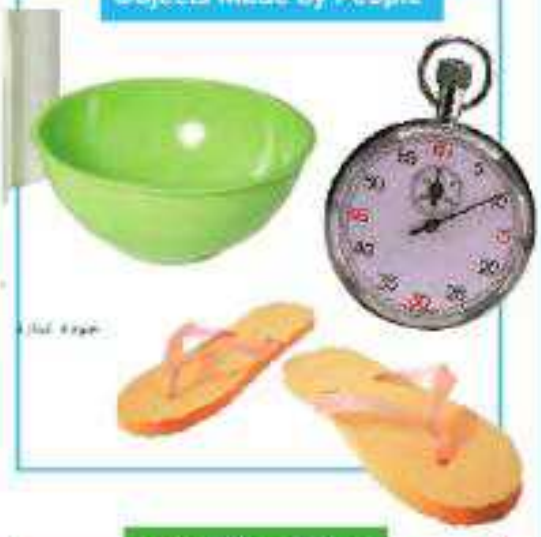
- What are some uses of water? Possible answers: for watering plants; for washing dishes and clothes; for showering; for drinking
- What are some types of matter that get recycled? Possible answers: cans, bottles, metals, glass, paper
- How can you reuse old clothes? Possible answers: turn them into rags for cleaning; donate them

▶ Develop Vocabulary

Have students draw a concept map relating to vocabulary terms in the lesson. If students have difficulty, write the following sentences on the board: *All matter has properties. Properties include mass, volume, buoyancy, and state. States are solid, liquid, and gas.*

Uses of Matter

Objects Made by People



Objects in Nature

What happens to the matter we use?

You use matter all the time. The food you eat is matter. Your chair is matter. You even breathe matter!

Some matter, like air, can be used again and again. Other forms of matter get thrown away. Too often, matter becomes trash. It goes into landfills or oceans.

Many people choose to ***reuse*** matter. This is when you use something again instead of throwing it away. An egg carton can be used to plant seeds. Are there other uses for things you throw away?

Matter can also be ***recycled***, or made into something else. Cans, paper, plastic, and glass can all be recycled. What else can you recycle?

Read a Photo

How are these objects classified? How else could you sort them?

They are classified as objects made by people and objects made by nature. They could also be grouped by color or size.

Quick Check

4. What is the difference between using matter and reusing matter?

Both involve using matter again, but recycling involves making the matter into something else.

Homework Activity

Physical Properties

Advise students that some properties apply to an object, and some apply to the material that it is made of. Have students choose a cooking utensil and list properties of the utensil, as well as properties of the materials that make up the utensil. Possible answers: For a metal spatula with a wooden handle: The spatula is flat and wide; the handle is shaped so that it can be easily held. The blade is metal, which is hard and strong; the wood does not conduct heat well.

3 Close

Lesson Review

▶ Discuss the Main Idea

Have students review their answers to the questions throughout the lesson. Address any remaining questions or misconceptions.

▶ Visual Summary

Have students summarize key points of the lesson in the Visual Summary. The titles in each box will help guide students to the topics they should summarize.

LESSON 1
Lesson Review

Visual Summary

Complete the lesson summary in your own words.

Properties of Matter Possible answer: All matter has mass. Other properties of matter include volume, magnetism, and buoyancy.

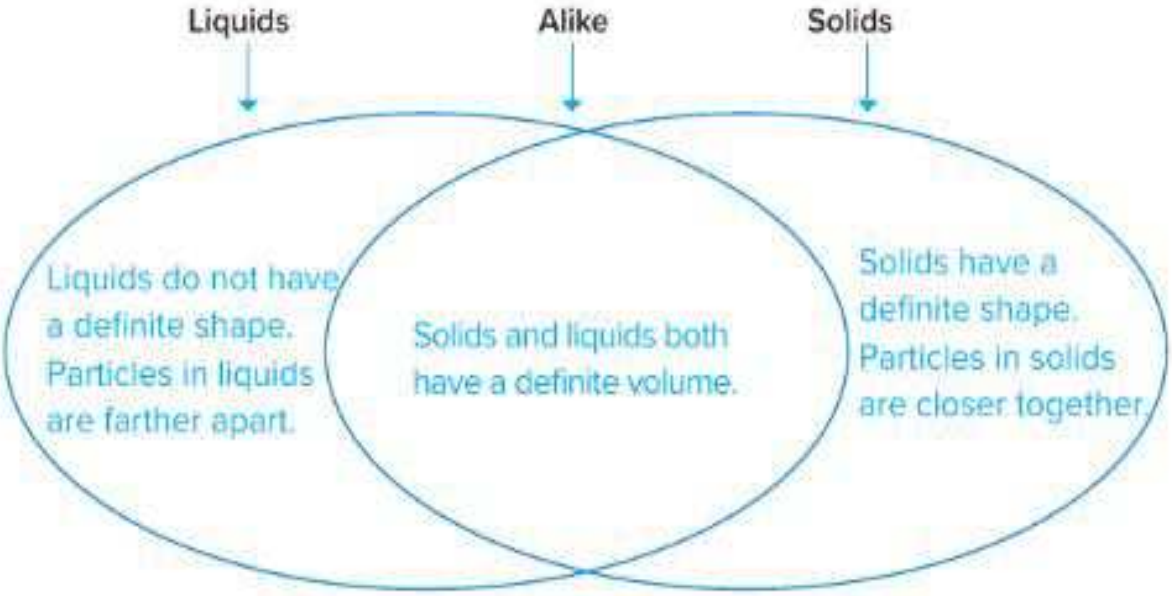
States of Matter Possible answer: The three states of matter are solid, liquid, and gas. Each has particles with different physical properties.

Uses of Matter Possible answer: People use matter many different ways. People can also reuse and recycle matter.

Think, Talk, and Write

1 **Vocabulary.** Solid, liquid, and gas are three states of matter.

2 **Compare and Contrast.** Choose two states of matter. How are they alike? How are they different?



3 **Critical Thinking.** Look around your school or classroom. List examples of solids, liquids, and gases.

Answers will vary. Accept reasonable responses.

4 **Test Prep.** Which of the following is matter?

A heat
B sound
C air
D light

Essential Question How do we explain what matter is?

Possible answer: Matter is anything that has mass and takes up space.

Math in Science

Objective

- Calculate the volume of a solid.

Taking Up Space

Learn It

Draw a rectangular solid on the board. Label the corresponding sides "6 cm," "4 cm," and "3 cm." Show students that they can find the volume of a rectangular solid by multiplying the length, width, and height.

Write on the board: $6 \times 4 = 24$; $24 \times 3 = 72$; volume = $72\ cm^3$

Students should understand that when the sides are measured in centimeters, the answer is in cubic centimeters: cm^3.

Math in Science

Taking Up Space

Volume is the amount of space that something takes up. Tools like measuring cups and beakers make it easy to find the volume of a liquid. You probably use measuring cups at home to add milk or water to a recipe. How can you find the volume of a solid?

To find the volume of a solid, you first take its measurements. Then, you make a calculation. For a rectangular solid, you measure its length, width, and height. Then, you multiply those numbers together.

Calculating Volume

- **The volume (V) of a rectangular object is the product of its length (l), width (w), and height (h). Another way of stating this relationship is:**
  $V = l \times w \times h$
- **In the example:**
  $V = 30\ cm \times 20\ cm \times 10\ cm$
  $V = 6{,}000\ cm^3$
- **What is a cm^3? It is a unit of volume called a cubic centimeter. One cm^3 is a cube with sides that are each 1 cm long. Six thousand of them would fit in a box with the measurements above.**

Let's look at an example. A box measures 30 centimeters in length, 20 cm in width, and 10 cm in height. To find its volume, just multiply the numbers.

Solve It

Calculate the volumes of the objects shown.

1. length = 6 cm, width = 4 cm, height = 2 cm

48 cm^3

2. length = 31 cm, width = 18 cm, height = 11 cm

6,138 cm^3

3. length = 5 cm, width = 25 cm, height = 38 cm

4,750 cm^3

Try It

Change the labels on the diagram and have students calculate the new volume.

Apply It

- Have students select a book from their desks, their backpacks, or the classroom bookshelf. (Paperback books will work better than hardcovers because the covers are the same size as the pages.)
- Tell students to measure the length, width, and height of the book, then calculate its volume.

ere to

Plan Your Lesson

Lesson 2 Measurement

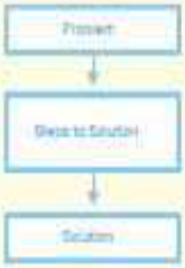
Essential Question

What tools can you use to study matter?

Objectives

- Describe some properties of matter that can be measured.
- Measure properties of matter using correct units.

Reading Skill Problem and Solution



You will need a problem-and-solution graphic organizer.

FAST TRACK

Lesson Plan When time is short, follow the Fast Track and use the essential resources.

1 Introduce
Look and Wonder

2 Teach
Develop Vocabulary
Discuss the Main Idea

3 Close
Think, Talk, and Write

Lesson 2 Measurement

Objectives

- Describe some properties of matter that can be measured.
- Measure properties of matter using correct units.

1 Introduce

▶ Assess Prior Knowledge

Discuss with students what a measurement is. Ask:

- What are some things that can be measured? Possible answers: weight; height; distance from home to school
- What must be included in a measurement? a number and a unit of measurement
- What are some tools used to make measurements? Possible answers: ruler, measuring cup, balance, scale, identical squares or cubes

Look and Wonder

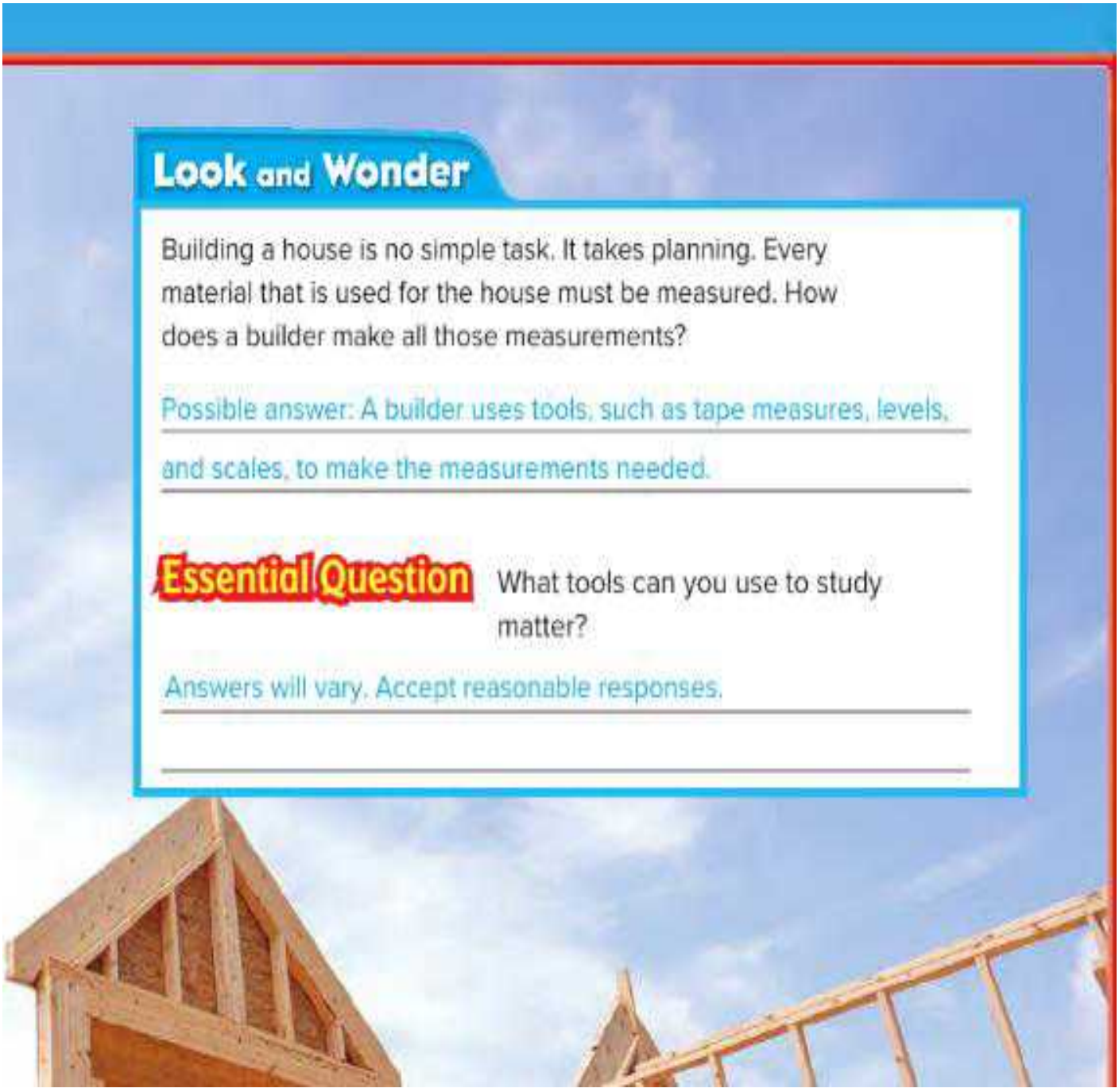
Invite students to share their responses to the Look and Wonder statement and question:

- **How does a builder make all those measurements?**

Write ideas on the board and note any misconceptions that students may have. Address these misconceptions as you teach the lesson.

Essential Question

Have students read the Essential Question. Tell them to think about it as they read through the lesson. Advise students that they will return to this question at the end of the lesson.



Look and Wonder

Building a house is no simple task. It takes planning. Every material that is used for the house must be measured. How does a builder make all those measurements?

Possible answer: A builder uses tools, such as tape measures, levels, and scales, to make the measurements needed.

Essential Question What tools can you use to study matter?

Answers will vary. Accept reasonable responses.

ENGAGE | EXPLORE | EXPLAIN | EVALUATE | EXTEND

Explore

Plan Ahead Prepare copies of the figures for students. They can trace the figures on their own papers, but it will save class time if they are given prepared copies of the figures.

Purpose Students learn to measure area by comparing numbers of small units of measure.

Structured Inquiry

1. **Measure** Make sure that the squares students draw are equal in size and do not overlap.

3. **Observe** Students will need to use the same method of measurement they used previously to accurately compare shape C with shapes A and B.

4. The shape with the fewest number of squares will be the smallest. The shape with the most squares will be the largest.

Explore

How can you compare matter?

Make a Prediction

Look at shapes *A*, *B*, and *C*. Predict how you can use the ruler to determine the largest and smallest shapes. Make a prediction.

Possible prediction: I can use the ruler to measure the shapes and determine which is largest and which is smallest.

Materials

- 3 shapes labeled *A*, *B*, and *C*
- ruler
- pencil

Test Your Prediction

1. **Measure.** Use the ruler to draw 2-centimeter squares on shapes *A* and *B*. Draw as many as you can fit. If you reach the edge, make a partial square.

2. **Use Numbers.** Look at shapes *A* and *B*. How will you use the squares you drew to determine which shape is largest? Smallest?

The largest shape will have the most squares. The smallest shape will have the least squares.

3. **Observe.** Repeat step 1 on shape C. Compare the three shapes again. Record your observations.

Possible observation: Shape B is largest because

Inquiry Activity

Draw Conclusions

4 Which shape is the largest? Smallest?

Possible answer: The square is the largest shape, and the triangle is the smallest shape.

5 **Communicate.** How did you use the 2-centimeter squares to compare the shapes?

Because the squares were all the same size, I could count them and use that number to determine largest and smallest shapes.

6 Was your prediction correct? Explain.

Answers will vary.

Explore More

Can you use a different measuring tool to compare shapes *A*, *B*, and *C*? Make a prediction. Then try it.

Answers will vary.

Open Inquiry

How could you draw several different shapes that are each one unit larger than the previous shape?

Answers will vary. Accept reasonable responses.

ENGAGE | EXPLORE | EXPLAIN | EVALUATE | EXTEND

Guided Inquiry **Explore More**

Have students draw three different shapes onto graph paper and cut out the shapes. Have students count the number of boxes in each shape. Encourage students to discuss how they used the boxes from the graph paper to compare the sizes of the shapes.

Open Inquiry

Have students explain how they could draw six figures, each a different shape and each one a unit larger than the one before it. Have students draw examples.

FAST TRACK

Alternative Explore

Which room is the largest?

Materials ruler, graph paper Tell students that the blueprint on the Activity sheet shows the plans of a house. Have students use a method similar to that used in Explore to compare the areas of the rooms. Have students list the rooms from largest to smallest. To extend the activity have students trace the blueprint onto a piece of graph paper and explain how the graph paper helps them to make their comparisons.

2 Teach

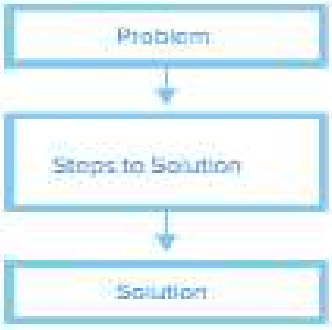
Read and Respond

Main Idea Have students examine the visuals in the lesson. Ask them to write a brief outline of what they think they will learn in the lesson.

Vocabulary Have students read aloud the sentences containing the vocabulary words. Ask students to state the content of the sentences in their own words.

Reading Skill Problem and Solution

Graphic Organizer Have students fill in a Problem and Solution graphic organizer as they read through the lesson. They can use the Quick Check questions to identify each problem and solution.



How do we measure matter?

▶ How do we measure matter?

Discuss the vocabulary words. Ask:

- Which tool can be used to measure the length of the classroom? Possible answers: ruler; meterstick; tape measure; the length of a foot or hand
- How can the area of the classroom be measured? by multiplying the length by the width

Read and Respond

How do we measure matter?

Measuring and counting squares is one way to compare size. When we measure, we use *standard units*. A standard unit is a measurement on which people agree.

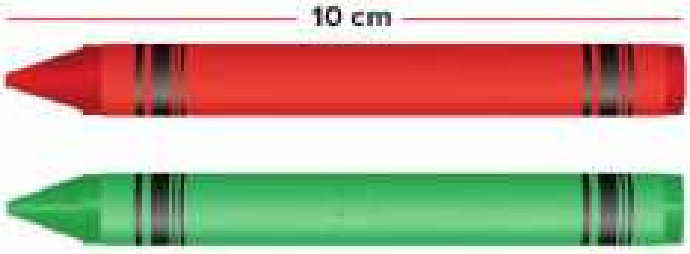
Scientists use standard metric units. The **metric system** is based on units of ten. It uses prefixes such as *kilo-*, *centi-*, and *milli-* to define the size of measurements. For example, 1 meter is divided into 100 cm. There are 1,000 meters in 1 km.

Metric Units	Amount	Estimated Length
1 centimeter	$\frac{1}{100}$ of a meter	the width of your thumbnail
1 decimeter	10 cm $\frac{1}{10}$ of a meter	the length of a crayon
1 meter	10 dm 100 cm	the length of a baseball bat
1 kilometer	1,000 m 100,000 cm	the distance you walk in 10 to 15 minutes

Read a Table

How many centimeters are in a meter? In a kilometer?

There are 100 centimeters in a meter. There are 100,000 centimeters in a kilometer.



You can measure length in centimeters.

Length and Width

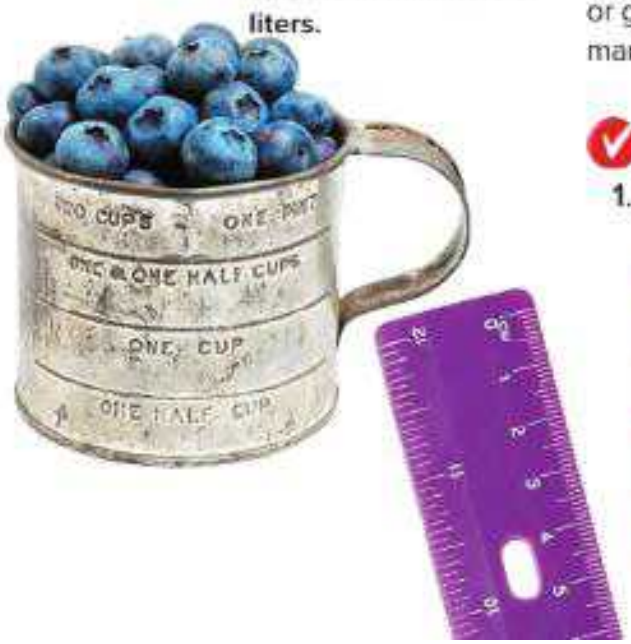
An object's **length** is the number of units that fit from one end to the other. *Width* is the number of units that fit across. How wide is this page? How long is it?

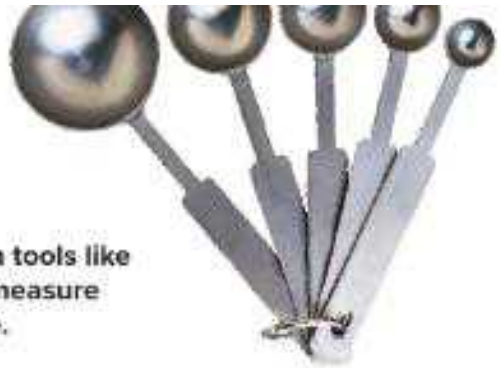
Area

Area (AYR•ee•uh) describes the number of unit squares that cover a surface. An easy way to find the area of a rectangular shape is to multiply its length by its width. The area of this page, for example, is 27 cm × 20 cm, or 540 square cm (cm^2).

What if a shape is not rectangular? Divide it into smaller squares. Find the area of each smaller shape. You might need to estimate parts of some shapes. Then add the area of each smaller shape to find the total area.

A baker can measure volume in milliliters or liters.





Kitchen tools like these measure volume.

Volume

Volume describes the number of cubes that fit inside an object. To find the volume of a rectangular solid, multiply its length by its width and height.

If a solid is not rectangular, you can use water. First, measure the amount of water in a container. Then, submerge the entire object below the water. Subtract the original water level from the new water level. The result is the volume of the object.

To find the volume of a liquid, pour it into a measuring cup, spoon, beaker, or graduated cylinder. Then read the markings on the container.

Quick Check

1. How can you measure the area and volume of your room?

Multiply the length of the room times the width to find the area. Multiply the length times the width times the height to find the volume.

Differentiated Instruction

Leveled Questions

EXTRA SUPPORT Make a list of items in the classroom. Divide the list into three parts according to whether the length, area, or volume is to be measured. Provide students with metric rulers and a copy of the list. Have students make the needed measurements and calculations to find the length, area, or volume of each item.

ENRICHMENT Have students draw a diagonal line througha rectangle. Then have them use this model and what they know about area to describe how to find the area of a triangle.

What is density?

▶ Discuss the Main Idea

Explain that density is a physical property of matter. Ask:

- Can the density of air be changed by heat? Yes, when air is warmed, its particles spread farther apart. The amount of mass in a given amount of volume is less in warm air. Therefore, the density of air can be decreased by heat.
- A piece of cork and a piece of clay both have the same volume. Which is denser? The clay is denser because it feels heavier, indicating that it contains more mass than the cork.

▶ Develop Vocabulary

density *Density* relates mass and volume. Point out that when the term *heavy* is used, it usually means that the object has a high density.

▶ Use the Visuals

Refer students to the visual. Ask:

- How do scientists determine the densities of these materials? They find the masses and volumes of the samples and then calculate the densities by dividing the mass by the volume.
- Why do cork and aluminum have single values of density, while marble has a range of densities? All cork and aluminum have the same makeup throughout. Marble is a metamorphic rock that was once limestone. Different samples of marble can vary in density because of impurities that were in the limestone.

Differentiated Instruction

Leveled Questions

EXTRA SUPPORT Liquid A has a density of 0.74 g/mL. Liquid B has a density of 0.87 g/mL. If the two liquids are poured together, which liquid will float on the other liquid? Liquid A will float on Liquid B.

ENRICHMENT A sample of gold has a mass of 247 grams and a volume of 13 cubic centimeters. What is the density of gold? 19 grams per cubic centimeter

Density and Buoyancy

The density of an object also affects its buoyancy. Remember, buoyancy is the upward force of a liquid or gas on another object.

Float or Sink?

Consider cork and water. The density of water is 1 g/cm^3. The density of cork is 0.24 g/cm^3. Does cork float or sink?

An object floats when its density is less than the density of the liquid or gas in which it is placed. The density of cork is less than the density of water. So cork floats on water. Liquids can float on top of water too.

Can you change the density of matter? If you add heat to air, the air particles move more quickly. They spread out more. The heated air is less dense. It rises as cooler, denser air forces it upward.

Read a Diagram

Why does a hot-air balloon float?

The air inside the balloon is less dense than the air outside. This heated air rises as cooler, denser air pushes it upward.

Quick Check

2. What is the density of a cube with a mass of 8 g and volume of 1 cm^3?
   A. 0.8 g/cm^3
   B. 2 g/cm^3
   C. 4 g/cm^3
   D. 8 g/cm^3

3. What should a hot-air balloonist do to go higher? Explain.

The balloonist should increase the heat of the air in the balloon. Since warm air has less mass per unit of volume than colder air, the colder air outside the balloon will force the warm air inside the balloon upward.

Quick Lab

Comparing Densities

See the Quick Labs in the back of the book.

Objective Observe how liquids of different densities interact when they are poured together.

Materials transparent cup or glass, metric measuring cup or graduated cylinder, 100 mL water, 100 mL oil, 100 mL syrup, craft stick, crayon, dry pasta

1. Possible predictions: They will mix together; they will separate into layers.

2. **Be Careful!** Have students put on safety goggles before pouring the liquids. Have students tilt the cup and pour each liquid slowly down the side, so that the separation of layers is more distinct.

3. The liquids separated into layers. From top to bottom the layers are oil, water, and syrup. Answers will vary based on students' predictions.

4. The stick will float above the oil. The pasta will float above the syrup. The crayon will float above the water and below the oil. A liquid or a solid will float above something that is more dense than it is.

LA Support

Use Realia Review the word density with students. Write it on the board and have students read it aloud. Discuss its meaning. Provide students with samples of salt and sand. Ask them to name each material. Then ask them which one they think has a greater density, the salt or the sand. Help them to find the mass and volume of each sample and calculate the density of each material.

BEGINNING Students can point to or name the salt or the sand.

INTERMEDIATE Students can use phrases or short sentences to describe density.

ADVANCED Students can use complete sentences to describe density.

What is weight?

▶ Discuss the Main Idea

Discuss with students that mass is the amount of matter in something and that weight is the force of gravity acting on that mass. Tell them that the force of gravity on the Moon is less than it is on Earth. Ask:

- How would your mass on the Moon compare with your mass on Earth? It would be the same.
- How would your weight on the Moon compare with your weight on Earth? It would be less on the Moon than it is on Earth.

▶ Develop Vocabulary

- gravity *Word Origin* The word gravity comes fromthe Latin word gravitas, which means "weight orheaviness." Ask students to explain how weight relates to gravity. Weight is the result of the pull of gravity on mass.
- weight *Word Origin* The word weight comes from the Latin vehere, which means "to carry or bring." Point out that people who had to personally carry items would relate these loads to their weight.

What is weight?

Weight is another way to measure matter. Weight and mass may seem similar, but they are not the same.

Mass is the amount of matter in an object. **Weight** measures the amount of gravity between an object and a planet, such as Earth. **Gravity** is a force, or pull, between all objects.

How are weight and mass related? The force of gravity depends, in part, on an object's mass. The more mass, the stronger the pull of gravity. The stronger the pull of gravity, the more an object weighs.

Unlike mass, an object's weight is different on other planets and on the Moon. The pull of gravity on the Moon is about $\frac{1}{6}$ as strong as on Earth. So an object's weight on the Moon is only $\frac{1}{6}$ of its weight on Earth.

Do you weigh yourself with a scale? Mass is measured with a balance. Weight is measured with a scale. The metric unit for weight is the *newton* (N).

An object with a mass of 1 kg weighs 9.8 N on Earth. On the Moon, the same object weighs just 1.6 N.

Quick Check

4. What is the difference between a balance and a scale?

A balance measures mass, while a scale measures weight, or the force of gravity on mass.

Homework Activity

Measure Length

Remind students that although the names are different, height and width are both measures of length. Have students use a meterstick or tape measure to measure the height of everyone who lives in their home. Then have students create a bar graph of the results.

3 Close

Lesson Review

Discuss the Main Idea

Have students review their answers to the questions throughout the lesson. Address any remaining questions or misconceptions.

Visual Summary

Have students summarize key points of the lesson in the Visual Summary. The titles in each box will help guide students to the topics they should summarize.

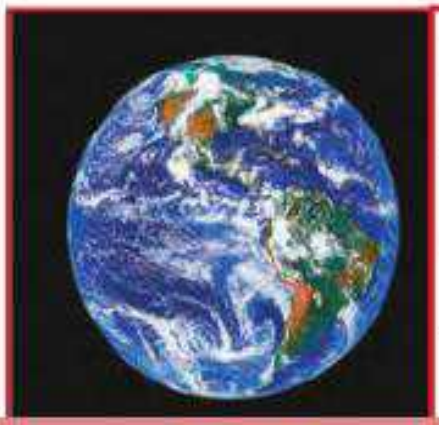
LESSON 2
Lesson Review

Visual Summary

Complete the lesson summary in your own words.

Measuring Matter Possible answer: We use standard units to measure the length, width, area, and volume of an object.

Density Possible answer: We calculate density by dividing the mass of an object by its volume.



Weight Possible answer: Weight is a measure of the pull of gravity. We measure weight with an instrument called a scale.

Think, Talk, and Write

1. **Vocabulary.** The number of unit squares that cover a surface describes its

area

2. **Problem and Solution.** Describe how to find the volume of air in your classroom.

Problem	Steps	Solution
Find the volume of air in the classroom.	Measure the length, width, and height of the classroom.	Multiply the room's length, width, and height to find the volume of the classroom.

3. **Critical Thinking.** Why does 1 kg of foam take up more space than 1 kg of rock?

Foam is much less dense than rocks are. It takes a much greater volume of foam to have the same mass as a rock.

4. **Test Prep.** This property of matter changes depending on the pull of gravity.

A density C mass
B length (D) weight

Essential Question What tools can you use to study matter?

Possible answer: You can use rulers, metersticks, measuring cups, balances, and scales.

Focus on Skills

Objective

- Estimate and measure mass and length.

Materials 3 rocks, gram masses, balance, metric ruler

Plan Ahead Gather enough rocks for each small group.

EXTEND Students will first estimate and then measure the mass and length of several rocks.

Inquiry Skill: Measure

▶ Learn It

- Explain to students that an object's properties can be measured in several ways, such as length, mass, volume, area, and temperature.
- Discuss measuring tools and their uses: metric rulers to measure length, volume, and area; balances to measure mass; and thermometers to measure temperature.
- Remind students that a measurement is expressed by a number followed by the proper unit of measurement.

Builder

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ENGAGE EXPLORE EXPLAIN EVALUATE EXTEND

▶ Try It

1. Help students to estimate mass by telling them that a gram is about the mass of one small paper clip.
2. Remind students that accuracy is important when taking measurements. Have them check their work by measuring the mass of their rocks again.
3. Help students to estimate length by telling them that a centimeter is about the width of the tip of their index finger.
4. Have students compare the rock's estimated length to its actual length.

▶ Apply It

1. Students' estimates of mass and length will vary. Most students will say that it was easier for them to estimate length because they have had more opportunities to measure the lengths of objects.
2. Remind students that when they are estimating, they should consider the size and density of the rocks.

Focus on Skills

▶ Apply It

Estimate and **measure** the mass and length of two more rocks. Record this data in your table.

1. Look at your data. Did you closely estimate the mass of each rock? Did you closely estimate the lengths? Which was easier for you to estimate—mass or length? Why?

Possible answer: No, I did not correctly estimate the mass or length of each rock. It was easier to estimate the length than the mass.

2. With practice, you can become better at estimating mass and length. Repeat the activity using different rocks. Record your estimates and actual measurements again in a table.

Rocks	1	2	3
Estimated Mass			
Actual Mass			
Estimated Length			
Actual Length			

Skill Builder

3. Were your estimates closer to your actual measurements this time?

Possible answer: Yes, because now I had a better idea of how big they were and what they weighed.

4. Do you think you can now estimate the mass of a rock before you pick it up? Try it for several rocks. Then use the balance to measure the actual mass. What property or properties do some rocks have that might throw off your estimate?

Possible answer: Not picking up the rock makes it harder to estimate its mass. It is more difficult because different rocks have different densities.

e to Plan Your Lesson

Lesson 3 Properties of Water

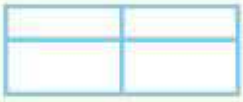
Essential Question

How can you describe the physical properties of water?

Objectives

- Explain the physical properties of water.
- Compare and contrast the three states of water.

Reading Skill Classify



You will need a classify graphic organizer.

FAST TRACK

Lesson Plan When time is short, follow the Fast Track and use the essential resources.

1 Introduce
Look and Wonder

2 Teach
Develop Vocabulary
Discuss the Main Idea

3 Close
Think, Talk, and Write

ENGAGE EXPLORE EXPLAIN EVALUATE EXTEND

Lesson 3 Properties of Water

Objectives

- Explain the physical properties of water.
- Compare and contrast the three phases of water.

1 Introduce

▶ Assess Prior Knowledge

Have students discuss what they know about the properties of water. Ask:

- What have you used water for today? Possible answers: drinking water, washing hands, bathing/showering, ice for drinks, cleaning
- Was any of the water you used a solid? A gas? A liquid? Possible answers: solid: ice, snow; liquid: drinking water, cleaning, showering/bathing; gas: steam in a shower or over boiling water

Look and Wonder

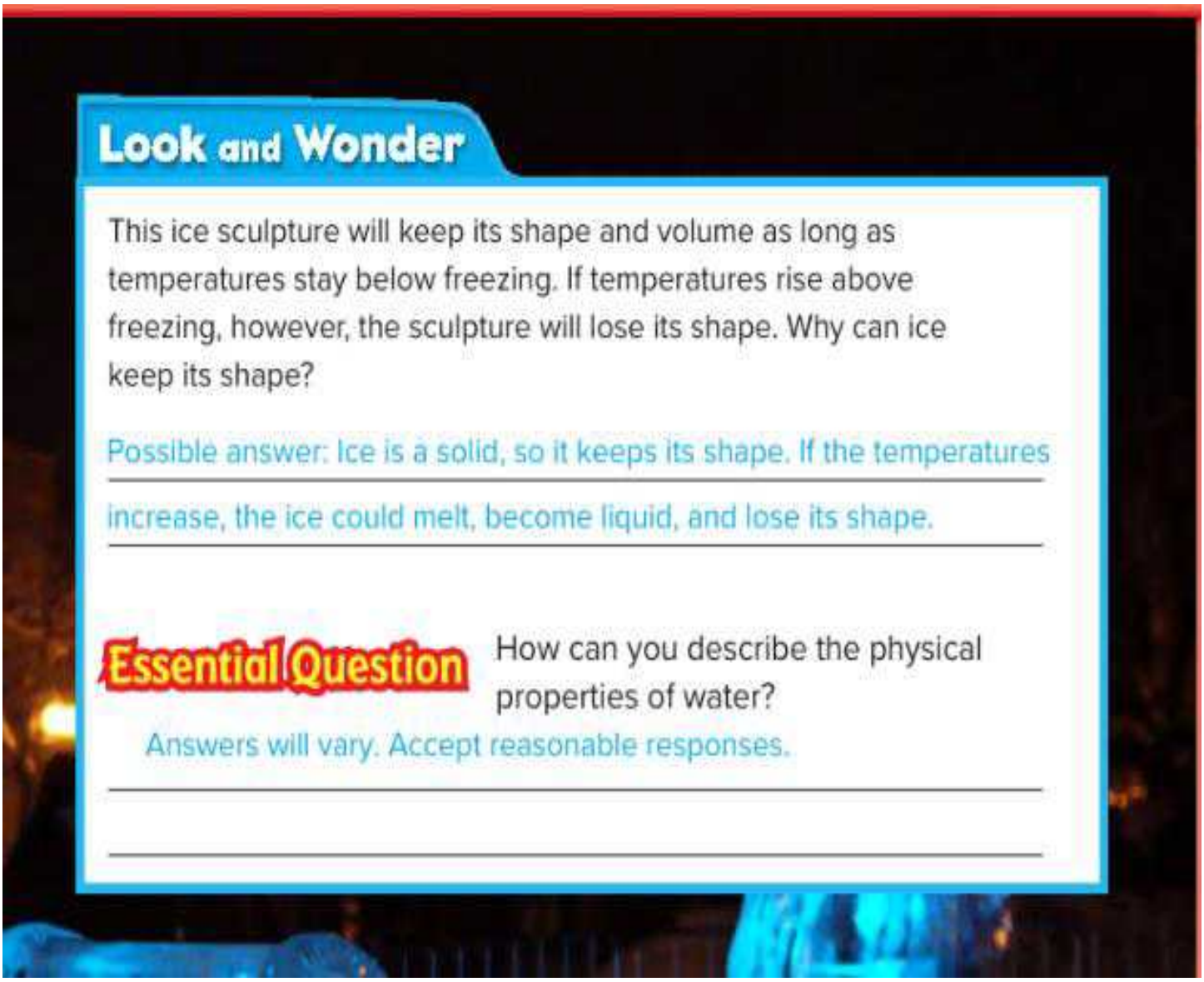
Invite students to share their responses to the Look and Wonder statement and question:

- **Why can ice keep its shape?**

Write ideas on the board and note any misconceptions that students may have. Address these misconceptions as you teach the lesson.

Essential Question

Have students read the Essential Question. Tell them to think about it as they read through the lesson. Advise students that they will return to this question at the end of the lesson.



Look and Wonder

This ice sculpture will keep its shape and volume as long as temperatures stay below freezing. If temperatures rise above freezing, however, the sculpture will lose its shape. Why can ice keep its shape?

Possible answer: Ice is a solid, so it keeps its shape. If the temperatures increase, the ice could melt, become liquid, and lose its shape.

Essential Question How can you describe the physical properties of water?

Answers will vary. Accept reasonable responses.

Explore

Plan Ahead Make the ice cubes ahead of time. Use square containers, such as the bottom half of a single-serving milk carton, so that the ice is easy to measure. Check that the ice cubes will fit into each container. Have areas reserved where students can work with water.

Purpose Students learn that changing containers does not change the volume or mass of a solid or liquid. However, it can change the shape of a liquid, but not a solid.

Structured Inquiry

2. **Measure** Remind students that the volume of a cube is length × width × height, and has cubic units such as cm^3.

4. Have students find the mass of each empty container, then the mass of each container with the ice cube in it. Subtract the mass of the container from the mass of the container with the ice cube to find the mass of the ice cube.

5. **Measure** Students should dry each container before measuring the mass and volume of water. Remind students to subtract the mass of the container found in step 4 from the mass of the container with water to find the mass of the water.

6. **Interpret Data** The mass and volume for the ice may have changed slightly due to melting, but should not change for water. The shape of water should have changed, but not of ice.

Explore

How does a container affect water's properties?

Make a Prediction

What happens when you change the shape or size of a container holding water? Will the water's volume, mass, and shape change? Make a prediction.

Possible prediction: The water's volume and shape will change, but not the mass.

Materials

- ice cubes
- ruler
- balance with set of masses
- 100 mL graduated cylinder
- bowl
- 150 mL beaker
- aluminum pan
- pitcher of water

Test Your Prediction

1. Record your observations in the table below.

	Volume	Mass	Shape
water in bowl			
water in beaker			
water in pan			
ice cube in bowl			
ice cube in beaker			
ice cube in pan			

2. **Measure.** Calculate the volume of the ice cube by measuring its length, width, and height.

Inquiry Activity

3. Measure the mass of the ice cube.

4. Place the ice cube in the three different containers. Use your table to record changes in volume, mass, and shape when the container is changed.

5. **Measure.** Repeat steps 3 and 4 with 100 milliliters of water.

Draw Conclusions

6. **Interpret Data.** Did any measurement change? Explain.

Answers will vary.

Explore More

How would you observe changes in the mass, volume, and shape of water vapor as it changes containers? Make a prediction and design an experiment to test it.

Answers will vary.

Open Inquiry

Will your results change if you use a liquid other than water? Explain.

Answers will vary. Accept reasonable responses.

2 Teach

Read and Respond

Main Idea Ask students what they know about the differences between water, ice, and steam. Have students look at the questions at the top of each two-page spread. Ask students what they think they will learn in this lesson.

Vocabulary Have students read aloud the vocabulary words and note any unfamiliar terms. Ask students to think about what the unfamiliar terms could mean, then have them look for definitions of those term. Compare their initial ideas to the actual definitions and point out similarities. Remind students that many terms may have a common meaning and scientific meaning.

Reading Skill **Classify**

Graphic Organizer Have students fill in a Classify graphic organizer as they read through the lesson. They can use the Quick Check questions to identify each classification.

What are some physical properties of water?

Discuss the Main Idea

Have students describe some physical properties of liquid water. Help students to realize that water is useful because of its special properties. For example, water is in most of the foods we eat and drink because it is cohesive and able to dissolve other substances. Ask:

- **What can you know about water from your senses?** Possible answers: It is odorless. You can see through it. It is wet.
- **What food or drinks have water in them?** Possible answers: juice, soda, milk, fruit, cooked pasta, watermelon

Read and Respond

What are some physical properties of water?

Water is an amazing substance! It is used for cooking, cleaning, heating, cooling, and drinking. Water is even used to generate electricity. What makes water so special?

Underline the part of the text that tells what specific particles make up water.

Water has no smell or taste. It is clear and nearly colorless. But water has many unique properties. Water is a molecule. A **molecule** is a particle of matter that is made up of more than one smaller particle joined together. Water is made of two hydrogen particles joined to one oxygen particle. The hydrogen side of the molecule has a positive charge. The oxygen side has a negative charge.

Water can dissolve many substances because its charged sides are attracted to them. This property allows it to carry minerals, nutrients, and chemicals as it moves through soil and our bodies. This property also makes water useful for cleaning.

Surface tension causes water to form drops. This property also allows water to move through plant roots and through our blood vessels.

Quick Check

1. Complete this sentence: Because water can dissolve substances, it can carry minerals and nutrients throughout our bodies.

Capillary action moves the water up the stem to the flower.

Develop Vocabulary

molecule *Word Origin* Explain that the root of molecule is *molecula*, which is Latin for "small mass." Amedo Avegadro first gave the word *molecule* a scientific meaning when he defined the smallest possible particle of a substance.

cohesive *Scientific vs. Common Use* The term cohesive is often used to refer to a group of people who stick together. In science, cohesive refers to molecules of a substance sticking together in the same way as a cohesive group of people. They are still individual molecules, but they will stick together if they can.

Use the Visuals

Refer students to the pictures. Explain that each shows a property of water. Ask:

- What are some substances that will dissolve in water? Possible answers: salt, sugar, drink mix, vinegar
- Even though the insect is heavier than water it has properties that allow it to use surface tension to walk on water. What are the insect's properties? Possible answers: It's only a little bit heaver than water; it uses a long "foot" to distribute its weight instead of walking on its toes.
- Water can carry minerals, nutrients, and dissolved colors. What will happen to the white flower if it stays in water that is colored blue? Possible answer: Capillary action will pull the blue water up to the flower and the flower will turn blue

Differentiated Instruction

Leveled Activities

EXTRA SUPPORT Ask students how many drops of water they think will fit on a coin. Have them lay a coin on a table and add one drop of water at a time to the top of the coin using a dropper. By adding the water slowly and carefully, students can use the cohesion of water to form a large "bubble" of water on the surface of the coin.

ENRICHMENT Give students a transparent cup with water and two matching paperclips. Have students gently put a paperclip into the water vertically and watch it sink, showing paperclips are denser than water. Then have students attempt to lay the second paperclip flat on top of the water. Because of surface tension, careful students may be able to get the paperclip to float.

Develop Vocabulary

water vapor Because all students are familiar with water, focus on the second word in the term, *vapor.* Many students may have had a humidifier in their home. Explain that a humidifier is also called a *vaporizer* because it turns liquid water into water vapor and adds the water vapor to the air.

How do the properties of water depend on the state of matter?

Discuss the Main Idea

Have students describe some physical properties of ice and water vapor. Help students to recognize that some of the properties of water depend on its state, while others do not. Ask:

- What properties of water are the same in all three states? Possible answers: It is clear and odorless. The mass of a molecule stays the same.
- What property determines whether objects will sink or float in liquid water? Density. Objects that are more dense than water will sink, while objects that are less dense than water will float.

How do the properties of water depend on the state of matter?

Water exists on Earth as all three states: solid, liquid, and gas. Water is the only substance to do this.

Ice is solid water. It is a hard, slippery substance. It is clear or white. The particles of ice are close together and have little freedom to move. Ice has a definite shape and volume. If you move ice from one container to another, its shape and volume will not change. The mass stays the same as well.

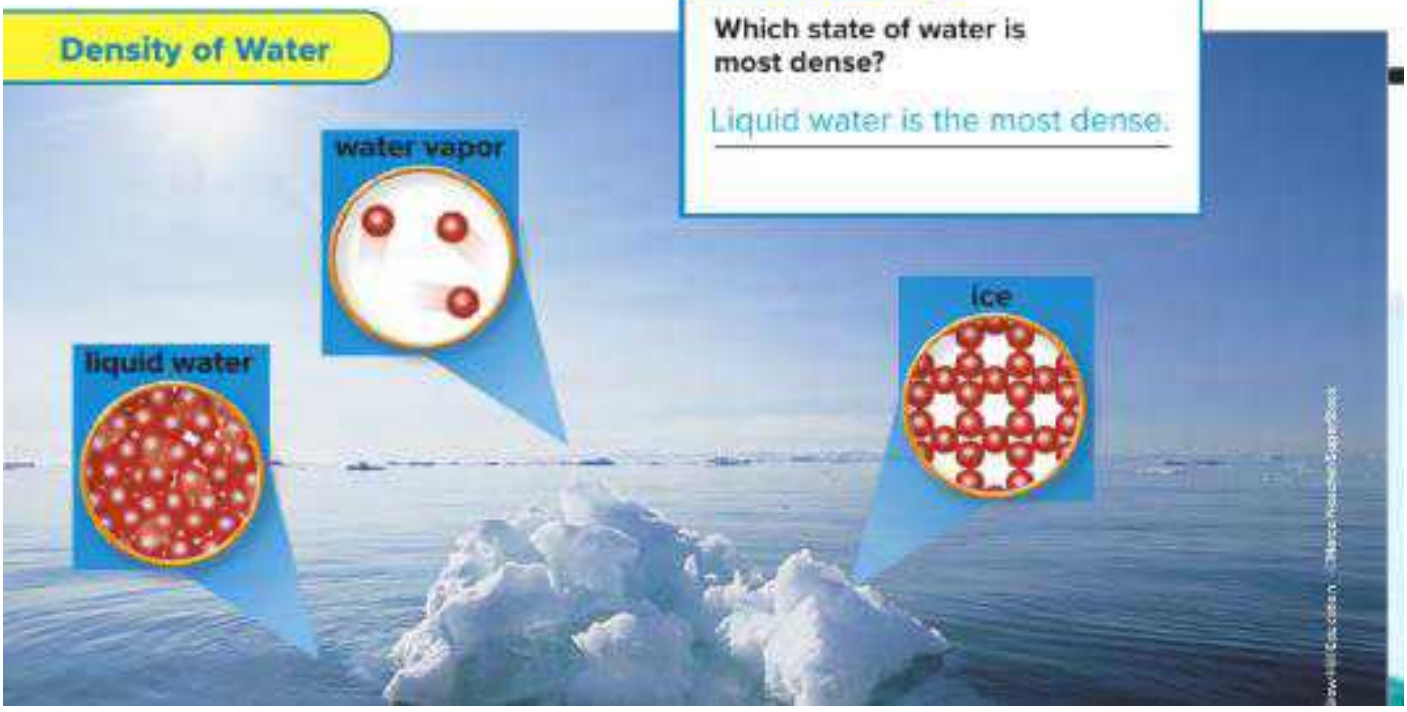
Liquid water is clear and colorless. Its particles are close together, but they can slide past each other. Liquid water has a definite volume, but not a definite shape. If you pour it from one container into another, it will take the shape of the new container, but its volume will not change. Neither will its mass.

Water vapor is the gaseous form of water. It is also clear and colorless. The particles of water vapor are far apart and move past each other easily. Water vapor has no definite volume or shape. If the container is changed, water vapor expands to fill the new container. Its mass stays the same.

Read a Photo

Which state of water is most dense?

Liquid water is the most dense.



ENGAGE EXPLORE **EXPLAIN** EVALUATE EXTEND

Quick Lab


whole groups


10 minutes

Too Dense to Float?

See the Quick Labs in the back of the book.

Objective Determine if objects are more or less dense than water.

Materials several small, waterproof objects with varying densities, large tub of water

2 Place each object slightly below the surface of the water to break the surface tension. Objects that are less dense than water will float. Objects that are denser than water will sink. Answers will vary based on objects used.

3 **Infer** Buoyancy is the upward force on an object equal to the weight of the volume of liquid displaced by the object. The buoyancy of an object must be greater than the weight of the object for it to float

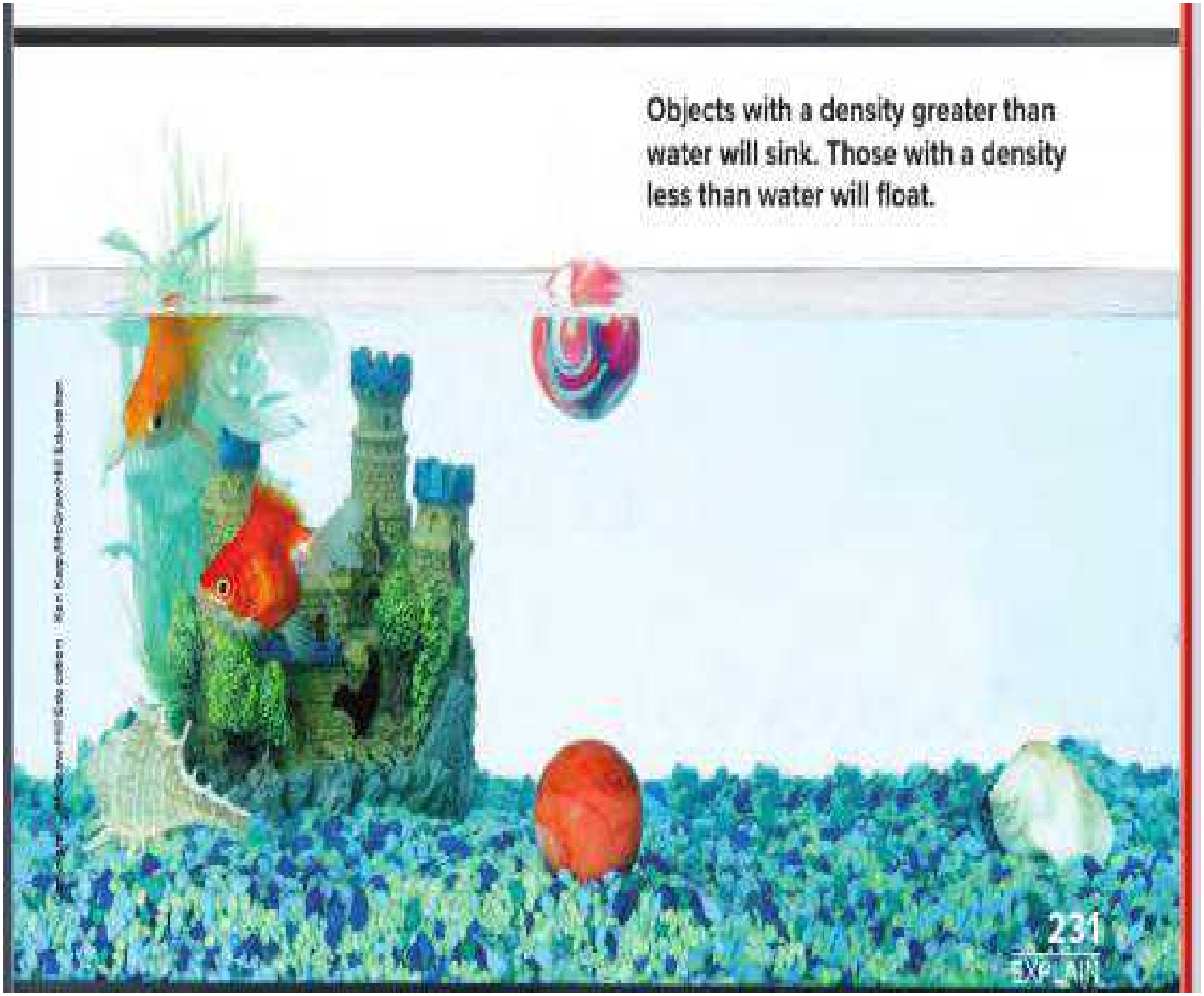
Density of Water

Water is different from other substances because it is less dense as a solid than as a liquid. When water freezes into ice, its particles spread out. The volume increases, but the mass stays the same. As a result, the density decreases. This allows ice to float on water. If it were not for this property of water, lakes would freeze solid from the bottom up.

Quick Check

2. Which properties of water depend on its state?

shape, volume, density


Objects with a density greater than water will sink. Those with a density less than water will float.
231
EXPLAIN

LA Support

Use Illustrations Prepare students for the Quick Lab by reviewing the concepts of density and buoyancy. Have students look at the nonliving objects in the aquarium photo and use their own words to describe which objects are more dense than water and which are less dense.

BEGINNING Students can use single words and point to the objects in the photo to indicate which are more dense and which are less dense than water.

INTERMEDIATE Students can use simple sentences or phrases to describe which objects are more and less dense than water.

ADVANCED Students can use complete sentences and correct grammar to describe what is depicted in the diagram.

What is the specific heat of water?

Discuss the Main Idea

Have students recall some specific properties of water, such as being a solvent, having high cohesion, and existing in all three states in nature. Remind students that water also covers more than 70% of Earth's surface. Students may be interested to learn that the average difference in temperature from night to day is usually less than 10°C. On Mars, the temperature can change over 66°C from night to day. Ask:

- How do you think cohesion affects the amount of energy needed to turn water into water vapor? Possible answers: high cohesion requires more energy to change from liquid water to water vapor.
- How does the high specific heat of water help make Earth livable? It stabilizes the air temperature from day to night so that there are only small swings.

Coastal cities tend to have cooler summers and warmer winters than similar inland cities.

Quick Check

3. How would the world be different if water's specific heat were lower?

The temperature of Earth's oceans would vary throughout the day and be hot during the day and cooler at night.

Homework Activity

How is water used in your home?

Have students research the way water is used in their home. They should analyze each use and determine what properties of water are important for that use. Students should record their results in a table. The first column of the table should indicate the purpose for which the water is being used. The second should indicate the state of water used, and the third should indicate the properties of water that make it useful for the purpose.

3 Close

Lesson Review

▶ Discuss the Main Idea

Have students review their answers to the questions throughout the lesson. Address any remaining questions or misconceptions.

▶ Visual Summary

Have students summarize key points of the lesson in the Visual Summary. The titles in each box will help guide students to the topics they should summarize.

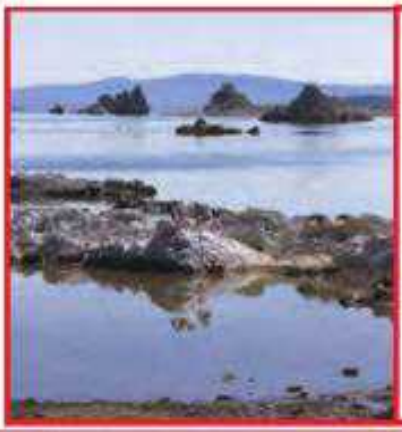
LESSON 3
Lesson Review

Visual Summary

Complete the lesson summary in your own words.

Physical Properties of Water Possible answer: Water is cohesive and can dissolve many substances.

Water's Density Possible answer: The density of water depends on its state of matter.



Specific Heat of Water Possible answer: The specific heat of water is very high. This means that it resists changes in temperature.

LESSON 3
Lesson Review

Think, Talk, and Write

1 **Vocabulary.** When water is in the form of a gas, it is called

water vapor

2 **Classify.** Which state of water has both a definite shape and a definite volume?

Definite Shape	Definite Volume
ice	ice

3 **Critical Thinking.** How do the properties of water support life on Earth?

Possible answer: They moderate Earth's temperature and transport nutrients throughout the human body.

4 **Test Prep.** Which properties of liquid water change when it is poured from a measuring cup into a shallow pan?

A density and shape
B volume and shape
C volume only
(D) shape only

Essential Question How can you describe the physical properties of water?

Possible answer: You can describe its volume, density, mass, ability to dissolve other substances, and specific heat.

ENGAGE EXPLORE EXPLAIN EVALUATE EXTEND

Focus on Skills

Objective

- Infer conclusions after experimenting and analyzing data gathered from an experiment and recorded on a chart.

Materials aluminum foil, paper clips, tank of water

Plan Ahead Have paper or cloth towels available to clean up water spills. Set out bins for used aluminum foil so it can be recycled.

EXTEND This activity teaches students how to infer a conclusion using deductive reasoning based on experimental data and observation.

▶ Learn It

Explain to students that to infer is to analyze observations or data and use this information to draw conclusions. Provide students with additional practice making inferences. Provide them with several data sets and ask them to infer conclusions. For example, provide a data set with the time it takes to go from home to different places, assuming speed is the same. Students may infer that if it takes more time to travel to a place, the location is farther away from home.

▶ Try It

1. Use aluminum foil sheets that are approximately 30 centimeters long by 30 centimeters wide. Because students will compare their results with those of their classmates, emphasize the importance of designing their boats independently.
2. Depending on the size and shape of the boat, it may hold anywhere from 50–150 large paper clips. Other small, identical objects can be used instead of paper clips. Encourage students to add the paper clips one at a time, counting them as they add them.

Integrate Math

Calculate Density

Remind students that an object sinks when its density is greater than the density of water (1.00 g/mL). Have students use a graduated cylinder with water to find the volume of a paper clip and a balance to find the mass.

Students should find the density of the paper clip by dividing the mass by the volume.

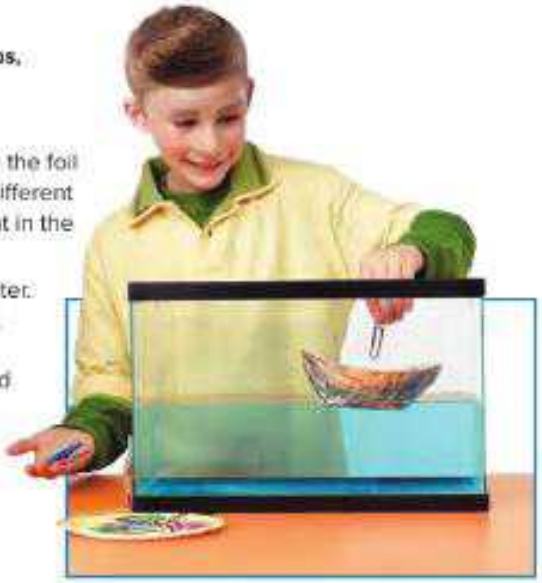
Since the density and mass of a single paper clip are very low, it may be easier to find the volume of 10 paper clips using a graduated cylinder with water and the mass of 10 paper clips with the balance, and then divide each by 10 before dividing the mass by the volume.

Focus on Skills

Try It

Materials aluminum foil, paper clips, tank of water

1. Take a sheet of aluminum foil. Use the foil to make a boat. Experiment with different designs. Draw a picture of the boat in the chart below.
2. Float the boat in a large pan of water. Place the paper clips into the boat and record what happens. How many paper clips can the boat hold before it completely sinks? Try to **infer** why the boat is sinking.



	Picture	Number of clips	How did it work?
Boat 1			
Boat 2			
Boat 3			
Boat 4			

Apply It

1. Record the data and the results from two other students in your chart.
2. Now it is time to analyze your data. Do you notice any pattern between the design of the boat and the number of paper clips?

Answers will vary.

3. As a class, design a boat that would carry the most paper clips possible. Use a final piece of aluminum foil to make the boat, and record how many paper clips it can hold. Did this boat hold more paper clips than the others?

Answers will vary.

4. Think about all the models you have seen. Did the ones that held more paper clips have anything in common? What was happening as more paper clips were added to the boat? Use your observations to **infer** what makes an object float. Communicate your opinions by writing down your conclusions.

Answers will vary.

▶ Apply It

1. Encourage students to record data from several other students. Because the shape and design of the boat are critical to students' inferences, be sure students accurately represent the boats in their drawings.
2. Students may infer that the greater the volume of the boat, the more paper clips it will hold. They may also mention that a boat that is even across its top will hold more paper clips because water will not enter the boat.
3. Students may make this boat identical to the one in their data set that carried the most paper clips. Encourage students to improve upon this design. If the class design does not produce a boat that carries more paper clips, have them analyze their design and infer how it could be improved.
4. Possible answers: In general, the boats that held more paper clips had greater volume. Adding paper clips added mass and increased the density of the boat. An object floats when its weight is less than the weight of the water it displaces, or the density of the object is less than the density of water.

   Point out that the water students use to float their boats is not moving. Ask students what factors in addition to the amount of cargo must be considered when designing an actual boat.

   Possible answers: The boat must be stable and not flood when in turbulent water; the sides must be high enough above the water level that waves do not go into the boat.

CHAPTER 6 Review

Visual Summary

Summarize each lesson in your own words.

Lesson 1 Matter can be described by its properties, such as mass, volume, and state.

Lesson 2 Matter can be measured using standard units of length, area, volume, mass, density, and weight.

Lesson 3 Water has many unique properties that allow it to be used in many different ways.

Vocabulary

Fill each blank with the best term from the list.

density	molecule
gravity	property
matter	water vapor
mass	weight

1. Anything that has mass and takes up space is matter.
2. The measure of gravity's pull between an object and a planet is weight.
3. The gaseous form of water is called water vapor.
4. Color is an example of a(n) property of matter.
5. To calculate an object's density you divide its mass by its volume.
6. A molecule is a particle of matter that is made up of more than one smaller particles joined together.
7. The amount of matter making up an object is an object's mass.
8. The pull between objects is called gravity.

Depth of Knowledge

Level 1 Recall Level 1 requires memory of a fact, a definition, or a procedure. At this level, there is only one correct answer.

Level 2 **Skill/Concept** Level 2 requires an explanation or the ability to apply a skill. At this level, the answer reflects a deep understanding of the topic.

Level 3 **Strategic Reasoning** Level 3 requires the use of reasoning and analysis, including the use of evidence or supporting information. At this level, there may be more than one correct answer.

Level 4 **Extended Reasoning** Level 4 requires the completion of multiple steps and requires synthesis of information from multiple sources or disciplines. At this level, the answer demonstrates careful planning and complex reasoning.

CHAPTER 6 Review

Skills and Concepts

Answer each of the following in complete sentences.

9. **Main Idea and Details.** Describe the physical properties of water.

Water is clear and odorless. Liquid water is also cohesive and a good solvent.

10. **Measure.** You want to know the area of a sheet of paper. What would you measure? How would you calculate the area?

Use a ruler to measure the length and width of the sides of the paper. Then multiply the length by the width to find the area.

11. **Critical Thinking** How can two items of the same shape and size have different densities?

They can have different masses.

12. **Descriptive Writing.** Describe the properties of copper.

Copper is a solid and a metal. It is shiny and bendable. Copper conducts heat. It is usually a brownish-orange color.

The Big Idea

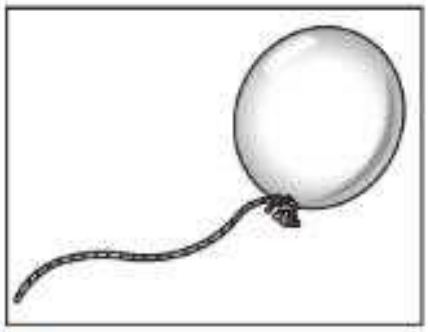
13. What are the properties of matter?

Propeties of matter include mass, volume, density, and specific heat.

Test Prep

Circle the best answer for each question.

1. **How can you measure the volume of the gas inside this balloon?**



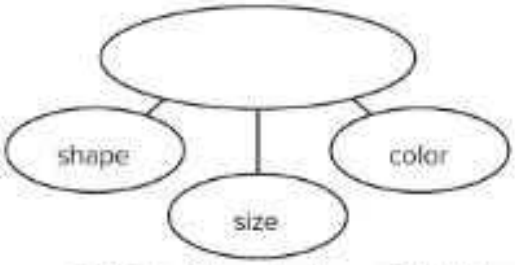
(A) Submerge the balloon in water. Subtract the original water level from the new water level.

B Measure the length and width of the balloon. Multiply the two numbers.

C Empty the contents of the balloon into a beaker. Record the volume.

D The volume cannot be measured.

2. **Study the diagram below.**



Which of these belongs in the blank oval?

A buoyancy

B properties of matter

(C) volume

D units of measurement

3. **Which unit would be used to measure the length of your desk?**

A meters

B grams

(C) centimeters

D g/cm^3

4. **The amount of gravity between an object and a planet is**

A volume.

B length.

(C) weight.

D mass.

5. **Study the table below.**

Liquid	Solid	Solid
coffee	water vapor	book
milk	helium	desk
juice	shoe	paper

Which word is in the wrong column?

A coffee

B milk

C desk

(D) shoe

6. Which of the following is a metric unit of measurement?

A meter
B mass
C weight
D color

7. An object's ability to float depends on its

A length.
B density.
C volume.
D weight.

8. The laboratory equipment below would be used to measure

A volume.
B mass.
C weight.
D length.

9. Mass is the measure of the

A amount of matter making up an object.
B weight of an object.
C space an object takes up.
D density of an object.

10. Matter is anything that has

A mass and volume.
B mass and buoyancy.
C volume and buoyancy.
D weight and buoyancy.

11. Choose an item that is an example of matter. List all the properties you can to describe it. Describe how you would measure each property you listed.

Answers will vary.

12. Complete the chart below.

State of Matter	Property	Example
gas	does not have a definite shape or volume	A. air
solid	B. has a definite shape a volume	pencil
C. liquid	has a definite volume, but no definite shape	oil