

**Red Edition**  
Grade 3–4  
reading level

**Purple Edition**  
Grade 4–5  
reading level

## Objectives

- Explore physical properties of matter.
- Discuss measuring mass, volume, and density.
- Explain states of matter.
- Describe chemical properties of matter.
- Understand atoms, the building blocks of matter.
- Discuss elements and how they are grouped in the periodic table.
- Explore molecules.
- Explore compounds.

## Reading Comprehension Skills

Preview the Book ♦ Compare and Contrast

**Skillbuilders are available for this title.**

## Supporting English Learners

**Develop Vocabulary** Create meaningful opportunities for English Learners to use new vocabulary in speaking, reading, and writing. Provide multiple exposures to science vocabulary such as *atom*, *mass*, and *matter*. Teach individual words and emphasize word-learning strategies such as using the word part *-ical* in words such as *chemical property* and *physical property*. Also emphasize the use of context clues, dictionaries, and thesauruses.

## Summary

Students begin the Delta Science Content Reader *Properties of Matter* by learning what matter is. The book introduces them to physical properties of matter and how these properties can be observed or measured. Students find out about the behavior of particles in solids, liquids, and gases and are introduced to chemical properties. They then read about what matter is made of. Students discover that all matter is made of atoms and that matter made of only one type of atom is an element. The book concludes with a discussion of how elements combine to form millions of different substances.

## Science Background

The universe we see around us is composed of matter. Matter is anything that has mass and takes up space. We can differentiate objects from one another based on descriptions of the objects' properties. Properties are attributes, traits, qualities, or characteristics of an object that can be detected by the senses. Measuring tools can extend the senses and help us observe and describe properties.

The properties of matter can be divided into two categories: physical properties and chemical properties. Physical properties can be observed by the senses. An object's state of matter—solid, liquid, or gas—is one physical property. Chemical properties, such as combustibility, are those that describe how a substance may change or react with other substances to form new substances.

Atoms are the fundamental building blocks of all matter. An atom is the smallest particle of an element that can still have the properties of that element.

An element is a substance that cannot be broken down any further into other substances. Elements combine to form compounds. The smallest possible unit of a compound is called a molecule.



# What Is Matter?

(pages 2–13)

## Before Reading

### Discuss the Cover

**Cover Image** Discuss the photograph on the cover of *Properties of Matter*. Use the information on the inside front cover to support the discussion.

**Science Statement** Discuss the science statement. Ask: *What do you think matter is? What do you think a property is? What do you see that you could measure?* (Possible answers: size or height of balloon)

### Build Reading Skills (page 2)

**Preview the Book** Use Build Reading Skills on page 2 to review how to preview the book. Discuss the steps. Then model previewing the headings.

**Think Aloud** *What can I learn from the headings? On page 4, I see the red heading “Physical Properties of Matter.” This must be the main topic. The next few headings are smaller and blue. These headings must break down ideas about physical properties into smaller parts. Let me check. When I skim the text under the blue headings, I see that these headings name different physical properties.*

Guide students as they finish previewing *Properties of Matter*. Focus on nonfiction text features.

- Prompt them to look at the headings, photographs, captions, and diagrams. Ask questions such as *Why do you think that feature is there? How will it help you understand what you read?*
- Prompt them to look at the bold Vocabulary words. Guide the class in looking up a Vocabulary word in the Glossary.

Students can apply the skill in the Reflect on Reading activity on page 13.

**K-W-L Chart** Have students begin a K-W-L chart. They should add to it after each section.

What I Know	What I Want to Learn	What I Learned
Height is a property of matter.	What are some other properties of matter?	

### Make a Connection (page 3)

**Make a Connection** Discuss the Make a Connection question. Use this discussion to build background and activate prior knowledge about matter. (Possible answers: sand, water, rocks, plants, fish)

**Find Out About** Read each statement to help students set a reading purpose. Explain that these are the important topics that they will learn about in this section.

**Vocabulary** Read the Vocabulary words aloud. Explain to students that they will see these words in bold in this section. Start a T-chart on the board for examples of *physical properties* and *chemical properties* of matter. Have students suggest examples as they read.

## During Reading

### Physical Properties of Matter (page 4)

- Ask: *What is the name for anything that has mass and takes up space?* (matter)
- Ask: *What are some things that are not matter? Why are they not matter?* (forms of energy such as light, heat, and sound; forces such as gravity and magnetism; They do not have mass or take up space.)
- Review metric and customary measurement, as appropriate, with students.
- ✓ **Checkpoint** (something about matter that we can observe with our senses or measure; long and yellow)

### Mass (page 5)

- Ask: *What is a balance?* (a tool that compares the mass of two or more objects)
- Ask: *What units do we use to measure mass?* (grams and kilograms)
- Tell students that the mass of a paper clip is about 1 gram.
- **Addressing Misconceptions.** Some students may associate the term *matter* with only solids because they can see and hold solid materials. Remind students that matter is anything that has mass and takes up space. Blow up a balloon to show that the gases we breathe out take up space even though they are invisible.
- Help students locate the pages in their math textbooks that cover mass. Elicit that learning about mass is important in both math and science.

- ✔ **Checkpoint** (Mass is the amount of matter in an object. We can measure mass using a balance.)

### Volume (page 6)

- Ask: *What is volume?* (the amount of space that matter takes up)
- Ask: *What do you need to know to find the volume of a solid object?* (its length, width, and height)
- Write the formula for volume on the board:  $length \times width \times height = volume$ . Explain that the volume of a solid object is given in cubic units, such as cubic centimeters, because it is calculated from measurements of three sides of the object.
- Help students locate the pages in their math textbooks that cover volume. Elicit that learning about volume is important in both math and science.
- Ask: *What are two tools used to measure the volume of a liquid?* (measuring cups, graduated cylinders)
- *Addressing Misconceptions.* Many students confuse mass, volume, and weight. Mass is the amount of matter in an object. Volume is the amount of space the object takes up. Weight is a measure of the force of gravity on the object. If astronauts land on the Moon, they have the same mass as on Earth. But they weigh less because of the Moon's lesser gravitational pull.

- ✔ **Checkpoint** (Measure the box's length, width, and height; then multiply those numbers together.)

### Density (page 7)

- Ask: *What is density?* (how much mass something has for its volume)
- Ask: *Why do most rocks sink in water?* (Most rocks have a density greater than that of water.)
- Discuss the photograph of the container of liquids on page 8. Prompt students to explain why the different liquids and solids in the container are floating in different places. Ask questions such as *Which is denser, the block or the oil?* (the block)

- ✔ **Checkpoint** (One can have more mass for its volume than the other.)

### State of Matter (page 9)

- *State* and *matter* are multiple-meaning words. Make sure students understand the differences between the words' science meanings and the way they are generally used in everyday speech.

- Ask: *What is matter made up of?* (tiny particles that are always moving)
- Ask: *What does it mean that a solid has a set volume and a set shape?* (It holds the same shape and takes up the same amount of space, even if you move it to another place.)
- Ask: *What are the particles in a solid like?* (They are packed tightly together. They can only vibrate back and forth in place. They cannot move past one another.)
- Ask: *How is a liquid like a solid?* (It has a set volume.) *How is a liquid unlike a solid?* (It does not have a set shape.)
- Ask: *What are the particles in a liquid like?* (They are not as tightly packed as in a solid. They can move around and slide past one another.)
- Ask: *If liquids do not have a set shape, can they be in any shape at all? Explain.* (Yes. They take the shape of the container they are in.)
- Ask: *What happens to the volume of a liquid when you pour it from one container to another?* (It stays the same.)
- Ask: *How is a gas like a liquid?* (It has no set shape.) *How is a gas unlike a liquid?* (It has no set volume.)
- Ask: *What are the particles in a gas like?* (They move freely and can spread far apart from one another. A gas will keep spreading out unless it is held in a closed container.)
- Ask: *What is plasma?* (a fourth state of matter that is like a super-hot, glowing gas)

- ✔ **Checkpoint** (solid: stone; liquid: juice; gas: oxygen)

### Other Physical Properties (page 12)

- Ask: *What is hardness?* (how easy it is for a material to scratch another material)
- Ask: *What does it mean for substances to be magnetic?* (Magnetic substances can be pulled, or attracted, by a magnet. They can also become magnets.)
- Ask: *What is a good conductor?* (a material electricity and heat pass through easily)

- ✔ **Checkpoint** (because most metals are good conductors of both electricity and heat)

## Chemical Properties of Matter (page 13)

- Ask: *What is combustibility?* (the ability to burn)
- Ask: *Why is iron not combustible?* (It may get hot and melt, but it will not burn.)
- Ask: *What causes rust?* (iron reacting with the oxygen in water and air)

- ✓ **Checkpoint** (Physical properties are things about matter that we can observe with our senses or measure. Chemical properties tell how a substance reacts with other substances.)

### After Reading

**Reflect on Reading** (page 13) After partners have discussed the pictures they chose, have them share their observations with the class. Remind them to pay attention to the pictures' captions.

**Apply Science Concepts** (page 13) This activity applies a concept from Find Out About on page 3. Help students plan their descriptions. Provide them with rulers or other measuring tools if possible. Emphasize that they should describe both physical and chemical properties.

## What Is Matter Made Of? (pages 14–23)

### Before Reading

#### Build Reading Skills (page 14)

**Compare and Contrast** Use Build Reading Skills on page 14 to review how to compare and contrast. Discuss the tips. Then use the information about atoms on page 16 to model comparing and contrasting.

**Think Aloud** *I read that atoms are made of even smaller parts. Protons and electrons are two of these parts. What are some ways protons and electrons are alike and different? They are alike because they are both parts of an atom. They are different because protons are in the nucleus of the atom and electrons move in the space around the nucleus.*

Guide students to compare and contrast the different states of water in the photograph on page 21. Remind them to ask *How are they alike?* to compare things and *How are they different?* to contrast things. Students can apply the skill in the Reflect on Reading activity on page 23.

## Make a Connection (page 15)

**Make a Connection** Discuss the Make a Connection questions. Use this discussion to build background and activate prior knowledge about what matter is made of. (Answers will vary. Possible answer: I think matter must be made of something really tiny, otherwise you would be able to see what it was.) Ask: *You can see that this shell has many sections, or parts. Do you think those parts are also made of even smaller pieces? What might those be?*

**Find Out About** Read each statement to help students set a reading purpose. Explain that these are the important topics that they will learn about in this section.

**Vocabulary** Read the Vocabulary words aloud. Explain to students that they will see these words in bold in this section. Start a word web on the board with *What Matter Is Made Of* in the center. Have students add to the web as they read.

### During Reading

#### Atoms (page 16)

- Ask: *How did the Greek philosophers' ideas about atoms turn out to be different from what we know today?* (They thought atoms could not be broken into smaller parts, but they can be.)
- Ask: *What are the smaller parts that make up an atom?* (protons, neutrons, and electrons) *Where in the atom are they found?* (Protons and neutrons are in the center of the atom, called the nucleus. Electrons move in the space around the nucleus.)
- Discuss the diagram of a helium atom on page 16. Explain that the protons have plus signs because protons have a positive electric charge. The electrons have minus signs because electrons have a negative electric charge. The neutrons are blank because neutrons have no charge.

- ✓ **Checkpoint** (because all matter is made up of these tiny particles)

#### Elements (page 17)

- Ask: *Are atoms of all elements the same?* (No. An atom of one element is different from the atoms of all other elements.)
- Ask: *What makes the atoms of one element different from the atoms of another element?* (the number of protons in each atom)

- Ask: *What does the atomic number of an element tell us?* (the number of protons in an atom of that element)

✔ **Checkpoint** (An element is matter that is made of only one kind of atom; Possible answers: oxygen, gold, copper, carbon)

## Grouping the Elements (page 18)

- Discuss with students the keys in the periodic table on pages 18–19. Have volunteers relate information in the keys to the table.
- Ask: *How are elements listed in the periodic table?* (in order of their atomic numbers)
- Ask: *What are the letters in the periodic table?* (chemical symbols that stand for the name of each element)
- Ask: *Look at the periodic table. How can you tell if an element is a metal, a metalloid, or a non-metal?* (look at the background color of its box)
- Ask: *How are metals and nonmetals usually different?* (Metals are often solid, most are shiny, and electricity and heat pass easily through them. Many nonmetals are gases.)
- Ask: *Look at the periodic table. How can you tell if an element is a solid, a liquid, or a gas?* (look at the color of its chemical symbol)
- Explain that an element's state of matter in the periodic table is its state under normal conditions. Remind students that matter can change state.
- Ask: *How are elements in each group, or column, alike?* (They have properties that are alike.)
- Have students look at the periodic table. Ask: *What is the chemical symbol for sodium?* (Na) *What is its atomic number?* (11) *Is it a metal, a nonmetal, or a metalloid?* (metal)

✔ **Checkpoint** (17; bromine and mercury)

## Molecules (page 21)

- Ask: *How does a molecule form?* (Atoms join with other atoms.)
- Discuss the diagram of a water molecule on page 21. Ask: *What atoms make up a water molecule?* (two hydrogen atoms and one oxygen atom)
- Ask: *What is one property that hydrogen and oxygen both have that water does not have?* (Hydrogen and oxygen can burn.)

✔ **Checkpoint** (a tiny particle made of two or more atoms joined together)

## Compounds (page 22)

- Emphasize the difference between atoms and molecules. An atom is the smallest unit of an element that has the properties of that element. A molecule is the smallest unit of a compound that has the properties of that compound.
- Ask: *What do scientists use to write the name of a compound?* (a chemical formula)
- Ask: *What are the letters in a chemical formula?* (chemical symbols of the elements in the compound)
- Ask: *What do the numbers in a chemical formula tell us?* (how many atoms of each element are in the compound)
- Ask: *What does the chemical formula CO<sub>2</sub> tell us a molecule of carbon dioxide is made of?* (one carbon atom and two oxygen atoms)
- Ask: *How are carbon compounds important to living things?* (Most plants and animals are made of carbon compounds. Living things use carbon compounds called sugars for energy.)

✔ **Checkpoint** (A compound is made of two or more different elements.)

## After Reading

**Reflect on Reading** (page 23) Assist students in completing their Venn diagrams as needed. (Possible answers: Elements: made of only one kind of atom, cannot be broken down into simpler substances; Compounds: made of two or more different elements that join to form a molecule, properties are not like the properties of the elements that make them; Both: made of atoms)

**Apply Science Concepts** (page 23) This activity applies a concept from Find Out About on page 15. (Possible answers: Alike: made of atoms; Different: gold: element, metal, solid, yellow, smallest unit is atom; water: compound, liquid, clear, smallest unit is molecule)

➡ **Continued on last page**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

# Test: Properties of Matter

## Part A: Vocabulary

balance	chemical property	compounds	density
elements	matter	molecule	physical property

Choose the correct vocabulary word for each definition. Write the word on the line.

1. All objects on Earth and in space are made of \_\_\_\_\_.
2. We used the classroom's \_\_\_\_\_ to find the mass of an apple.
3. To find the \_\_\_\_\_ of a material, we divide mass by volume.
4. The \_\_\_\_\_ of hardness tells how easy it is for a material to scratch another material.
5. One \_\_\_\_\_ of iron is its ability to rust.
6. Copper and gold are \_\_\_\_\_, so they cannot be broken down into simpler substances.
7. A water \_\_\_\_\_ is the smallest unit of water that has the properties of water.
8. Most living things are made of carbon \_\_\_\_\_.

## Part B: Science Concepts

Mark the best answer to each question.

9. Which of the following is a chemical property of matter?  

(A) temperature	(C) density
(B) combustibility	(D) color
10. What does an element's group, or column, in the periodic table tell you?  

(A) The element shares properties with other elements in the group.
(B) The element shares an atomic number with other elements in the group.
(C) The element shares a chemical formula with other elements in the group.
(D) The element shares chemical symbols with other elements in the group.

## Test: Properties of Matter (continued)

11. Most elements are these shiny materials.

- (A) liquids
- (B) nonmetals
- (C) metalloids
- (D) metals

12. What is  $\text{NaHCO}_3$  an example of?

- (A) an atom
- (B) an element
- (C) a compound
- (D) a metalloid

Write the answer.

13. What is volume? How is it measured for a solid? How is it measured for a liquid?

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14. Tell about what the three main states of matter are like. Make sure to explain how the particles of matter move in each one.

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15. Look at the diagram of a helium atom. Tell what the parts labeled A, B, C, and D are called.

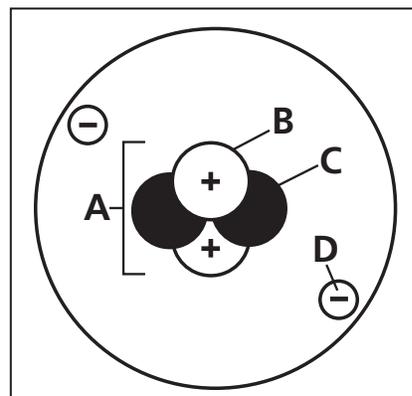
electron	neutron	nucleus	proton
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A: \_\_\_\_\_

B: \_\_\_\_\_

C: \_\_\_\_\_

D: \_\_\_\_\_



# Let's Review

## (inside back cover)

Have students complete their K-W-L charts before answering these questions. Possible answers are shown.

- 1. Cover Connection** (Matter has physical properties that can be observed, such as color, shape, and hardness. We can also measure physical properties. For example, we measure mass with a balance. We can also observe if an object has chemical properties, such as combustibility or the ability to rust.)
- 2.** (Physical properties noticed with senses: rectangular, colorful pictures, smooth pages, hard cover, soft inside; Chemical properties: combustible; I could use a balance to find the book's mass and a ruler to find its length, width, and height.)
- 3.** (Atoms of elements combine in many different ways to form millions of compounds. Compounds make up most of the living and nonliving things around us.)
- 4. Compare and Contrast** (Wood: brown color, less dense than brick, combustible; Brick: reddish, more dense than wood; Both: same shape, same size (volume), solid)
- 5. Write** (Reports should include the element's name, classification (metal, nonmetal, or metalloid), atomic number, chemical symbol, and state of matter. Reports should also include where the element is found, what it is used for, and a fun or surprising fact about the element. Monitor and assist students as they use the library or the Internet.)

**Try It!** Advise students that they must pour the liquids slowly. Suggest that they try the experiment several times, adding the liquids in a different order each time to see if they get different results. Students will learn that the cooking oil floats in a layer on top of the water because it is less dense than water, while the corn syrup sinks below the water because it is more dense than water.

**Science at Home** Have students do this activity at home with family members. Suggest that students make this activity into a game, with family members taking turns choosing at least three objects and challenging one another to identify the common property. For example, if the objects were a spoon, a stuffed animal, and a chair, the common property could be that they are all solids.

## Answers to Test

### (Teacher's Guide pages 6–7)

**1.** matter **2.** balance **3.** density **4.** physical property **5.** chemical property **6.** elements **7.** molecule **8.** compounds **9.** B **10.** A **11.** D **12.** C **13.** Volume is the amount of space that matter takes up. The volume of a solid is measured by multiplying the object's length, width, and height together. The volume of a liquid is measured with a measuring cup or a graduated cylinder. **14.** A solid has tightly packed particles, a set volume, and a set shape. A liquid has particles that can slide past one another, a set volume, and no set shape. A gas has particles that move freely, no set volume, and no set shape. **15.** A: nucleus; B: proton; C: neutron; D: electron

**ADDITIONAL ASSESSMENT OPPORTUNITIES** Use the Checkpoints, Reflect on Reading, and Apply Science Concepts features and Let's Review questions as additional assessment opportunities.

*Delta Science Content Readers* are 24-page nonfiction student books with informative, engaging text and full-color photos and illustrations. The readers present key science content and vocabulary found on state tests, present key reading skills and strategies useful for reading informational text, support and extend the experiences and content of hands-on activities, promote scientific inquiry, and serve as a home-school link. They are available in two editions: Red Edition for Grades 3–4 and Purple Edition for Grades 4–5.

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