UNIT OVERVIEW

Everything on this planet is made of matter. All matter has properties that help distinguish it from other types of matter. The Properties unit explains how shape, color, texture, weight, state of matter, and other properties can be used to identify, describe, and compare matter. The unit also explains that we choose to make things out of materials that have the properties we need or want.

Certain reading resources are provided at three reading levels within the unit to support differentiated instruction. Other resources are provided as a set, with different titles offered at each reading level. Dots on student resources indicate the reading level as follows:

- low reading level
- middle reading level
- high reading level

THE BIG IDEA

We constantly observe our environment and the objects found in it. Identifying properties of objects helps us make decisions and communicate with precision. Practicing careful observation will prepare students to become successful scientists and citizens. It may also allow them to appreciate the special qualities of the things around them that they might normally take for granted.

Other topics

This unit also addresses topics such as: the Mohs scale of hardness, how steel is made, and the properties of various items including toys, homes, and shoes.

SPARK

The spark is designed to get students thinking about the unit's topics and to generate curiosity and discussion.

Materials

- sheet of colored construction paper
- pair of similar objects (for example, air balloon and water balloon, Ping Pong ball and golf ball, pencil and pen)

Activity

Ask students to share what they know about matter. Clarify the different meanings of the word. Explain that any physical object they can think of is made of matter.

Show students a piece of colored construction paper and invite them to describe it in as many ways as they can. Then prompt them with questions to get them thinking about more of the paper's properties. Is it smooth or rough? Explain that these words describe its texture. What color and shape is it? Is it thick or thin? How heavy is it? Does it bend, or is it rigid? Tell students that all these details about an object are called its *properties.*

Now fold the paper into a simple airplane or another shape. Ask students whether doing this changed the matter that the paper is made of. Did the texture, color, or weight of the paper change? Explain that only the shape and size have changed. Now, tear the paper into pieces. Students may observe that the shape and size have changed again and that the texture is now a bit different on the edges, but the pieces are still made of the same kind of matter as when the paper was whole. Ask students whether they can think of other things that can change shape or size without the material changing (for example, balloons, towels, milk, and bubbles).

Show students a pair of similar objects. Ask them to describe as many details about each one as they can. Ask how the two objects are similar and how they are different.

Below are questions to spark discussion.

How many different words can you think of to describe the shape of something?

What else is shaped like a sheet of construction paper? How is it similar to and different from a sheet of construction paper?

What else is made of the same material as a sheet of construction paper? How is it similar to and different from a sheet of construction paper?

How is the texture of the (first object) different from the texture of the (second object)?

If we placed five objects in order from biggest to smallest, would they also be in order from heaviest to lightest? Why or why not?

What do you think would happen if we placed each of the objects we observed into a bucket of water?

Use this activity to begin an introductory discussion about how we can use observational skills to describe the properties of objects around us.

Many of the unit's vocabulary terms are related to the spark activity and can be introduced during the spark. For vocabulary work, see the Vocabulary section in this *Unit Guide*.

PRIOR KNOWLEDGE

Invite students to explain their understanding about properties of matter and how these characteristics give things special qualities.

Probing Questions to Think About

Use the following questions to have students begin thinking about the properties of matter.

- When you sharpen a pencil, do you change any of its properties? What shape, color, and texture are the shavings? How are the shavings similar to and different from the pencil?
- What would happen if you dropped one cooked and one uncooked piece of spaghetti on the floor? How do the properties of spaghetti change once it has been cooked?
- Can you think of anything that changes color over time? Give examples.
- How are the properties of wet glue different from the properties of dry glue?
- How does water change if you put it in a freezer? Heat it on a hot stove?
- Do you think a magnet would be attracted to a rubber band? A desk? A jacket? Why or why not?
- If you leave a grape and a rock outside in the sun for several days, how might each object change?
- How does a marshmallow change if you hold it on a stick over a fire? How might the stick change if it's made of wood? Metal?

Tell students they will learn more about these topics soon.

UNIT MATERIALS

Each unit provides a wide variety of resources related to the unit topic. Students may read books and other passages, work in groups to complete hands-on experiments and investigations, discuss science ideas as a class, watch videos, complete writing tasks, and take assessments.

Resources are available for printing or projecting, and many student resources are also available for students to access digitally on Kids A–Z.

Selected unit resources are available in more than one language.

For a complete list of materials provided with the unit, see the Properties unit page on the Science A–Z website.

VOCABULARY

Use the terms below for vocabulary development throughout the unit. They can be found in boldface in the *Nonfiction Book*, the *Quick Reads*, and/or other unit resources. These terms and definitions are available on *Vocabulary Cards* for student practice. Additional vocabulary lists are provided in the teaching tips for *Investigation Packs* and *FOCUS Books*.

Core Science Terms

These terms are crucial to understanding the unit.

color	any shade made when light reflects off something
gas	matter that can freely change shape and size; often it can't be seen
liquid	matter that keeps its size but takes the shape of its container
magnet	a piece of metal that sticks to iron or steel
material	any kind of matter that is used to make something
matter	anything that takes up space and has weight
property	a feature or quality that can be used to describe something
shape	how something looks around the outside
size	how big or small something is
solid	matter that keeps its shape and size

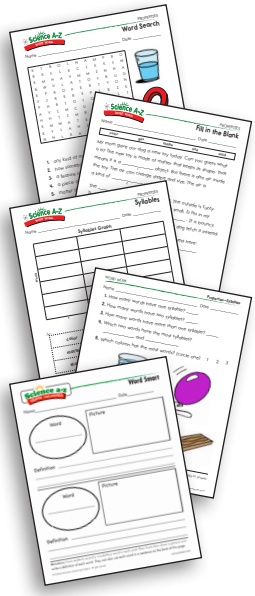
Other Key Science Terms

The following vocabulary is not essential for comprehending the unit but may enrich students' vocabulary.

mineral	a solid, natural material that does not come from a plant or animal
Mohs scale	a measure of how hard something is, using minerals for comparison
ore	a rock that has useful minerals or metals inside it
steel	a kind of metal made of iron and carbon
texture	how something feels to the touch

Vocabulary Activities

You may choose to introduce all the terms that will be encountered in the unit before assigning any of the reading components. *Vocabulary Cards* with the key science terms and definitions are provided. Dots on the cards indicate the reading levels of the *Nonfiction Book* or the *Quick Reads* in which each term can be found. If all level dots appear, the term may come from another resource in the unit. Students can use these cards to review and practice the terms in small groups or pairs. The cards can also be used for center activity games such as Concentration.



The *Word Work* activity sheets offer fun puzzles and practice with key vocabulary terms from the unit. For further vocabulary practice and reinforcement, you can choose from the vocabulary *Graphic Organizers*. To build customized vocabulary lessons with terms related to the topic, see Vocabulary A-Z.

Students can use the *Word Smart* vocabulary *Graphic Organizer* to organize information on the science terms. You may want to assign each student one to three words to share his or her *Word Smart* knowledge with classmates. Students who have the same word should first compare their *Word Smart* sheets with each other and then report to the larger group.

The science terms can be used in oral practice. Have students use each term in a spoken sentence.

As students read, encourage them to create a science dictionary by recording new vocabulary terms and definitions in their *SAZ Journal*.

BACKGROUND AND MISCONCEPTIONS

Use this section as a resource for more background knowledge on unit content and to clarify the content for students if misconceptions arise. Refer to Using the Internet below for more ways to extend the learning.

Q: *Doesn't the word* property *mean something you own?*

A: Yes, it does, but the word *property* has more than one meaning. It can mean the things a person owns (for example, a house, clothes, or a toothbrush). But in science, a *property* is a trait or quality of an object. It is a way of describing that object. Words that describe shape, texture, size, or density are considered properties of an object. People have properties, too—such as our height, weight, hair color, voice, or posture—but when describing a person, these words are often referred to as *characteristics.*

Q: *Is looking at an object the only way to identify its properties?*

A: No. When we observe an object, our sight is often the first sense we use to describe it. But we can use our other senses as well (hearing, smell, touch, and taste). Scientists tend to study an object more thoroughly than by simply observing it with their senses. They may attempt to identify the chemical structure of something and test how the item behaves under certain circumstances.

Q: *Is it true that air is not matter because it cannot be seen?*

A: No. It may be difficult for students to picture that something invisible could be matter. But air does occupy space, and it has mass (measured as weight), so it is matter. When a balloon is inflated with air, it gets bigger, which proves that air takes up space. And a balloon that is inflated does weigh more than one that is not, due to the added weight of the air inside.

Q: *Are water and ice different types of matter because one floats and one doesn't?*

A: No. Water and ice are the same kind of matter. Both are made of hydrogen and oxygen. But water changes from a liquid to a solid at a lower temperature. Similarly, at a higher temperature, water turns into water vapor, a gas. But in all three states, water is the same matter.

Q: *Are there any other shapes besides squares, circles, triangles, and rectangles?*

A: Yes, there certainly are! There are so many kinds of shapes that it would be impossible to name them all. Children learn several common shapes from an early age and may think that these are the only possibilities. But most objects are irregularly shaped, such as a sock, a tree, a bottle, or a lizard. Most shapes that are named have straight edges, equal interior angles, parallel sides, and/or sides that are curved in a predictable manner. Many objects with traditional shapes—such as square crackers, circular breath mints, and triangular street signs—are made by people. In general, natural objects tend to have more variety in their shape than those made by people.

Q: *Could any common objects come in a different shape than they do now and still work just as well?*

A: Some could, and others could not. Many shapes of noodles work equally well as food once cooked. Light bulbs come in a variety of shapes, yet they all give off light. But spherical bricks would be very difficult to stack in constructing a wall. Similarly, a golf ball shaped like a cube would not fly or roll well. Objects have different shapes and sizes because they have jobs to accomplish that call for a certain shape.

Q: *If one thing is larger than another, is it always heavier?*

A: While larger objects are often heavier than smaller ones, this is not always the case. Large things can be light for their size, and small things can be heavy for their size. The material from which an object is made affects its weight. A suit of armor is much heavier than a suit made of cloth. Students might compare a large beach ball and a rock half its size. The ball is light, and the smaller rock is heavy. Meanwhile, two rocks of the same size can have very different weights due to their density, or how tightly packed the material is inside them.

Q: *Is a large magnet always stronger than a small magnet?*

A: The size of a magnet does not always determine its strength, although larger magnets are usually stronger than smaller ones. Some very large magnets can even pick up cars! Magnets can vary in strength due to electricity, use, exposure to heat, and other factors. But the size of a magnet does tend to be a good way to predict its strength.

Q: *Do dark objects always hold heat better?*

A: While dark colors do absorb more heat than light colors, the material that matter is made of is another important factor in its ability to hold heat. Think about the seat belt in a car during summer. The metal part is hottest, even if the fabric is a darker color. But if two objects made of the same material are different colors, one color may absorb heat more than the other. A black car will be hotter to the touch than a white car of the same type. And dark hair will feel hotter in the sun than light hair.

Q: *What else comes in all three states (solid, liquid, and gas) besides water? I've never seen a liquid rock!*

A: Many things occur in multiple states. When subjected to enough heat and pressure, rocks and metals can melt and change into their liquid form or even turn into a gas. Lava is a liquid form of rock. Only after it flows out of volcanoes and cools does it become hard, solid rock. When students recycle metal cans, the scrap metal will be melted into a liquid and then cooled back down so it can be turned into new, solid objects. Fluorescent lamps may contain mercury vapor, a gaseous form of metal. Nitrogen is a gas that is a large part of the air we breathe. But it can also be turned into a liquid at a very low temperature. Liquid nitrogen is used to freeze things instantly, which can be useful in science. Dry ice is the solid form of carbon dioxide. It can be used to keep foods or lab specimens frozen, but if touched, it can cause serious burns.

EXTENSION ACTIVITIES

Using the Internet

Most search engines will yield many results when a term such as *properties* or *properties of matter* is entered. You can also search for more information on a specific property, such as *color* or *texture.* Be aware that some sites may not be educational or intended for the elementary classroom. More specific inquiries are recommended, such as:

- classifying matter
- fabric textures
- list of adjectives
- magnetic objects
- states of matter for kids
- regular and irregular shapes
- density of everyday objects
- Does it float?

Projects and Activities

- **Project:** Collect a variety of items with different shapes and textures, and put them in bags so students cannot see inside. Have students work in pairs to identify the objects based on feel (texture) alone.
- **Project:** Have groups of students play a game called "What's the Matter?" in which students from other groups guess the identity of an object, either by listening to clues or by using senses other than sight.
- **Inquiry Science:** Provide tubs of water and invite students to bring in a variety of objects that may or may not float. Allow students time to predict, test, and reflect as they investigate which objects float and which do not.
- **Writing:** Ask students to select an object they would like to write about in detail. Instruct them to describe its materials and properties. Then challenge them to address why they think the object's properties were selected when it was designed. For extensive writing instruction, visit Writing A-Z.
- **Arts:** Choose an interesting object to display in front of the class. Allow students to cut out magazine pictures of items that have one or more properties in common with the selected object. Instruct students to draw the class object in the middle of a sheet of construction paper, and then have them paste their own pictures around the central object. Ask students to draw lines connecting the central image to the other images and to label each line with the property that the connected items have in common.

- **Technology/Project:** Use the Internet to find pictures of very unusual or hard-to-identify objects. Project them on a screen and have students analyze each object's properties to deduce and debate its identity or use.
- **Project/Home Connection:** Have students compare and contrast matter found in the classroom and matter found outdoors. Encourage them to use as many of their senses as possible to observe the matter in each location. Students might also compare and contrast the matter they find at home with the matter they encounter at school.
- **Project/Home Connection:** Have students create a list of ten items they use most at home. Have them list each object on a separate index card, with several of its properties listed below it. They might also draw a picture of it on the blank side of the card. Back in class, place students in groups and let them play card games using their completed cards. For example, they might play Go Fish by asking opponents for cards containing red objects or things made of wood. Or they might play a variation of Uno by placing one card on top of another if the objects share at least one property, until one player has discarded all of his or her cards.
- **Field Trip:** Plan a trip to a local nursery, botanical garden, forest, farm, or nature preserve. Take photos or provide drawing materials so students can return to class with pictures of what they observed. Have students write down as many properties as they can for each item they observed. Back in class, display the pictures on a bulletin board and post students' observations beside each image.
- **Research/Home Connection:** Students can conduct research as a family/home project or in the library/media center to extend the learning about a topic in one of the *Quick Reads* or other unit resources.