

UNIT OVERVIEW

Light is electromagnetic energy that allows us to see. The Light unit helps students explore the properties of light—where it comes from, how it moves, and how it interacts with objects. Objects can absorb light, reflect it, or both. Certain surfaces absorb more light than others. Absorbed light energy turns into heat energy. When an object blocks light, shadows form on the opposite side. Visible light is made up of all the colors of the rainbow. Objects appear colorful because they absorb certain colors of light and reflect others to our eyes.

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

Light allows us to see, which provides us with information about our surroundings. Understanding the physical properties of light helps us anticipate how light will behave as we use it and interact with it. Light also produces colors and shadows, which adds to the beauty and complexity of the world around us. Light is the basis of many human endeavors, such as astronomy, photography, painting, design, and cinematography. It also keeps our planet warm enough for life to survive and flourish.

Other topics

This unit also addresses topics such as: how rainbows form; the ways shadows vary; and additional properties of light such as fish that glow and neon lights.

SPARK

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

Materials

- lamp, bright flashlight, or other focused light source
- large sheets of white paper (1 per student)
- pencils
- black construction paper
- glue



Activity

Darken the room and position a focused light source about 2 meters (6 ft.) from a wall. Set up multiple light sources around the room as materials and space allow. Place students in pairs and give each student a pencil and a large sheet of blank white paper.

Have one student at a time tape his or her paper to the wall in the path of the light. This student will act as a model, standing in profile directly in front of the paper. (To help keep still, the model may rest his or her head against the paper with a foam cup or rolled sweater.) A shadow of the model's head should appear on the white paper. The student's partner should quickly outline the shadow with a pencil to create a silhouette of the model's head. Once done, let partners switch places to draw a silhouette of the other student.

Students can cut out their own silhouette and glue it to a piece of black construction paper. The activity can also be done with reversed paper colors. Invite students to share their work with the class.

Below are questions to spark discussion.

Why did your shadow show up on the paper?

What would happen if you turned off the light? Why?

What was the shape of the shadow? Why?

What color was the shadow?

If you used colorful light, what color would your shadow be?

What do you think would happen if you moved your head closer to the light or moved the light closer to the wall?

Use this activity to begin an introductory discussion about light. Explain that light is a type of energy that allows us to see. Light moves in certain ways and does certain things, depending on what it bounces into as it moves. Throughout the unit, students will learn more about light.

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 what they know about light. Discuss what would happen if there were no longer any light. How would the world look?

Probing Questions to Think About

Use the following questions to have students begin thinking of what they know about light.

- What is light?
- Where does light come from?



- Can you see light? Smell it? Taste it? Hear it? Feel it?
- Do plants and animals need light? Why or why not?
- What do shadows look like? Do they move? Do they change shapes?
- Why are rainbows so colorful?
- Why are some things shiny and bright while other things are dull and dark?
- Why do lightbulbs feel warm?

Tell students they will learn more about these topics soon.

UNIT MATERIALS

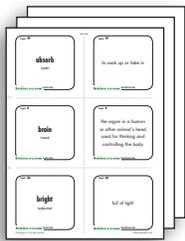
Each unit provides a wide variety of resources related to the unit topic. Students may read books and other passages, work in groups to complete hands-on experiments and investigations, discuss science ideas as a class, watch videos, complete writing tasks, and take assessments.

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 Light 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.

| | |
|--------------------|---|
| absorb | to soak up or take in |
| color | a shade or mixture of shades made when light reflects off something |
| dark | having little or no light |
| energy | the power to do work, make a change, or move objects |
| heat energy | a form of energy that makes things feel warmer or hot |
| light | energy that helps us see |
| reflect | to send light, sound, or heat back toward where it came from |
| shadow | a dark area made when an object blocks light |
| source | a person, place, or thing from which something comes |

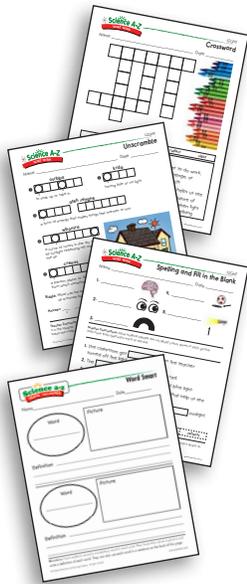
Other Key Science Terms

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

| | |
|-------------------------|--|
| brain | the organ in a human or other animal's head used for thinking and controlling the body |
| bright | full of light |
| dull | not having much color or brightness |
| eyes | the parts of the body that allow humans and other animals to see |
| indigo | a dark blue color between blue and violet |
| light rays | the straight paths on which light energy travels |
| mirror | a smooth surface that reflects light clearly |
| pigments | substances that give color to something, such as the colors in paints |
| primary colors | three main colors that can be mixed together to make other colors |
| rainbow | a curve of colors in the sky made by sunlight reflecting off water in the air |
| secondary colors | colors made by mixing two or more primary colors |
| shiny | having a smooth surface that reflects a lot of light |
| sight | the sense that allows humans and other animals to see |
| violet | a blue-purple color that can be seen in the lowest curve of a rainbow |

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: *How does light help me to see?*

A: We see objects when light enters our eyes through our pupils. The eye has a special structure, called the *retina*, that detects light. Other parts of the eye—such as the cornea, iris, and lens—help focus the light and control how much light hits the retina. The retina sends information to the brain. The brain interprets the information from the eye and tells us what we are seeing.

Q: *Are my eyes a light source?*

A: No. Eyes can detect light, but they do not produce light. We see when light reflected from objects enters our eyes.

Q: *Can animals see in complete darkness?*

A: No. The sense of sight, by definition, requires at least some amount of light. However, some animals have adapted to see in very low light. In fact, many animals, such as cats, have a special reflective membrane in their eyes called the *tapetum lucidum*. This membrane helps nocturnal animals see at night. Bats are able to fly in complete darkness, but this ability is due to the use of hearing sound (sonar) rather than seeing light. They send out high-pitched sounds and navigate based on how long it takes for the sounds to return to them after bouncing off nearby surfaces.

Q: *Because I can see something, does that mean it makes light?*

A: No, not necessarily. Actually, most objects do not make light. We only see them because light bounces off them and is reflected into our eyes.

Q: *Can an object absorb and reflect light at the same time?*

A: Yes. In fact, almost all objects absorb and reflect light. The amount of light and the wavelengths of light that an object absorbs determine its appearance. The combination of absorption and reflection from the surface of an object determines the color, texture, and sheen that we see.

Q: *Does light have any color?*

A: Yes. Visible light is referred to as *white light* because it often appears white. However, light that looks white to our eyes is actually the sum of all the colors (wavelengths) of the visible light spectrum added together. We can see specific colors when white light is filtered; only certain wavelengths reach our eyes. We can also see specific colors when a surface absorbs some wavelengths of visible light and reflects others to our eyes. A prism separates visible light into all of its wavelengths, which allows us to see all the colors of a rainbow.

SPECIAL NOTE: For a hands-on activity that allows students to compare mixing colors of paint with mixing colors of light, see the [Process Activity](#) offered with this unit.

Q: *I can't see anything between my flashlight and the wall that I'm shining it on. Is light invisible?*

A: It depends on the type of light. Light is a type of electromagnetic energy that includes a wide spectrum of wavelengths, such as microwave, infrared, ultraviolet, x-ray, and visible. In fact, visible light makes up only a small portion of all electromagnetic energy. Within the visible light spectrum, in order to see light, the light rays must enter our eyes. When light travels past our field of vision without entering our eyes, we can't see it, but the light is still there and is visible (able to be seen). We would see the light if our eyes were in its path or if an object reflected the light rays into our eyes

EXTENSION
ACTIVITIES

Using the Internet

Most search engines will yield many results when the term *light*, *shadow*, or *color* is entered. You can also perform a more specific search, such as *perception of light by the human eye*. Be aware that some sites may not be educational or intended for the elementary classroom. More specific inquiries are recommended, such as:

- properties of light
- natural and artificial light sources
- how eyesight works
- rainbow diagram
- visible light spectrum
- light and heat for kids
- shadow simulation
- color by addition and subtraction



Projects and Activities

- **Project:** Assemble a collection of objects, including examples that are transparent (such as CD cases and sheet protectors), translucent (such as plastic cups and wax paper), and opaque (such as books and wooden blocks). Ask students to observe whether light passes through each one. If students can see through the object, is the image clear or blurry? Discuss the results.
- **Project/Arts:** Let students create a set of color cards by attaching colorful items to index cards. These may include small pieces of gift wrap, comics, magazine images, fabric, wallpaper, or paint swatches. Students should sort their collection into color families and then arrange the clippings within each color family from left to right according to brightness.
- **Arts:** Ask students to look closely at a bowl of fruit, a stack of blocks, or any other subject that has multiple layers and draw it using only a pencil and paper. Have students examine where shadows form and encourage them to draw the subject using shading for the shadows.
- **Guest:** Invite a local fine-art painter or sculptor to the classroom to discuss with students how he or she uses light, colors, and shadows to create art.
- **Project/Home Connection:** Ask students to keep a journal with sketches and measurements of their shadow at different times of day, always in the same outdoor location. If possible, extend the project to span several weeks so students can track shadow patterns over time.
- **Technology:** Help students to use the Internet to research how compact fluorescent lightbulbs (CFL) differ from regular incandescent lightbulbs and how using these bulbs can reduce energy usage.



- **Writing:** Invite students to write or dictate a story in which lights, reflections, colors, or shadows play an important role. Help them brainstorm the story elements, providing examples as necessary. For extensive writing instruction, including how to write a narrative, visit [Writing A-Z](#).
- **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.

