

# Light Unit Teacher Masters: Table of Contents

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Dear Families,

Our class is beginning the Science Companion<sup>®</sup> unit about light. Although we live in the presence of natural and artificial light 24 hours a day, we may not think about what light is, how it behaves, and why it makes sight possible. Your child's study of light in the classroom will focus on how light behaves.

In class, the children will:

- Identify sources of light
- Investigate how light travels in straight lines until it hits something
- Observe how light interacts with materials
- Learn that some of the light that bounces off an object bounces into the eye, enabling us to see
- Discover that some materials, like mirrors, bounce light in the same direction, while other materials, such as white paper, scatter light in many different directions
- Explore how light that passes through an object can bend

From time to time, your child will bring home handouts called **Family Links**. These handouts will give you information about what your child is learning and offer suggestions about how you can help. They will be your link to the classroom. There are three kinds of Family Link handouts:

- **Homework** assignments your child completes and returns to class.
- **Fact Sheets** containing information you and your child can read and refer back to about the topics your child is learning. These sheets provide you with enough information to confidently share your knowledge of the topic and help your child learn.
- **Home Activities** for you and your child to work on together. They are not required homework.

If you have access to the Internet, there are wonderful sites where children can explore light further and delve as deeply into the topic as their interest takes them. Visit [www.sciencecompanion.com/links](http://www.sciencecompanion.com/links) to find descriptions of recommended web sites.

The combination of hands-on, multisensory learning, and an amazing scientific phenomenon, make the Light Unit very engaging for children and adults. Hopefully, you will share some of your child's enthusiasm, thereby learning with them while helping them explore.

Sincerely,

# Children’s Ideas About Light

## Misconceptions About Light

Children experience light every day of their lives, yet many think that light is “nothing.” With light all around them, most children—and adults—don’t think to question what it is, where it is, how it gets from one place to another, or how it makes sight possible.

Researchers who interviewed children found that they had various ideas about light:<sup>1</sup>

- Light does not exist unless it is intense enough to be perceptible.
- It is possible to see in total darkness.
- Light is the same thing as its source (e.g., an electric bulb) or its effects (e.g., a bright room).
- Light just exists; it doesn’t move.
- Light stays on non-shiny objects; they don’t reflect any light.
- We see because we focus our eyes on something.

Children are not the only ones with misconceptions. Even adults who can recite the speed of light may not fully understand its characteristics.

## Correcting Misconceptions

Studying light is challenging because it is not a state of matter (like a solid, a liquid, or a gas), but is energy. However, this unit includes several ways for your child to experiment with light and discover what and where it is.

Your child’s class has the opportunity to correct misconceptions. By studying light, the children learn that:

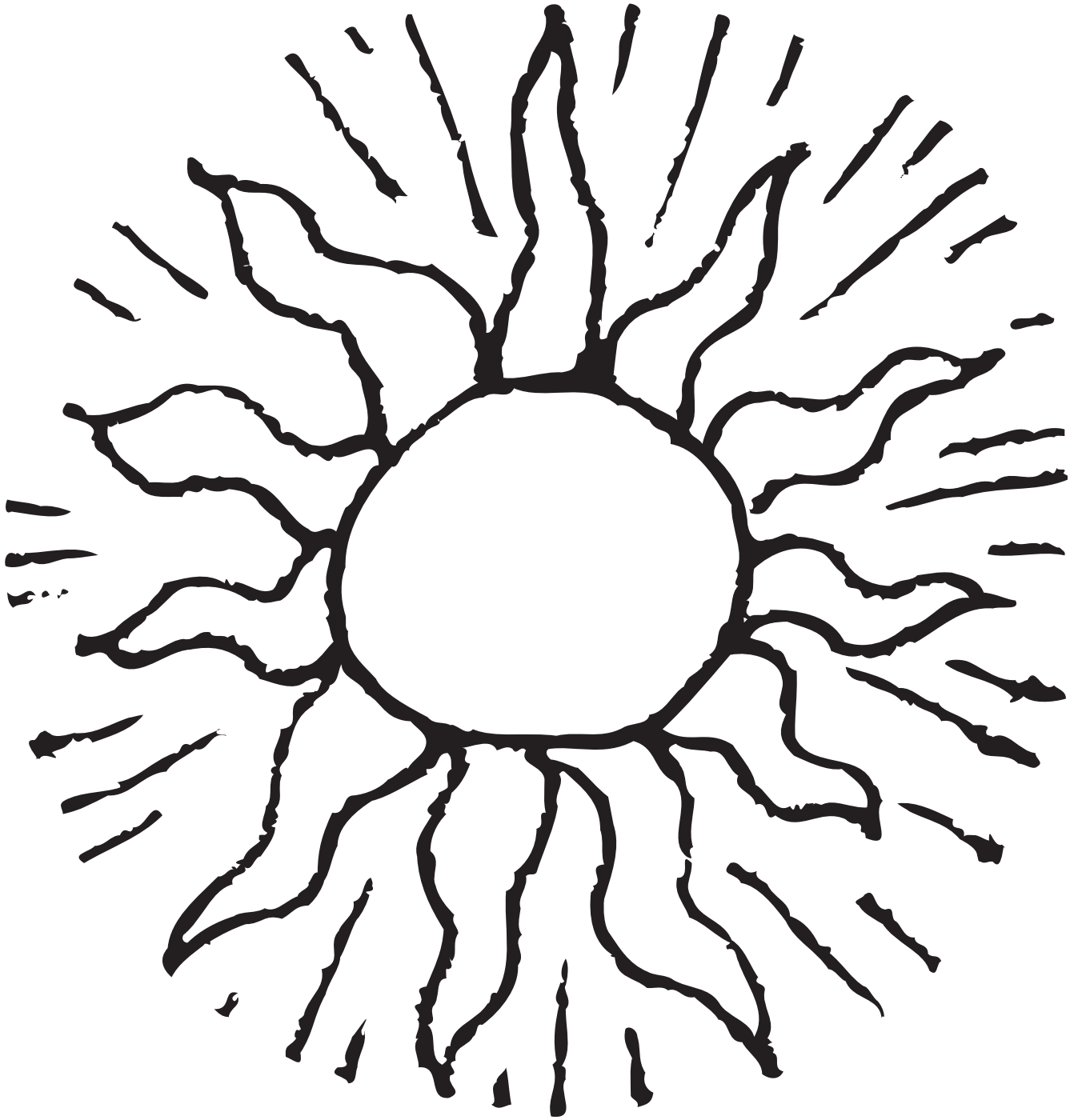
- If you can see something, then light must be present.
- Light travels in straight lines. It moves outward in all directions from a source until it hits something.
- When light hits something, one or more of three things happens: the light bounces off the object, goes through it, or is absorbed by it.
- When light goes through a transparent object, it either goes straight through or changes directions.
- The eye detects light.
- You see when light comes into your eye.

<sup>1</sup> Driver, R., Squires, A., Guesne, E., Tiberghien, A. *Children’s Ideas in Science*. Philadelphia: Open University Press, 1985.

Driver, R., Squires, A., Rushworth, P., and Wood-Robinson, V. *Making Sense of Secondary Science*. New York: Routledge, 1994.

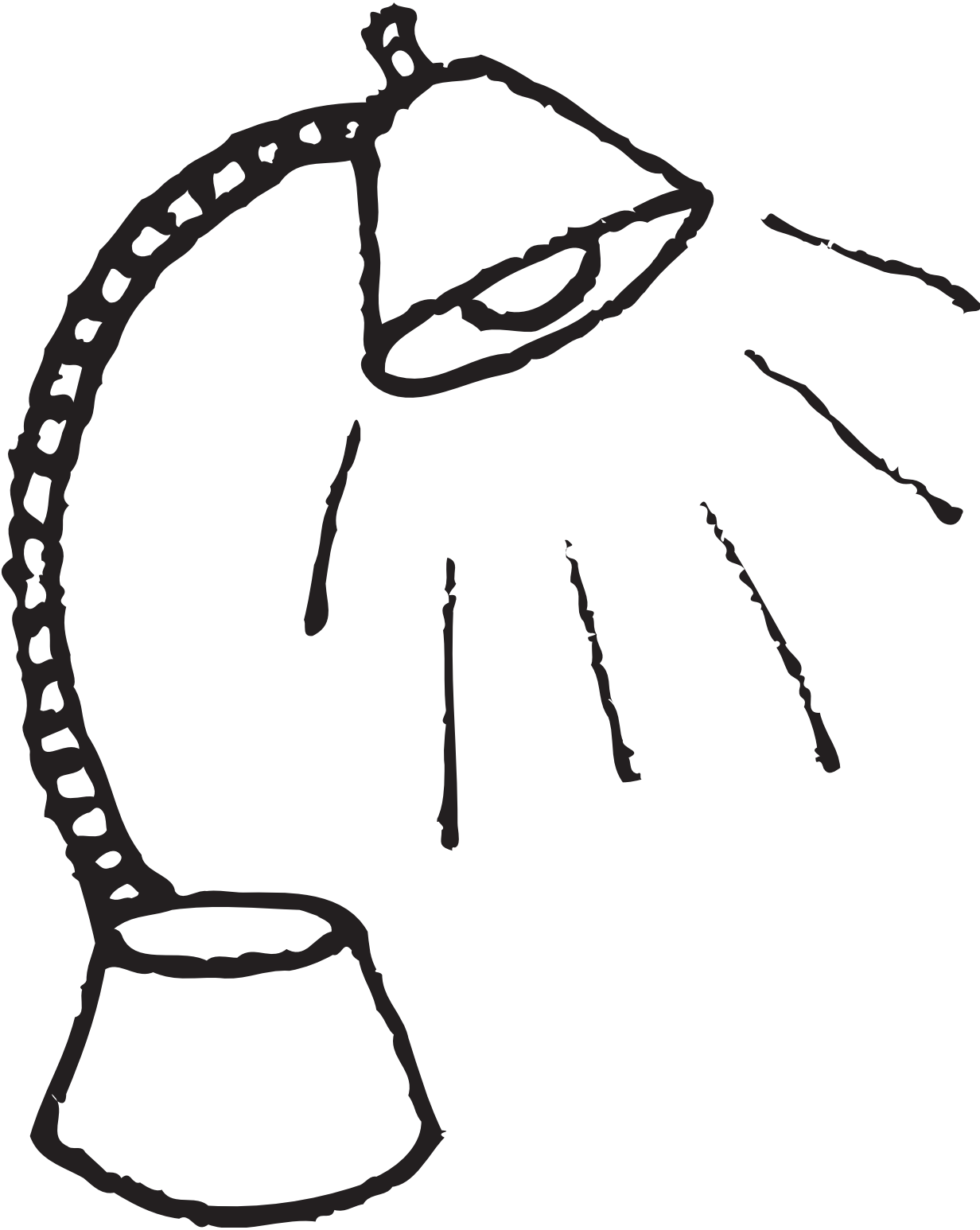
# Role Card

Sun



# Role Card

Lamp



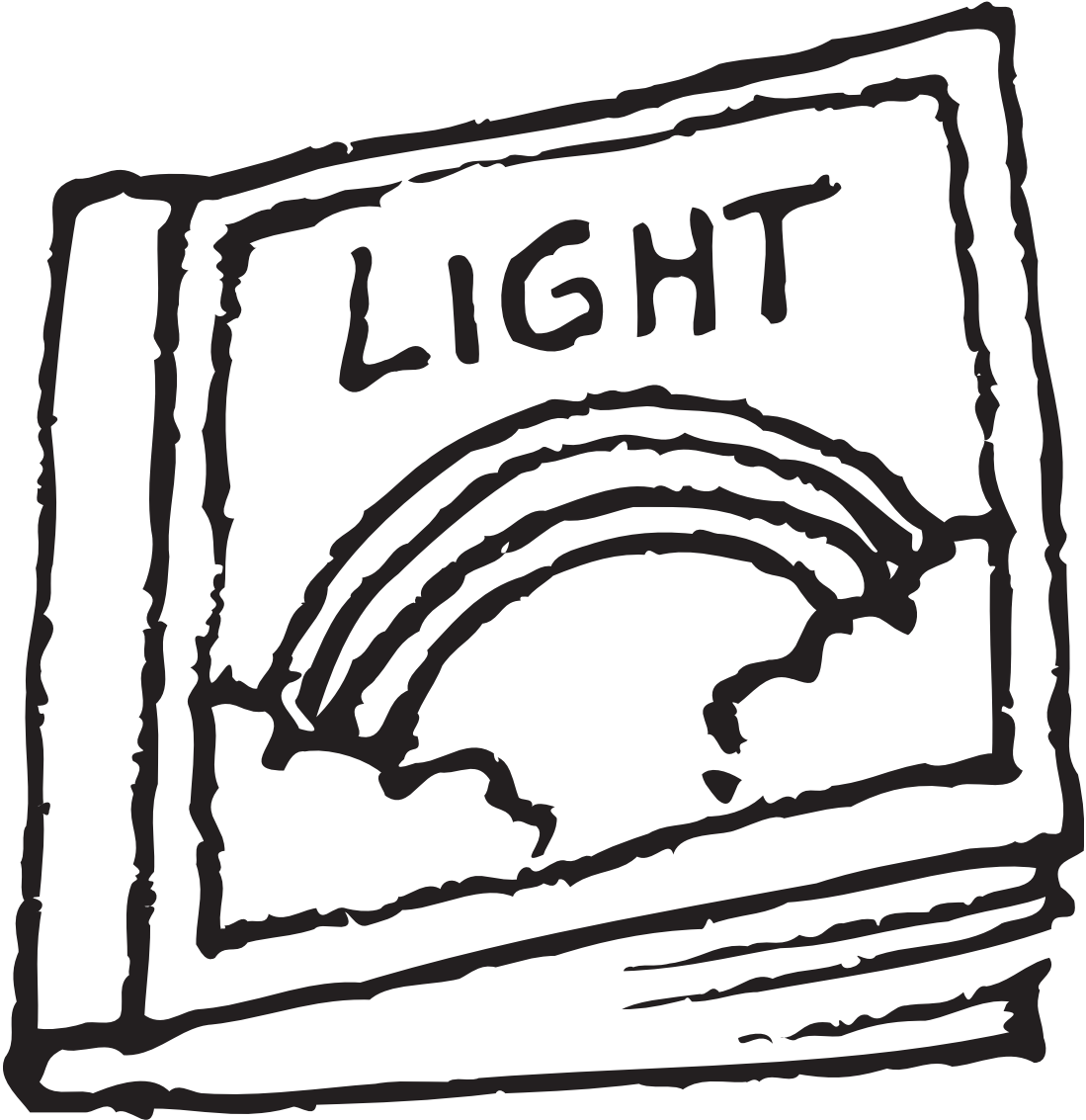
# Role Card

Tree



# Role Card

Book



# Role Card

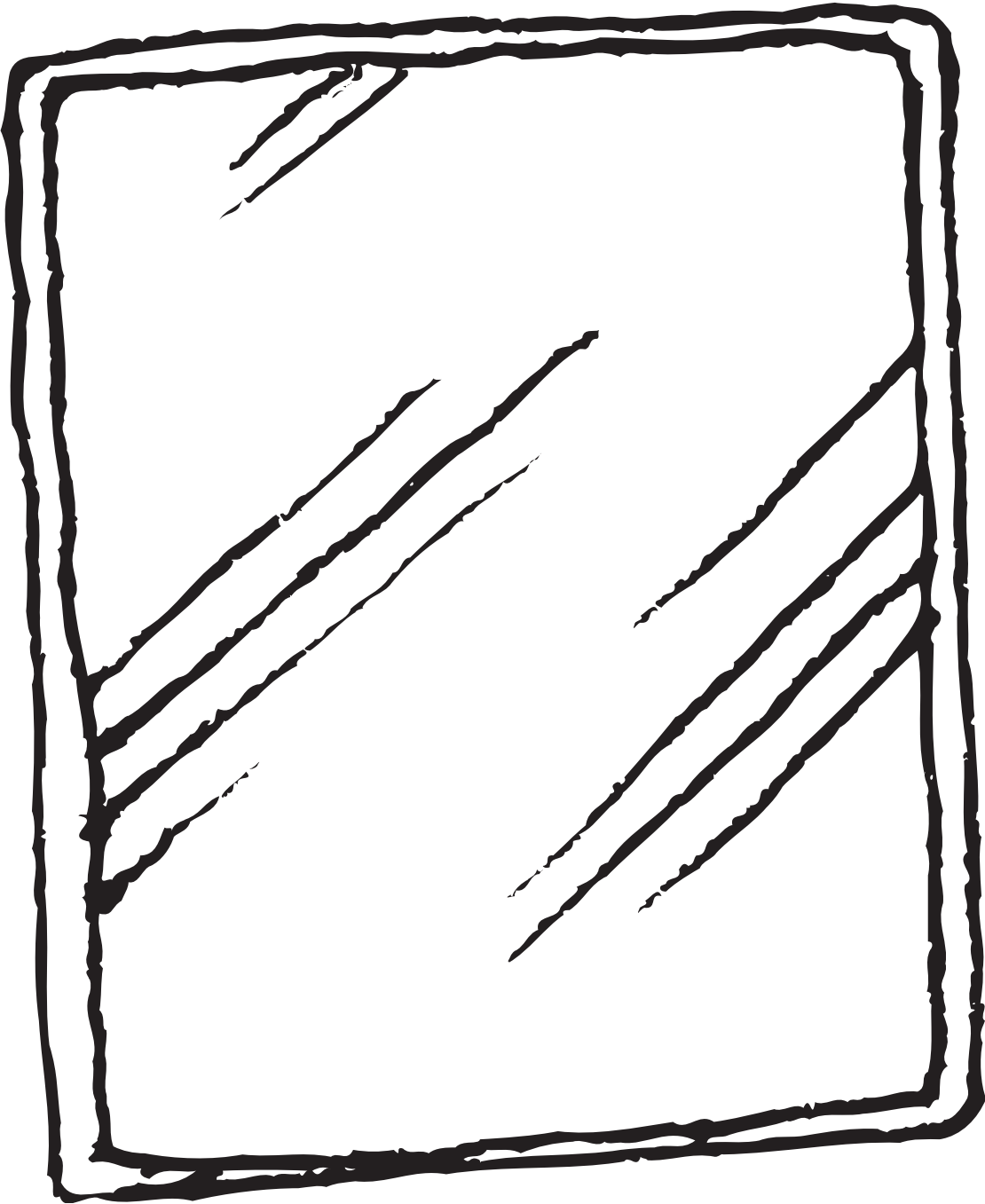
Eye





# Role Card

Mirror



## Role Card

# Light Beam

# Modeling Light—Act 1, Tree

## Light Beam

Travel in a straight line from the sun in a direction away from the wall or tree. Reflect off the first object you hit. Travel in a straight line again and get absorbed by the next object you hit.

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# Modeling Light—Act 1, Tree

## Light Beam

Travel in a straight line from the sun to the wall. Get absorbed by the wall.

# Modeling Light—Act 1, Tree

## Light Beam

Travel in a straight line from the sun to the wall. Reflect off the wall and get absorbed by the next object you hit.

---

# Modeling Light—Act 1, Tree

## Light Beam

Travel in a straight line from the sun to the window. Pass through the window into the child's eye.

# Modeling Light—Act 1, Tree

## Light Beam

Travel in a straight line from the sun to the tree. Get absorbed by the tree.

---

# Modeling Light—Act 1, Tree

## Light Beam

Travel in a straight line from the sun to the tree. Reflect off the tree towards the wall. Get absorbed by the wall.

# Modeling Light—Act 1, Tree

## Light Beam

Travel in a straight line from the sun to the tree. Reflect off the tree towards the window. Pass through the window into the classroom. Reflect off the first object you hit, and get absorbed by the next object you hit.

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# Modeling Light—Act 1, Tree

## Light Beam

Travel in a straight line from the sun to the tree. Reflect off the tree towards the window. Pass through the window into child's eye.

# Modeling Light—Act 1, Tree

Eye

Say, “I see the tree!” when the light beam that reflected off the tree hits you.



# Modeling Light—Act 2, Periscope

## Light Beam

Travel in a straight line from the lamp to the first object you hit. Reflect off the object. Travel in a straight line and get absorbed by the next object you hit.

---

# Modeling Light—Act 2, Periscope

## Light Beam

Travel in a straight line from the lamp to the outside of the periscope (not the opening). Reflect off the outside of the periscope and continue to reflect off objects around the room.



# Modeling Light—Act 2, Periscope

## Light Beam

Travel in a straight line from the lamp to the book. Reflect off the book towards the outside of the periscope. Get absorbed by the outside of the periscope.

---

# Modeling Light—Act 2, Periscope

## Light Beam

Travel in a straight line from the lamp to the book. Get absorbed by the book.

# Modeling Light—Act 2, Periscope

## Light Beam

Travel in a straight line from the lamp to the book. Reflect off the book towards the opening of the periscope and enter the opening. Reflect off the first mirror to the second mirror. Reflect off the second mirror back into the classroom. Get absorbed by the first object you hit.

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# Modeling Light—Act 2, Periscope

## Light Beam

Travel in a straight line from the lamp to the book. Reflect off the book towards the opening of the periscope and enter the periscope. Reflect off the first mirror to the second mirror. Reflect off the second mirror into the child's eye.

# Modeling Light—Act 2, Periscope

## Eye

Say, “I see the book!” when the light beam that reflected off the second mirror hits you.

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

## Family Link with Science—Homework

# Milk Carton Collection

Your child is studying the topic of light in science class. The children will be making periscopes from quart cartons in a future lesson.

Please bring as many empty 1-quart rectangular cartons (e.g. milk, creamer, orange juice, or egg substitute) as possible to class. Make sure to wash them out first.

A tip: Consider buying four quarts instead of the usual gallon on a shopping trip.



Please complete this assignment for science class.

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

## Family Link with Science—Homework

# Sources of Light

Today in science class, as part of our study of light, we talked about light sources and attempted to make the classroom completely dark.

With a family member, look for sources of light both inside and outside your home. List as many of these sources of light as possible.

Source of the light	Description of light emitted from source

Please complete this assignment for science class.

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

## Family Link with Science—Homework

# Bouncing Light

Your child is studying light in science class. Today in class we talked about how light bounces off objects.

Share with a family member what you learned in class today about how light bounces. With their help, gather together two different objects, one that is smooth (such as a mirror) and one that is rough or uneven (such as a bowl of flour). Darken the room, and use a flashlight or other light source to bounce light off each object.

Then teach your family member what light does when it hits each of the different objects. Where does the light go? As you explain, use a cluster of straws or pencils to represent beams of light.

What questions do you still have about bouncing light?

Please complete this assignment for science class. Keep the objects you observed handy. You will use them again in the next Family Link.

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

## Family Link with Science—Homework

# Bouncing Light and Vision

As you know, your child is studying light in science class. Today in class the children considered how the eye reacts to differences in light.

Take the two different objects (such as a mirror and a bowl of flour) that you bounced light off of in the previous family link for Lesson 4. Teach someone at home how you are able to see the objects. Think about the role light plays in seeing and if the pupil changes. Consider using straws or pencils again to represent beams of light.

What questions do you still have about how you see objects?

Please complete this assignment for science class.

## Family Link with Science—Home Activity

# Making a Periscope (page 1 of 4)

Today in science class, as part of our study of light, we used periscopes to observe objects and explored how light travels in periscopes.

### Materials

Masking tape

2 milk cartons, 1-quart (You can also use juice or other 1-qt cartons.)

2 mirrors, 2.25 in x 3.5 in, found at craft stores

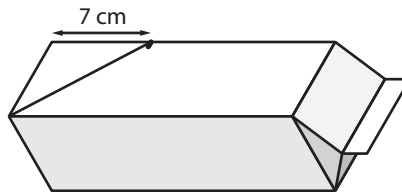
Pen

Ruler

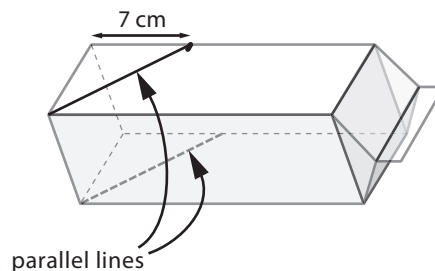
Scissors

### Directions

1. Make sure the cartons are clean and dry.
2. Lay a carton on one of its sides. Use a ruler to measure 7 cm (2.75 in) up the left edge from the bottom of the carton, and use a pen to make a mark there.
3. Use the ruler and pen to draw a diagonal line from the bottom right corner to the mark you made.



4. Repeat steps 2 and 3 on the opposite side of the carton so the lines are parallel to one another. (The lines need to be parallel so a mirror can slide through from one side to the other.)



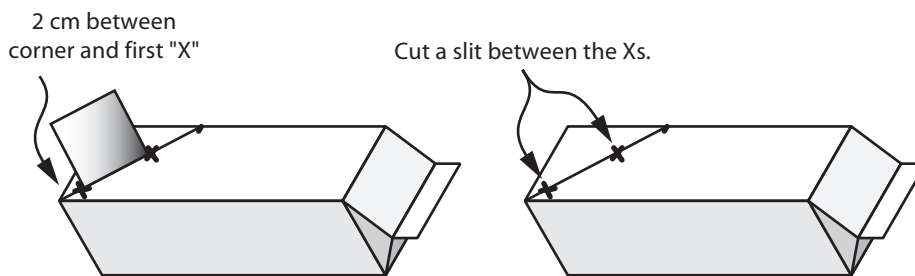
This activity is optional.



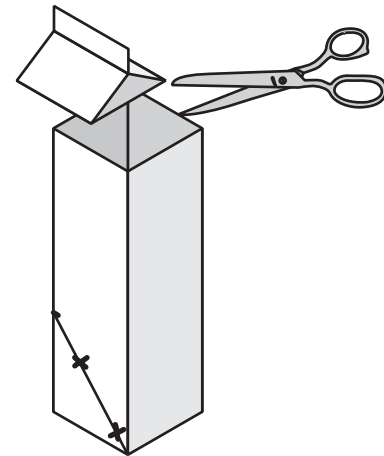
## Family Link with Science—Home Activity

# Making a Periscope (page 2 of 4)

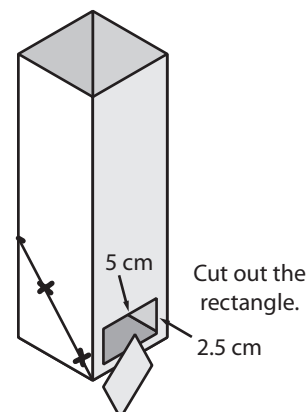
5. Use a ruler to measure 2 cm (.75 in) up each diagonal line from the bottom corner and use a pen to mark the spot with an X. Place one of the short sides of the mirror against the line, starting at the X, and make another X where the mirror ends on the diagonal line. Start at the X near the bottom corner and cut on the line to the next X. Do not cut all the way to the mark you made at the edge of the carton.



6. Cut around the top of the carton, removing the part that pours the milk out.



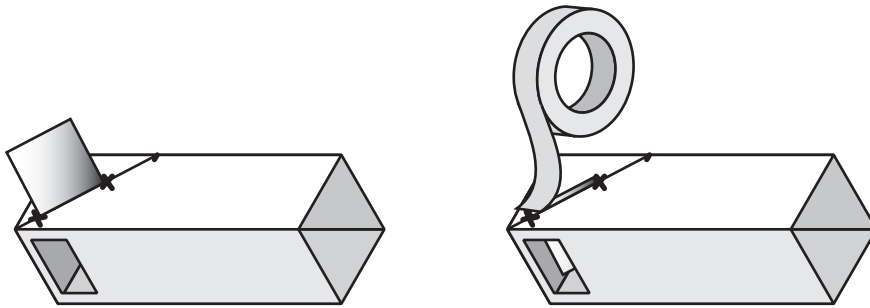
7. Use the ruler and pen to draw a rectangle on the side of the carton that is adjacent to the lower end of the slits. Draw it 5 cm (2 in) long and 2.5 cm (1 in) high, close to the bottom of the carton. Your measurements don't have to be exact. Cut out the rectangle on the carton.



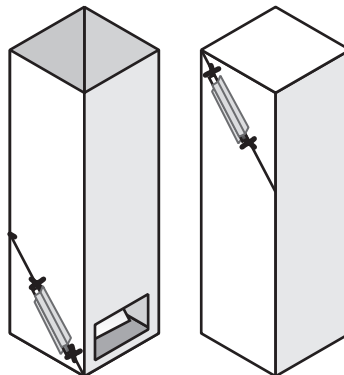
## Family Link with Science—Home Activity

# Making a Periscope (page 3 of 4)

8. Turn the carton to one of the sides with the diagonal slits. Slide the mirror through the slit so the shiny, reflecting side faces the hole you cut. (Be careful not to mark the mirror with fingerprints.) Slide the mirror all the way through the carton so the edges stick out of the slits on both sides. Use tape to fasten the mirror to the milk carton.



9. Repeat steps 2 through 8 for the second carton.
10. Stand one milk carton up on a table, with the hole facing you. Place the second carton upside-down, with the mirror on the top and the hole facing away from you.

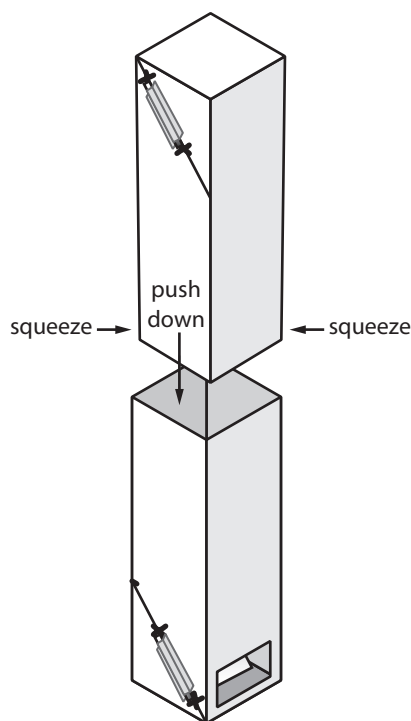


Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Family Link with Science—Home Activity

# Making a Periscope (page 4 of 4)

11. Use your hand to pinch the open end of the upside-down carton just enough for it to slide into the other carton. Tape the two cartons together with masking tape.



12. Look at some objects through your periscope. Explain to a family member how you are able to see an object using the periscope. How does light travel through it? Does the light enter your eyes? How do you know? Draw a picture if it helps you explain your ideas.

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

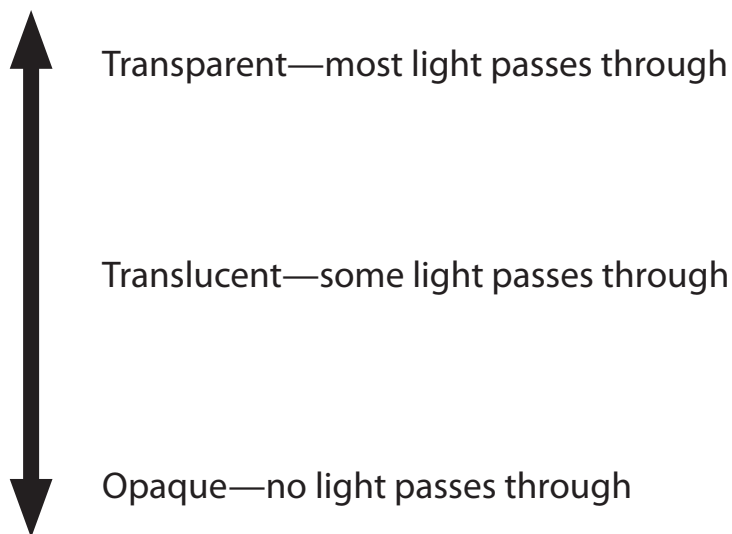
## Family Link with Science—Homework

# Sorting Objects

Your child is studying light in science class. Today in class we talked about how light passes through materials. We also explored a variety of materials that let most, some, or none of the light pass through them.

With a family member, collect four objects. To determine how much light passes through them, hold each object up to a flashlight or other light source. Write down the name of your object in the place next to the arrow that describes it most accurately.

### Object



Feel free to bring in one of your objects to display in the class collection of opaque, translucent, and transparent materials.

Please complete this assignment for science class.

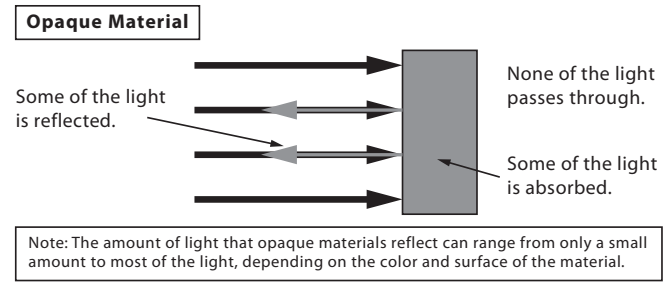
## Family Link with Science—Fact Sheet

# Light and Materials

Your child's science class has explored the difference between opaque, translucent, and transparent materials.

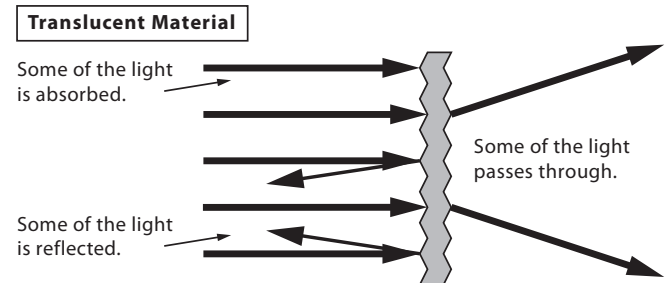
### Opaque Materials

Opaque materials include materials such as wood, brick, and metal. An opaque material does not allow any light to pass through it. Most opaque materials both absorb and reflect the light that hits them.



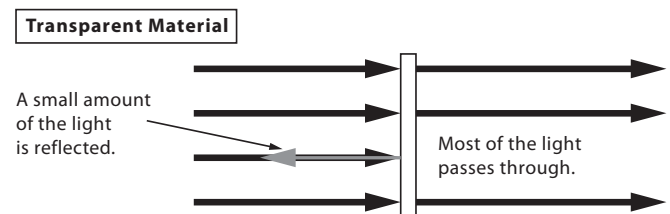
### Translucent Materials

Translucent materials include materials such as tissue paper, frosted glass, and wax paper. A translucent material allows some light to shine through it, but the light is scattered. Some materials that you may not expect to be translucent really are. (To see an example, go into a dark room and shine a flashlight through your hand.) A translucent material also absorbs and reflects some of the light that hits it.



### Transparent Materials

Transparent materials include materials such as window glass, clear plastic, and water. A transparent material allows most of the light that hits it to pass through. If you look through a transparent material, such as a window, objects can be seen clearly on the other side. No material is completely transparent. Some light will always be absorbed or reflected by the material that it passes through. The reflected light enables us to see the transparent material.



Keep this sheet to read and refer to.

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

## Family Link with Science—Homework

# Light and Shadows

Today in science class, as part of our continuing study of light, we talked about opaque objects—objects that do not let any light pass through them.

With a family member's help, make shadow puppets using your hands.

1. Press the flashlight into the palm of your hand and turn it on. Does light pass through your hand?
2. Position your hand near a wall and shine a flashlight on it.
3. Make rabbit ears by holding your hand in a fist with your middle and index fingers extended.
4. Try to make a dog by holding your hand with your palm facing you. Your thumb is the dog's ear and your pinky finger is the dog's mouth.
5. Come up with some of your own animal shapes. Remember these shapes so you can share them with the class.

Think. Why do opaque objects form shadows? How can you use what you've learned about light to explain shadow formation? If light does not pass through opaque objects, what do you think happens to it?

Please complete this assignment for science class.

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

## Family Link with Science—Home Activity

# Bending Light

Your child is studying light in science class. Today in class we talked about transparent materials and how light passes through them. We also explored how light changes direction when it passes through some transparent materials. This is known as refraction.

### Materials

Colored pencils, crayons, or markers

Glass jar with lid

Paper

Water

### Directions

1. Share with a family member what you learned in class about how light can change directions, or refract, when it passes through transparent objects.
2. Draw a picture on a sheet of paper.
3. Fill a glass jar with water and secure its lid tightly.
4. Put the picture behind the jar. Does it look bigger or smaller? What happened to the light as it passed through the water in the jar?
5. Experiment with other objects around your house by putting them behind the jar. Are you surprised by what you see? Why or why not?

This activity is optional.

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

## Family Link with Science—Homework

# How We See a Tree

Your child is studying light in science class. Today in class we became beams of light and acted out how a tree through a window and an object through a periscope are seen.

Think about what you learned in class today about how light enables you to see a tree through a window.

Describe to a family member how light travels and hits a tree. Why can you see the tree?

Here are some questions for you to consider as you explain how you see the tree to your family member:

- What was the source of the light?
- How did the light travel to the tree?
- Where did the light go after it reached the tree?
- Did some of the light enter your eye? How did it get there?

Please complete this assignment for science class.