

How Light Travels

Teacher Facilitation Notes

In General . . .

- Project the slide deck in edit mode—do not show it as a slideshow.
- Hide the speaker notes before projecting. (View/Show Speaker Notes)
- Hide the filmstrip to the left. (View/Hide Filmstrip.)
- Hide the toolbar. (Click on the up arrow at the right end of the tool bar.)
- Call on students to read the various content shown on slides.

Materials Needed Per Group:

Explore 1: Lining Up Light

Index cards (3 x 5-inches), 5

Sharpie™, 1

Plastic, reclosable baggie, 1

Small, rectangular mirror, 2

Medium binder clips, 5

Small keychain laser, 1

Metric ruler, 1

Explore 2: Just Passing Through . . . or NOT!

Clear, plastic glass

Paper towel

Paper or foam plate

Quart-sized baggie

Metal Spoon

Piece of cardboard

Empty glass jar

CD or DVD

Wooden spoon

Book

Explore 3: A Game of Mirrors

Foil square

Square of black paper

Binder clips, 3

Target Pattern

Tape

Fabric square

Small mirrors, 3

Laser light, 1

Manila folder

Marker

Explore 4: Refraction Action

Clear, plastic glasses, 3

Clear Soda (i.e., Sprite™)

Flashlight

Paper towels

Water

Cooking oil

Milkshake straws, 3

Other Materials

Student Recording Sheets

Student Summative Evaluation

Pencils

Hole punch

Science notebooks

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Advanced Preparations

- In general, gather all of the materials in a central location for ease of distribution.
- Explore 1–Prepare a set of materials for each lab group:
 - Use a Sharpie™ to label a resealable baggie for each group, *Lining up Light*.
 - Punch a hole in four of the index cards as far down from the top edge as possible and centered across. (Leave one without a hole.)
 - Place the 5 index cards, 5 binder clips, a marker, and a small keychain laser in each baggie.
- Explore 2–Prepare a set of materials for each lab group by placing all of the materials in the quart-sized baggie.
- Explore 3–Prepare a set of materials for each lab group. Duplicate the target pattern on regular paper.
- Explore 4–If possible, purchase milkshake straws (thicker) or brightly colored straws that are easier to see in the oil.

Engage: What is Light

- Introduce the lesson with the video *What is Light?*
- Have students answer the questions in their science notebooks, their recording sheet, or in the digital student file.
- Discuss their answers as desired.
- Allow time for students to match the vocabulary terms to their definitions on their recording sheet or digital file. Call on volunteers to drag and drop the terms under their definitions.
- Go to the glossary page for each term. Call on volunteers to define the terms in their own words.

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Explore 1: Lining Up Light

- Review lab safety rules before beginning this activity—NEVER SHINE A LASER AT ANOTHER PERSON. USE THE LASER ONLY AS DIRECTED. Tell students there is no second chance—if they deliberately use the laser incorrectly in a dangerous manner, they are out of the activity.
- Have the groups work together to set up their system for testing to see if light travels in a straight line.
- Let the groups work independently to do step 5 and the two challenges. Circulate among the groups asking questions and monitoring thinking as they work.
- Make sure they answer the questions on their recording sheets.
- Review how to complete a C - E - R. Depending on student ability levels, have students complete the graphic organizer as a whole class, in groups, or individually.
- Go to the glossary page for each term. Call on volunteers to define the terms in their own words.

Explore 2: Just Passing Through . . . or NOT!

- Have students make predictions about which materials will allow most of the light to pass through them, some of the light, or none of the light.
- Have groups complete the lab independently.
- Call on volunteers to give the results of their investigation. Fill in the class table as they talk about what they observed. Discuss results as desired.
- Read about the terms *transparent*, *translucent*, and *opaque*. Discuss.
- Have students identify whether each picture is an example of a transparent, a translucent, or an opaque object.
- Go to the glossary page for each term. Call on volunteers to define the terms in their own words.

Explore 3: A Game of Mirrors

- Have groups complete the activity as desired. Discuss.
- Go to the glossary page for the term *reflect*. Call on volunteers to define the term in their own words.

Explore 4: Refraction Action

- Have groups complete the activity as desired. Discuss.
- Go to the glossary page for the term *refract*. Call on volunteers to define the term in their own words.

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Explain

- Read and discuss the introductory slide.
- The second slide in this section is an anticipation guide.* Have students decide if they think each statement is True or False. Fill in the “Before Reading” based on a consensus of student opinions. Leave the final column blank at this time.
- Call on volunteers to read the next slide (How Light Travels). Discuss. Complete the question slide for How Light Travels. (Be sure to go back and complete the original anticipation guide.)
- Continue in the same manner, reading the information and completing the anticipation guides before and after reading each section.
- Discuss and explain

*Read more about [Anticipation Guides](#).

Elaborate

- Play the game according to the directions on the slide. You may choose to play more than one time. You might divide the class into teams and award points as teams guess a term, etc.

Evaluate

- Work through the evaluation slides together as a class or have students complete them independently.
- Assign the quiz to students as desired.

How Light Travels

Name: KEY

Evaluation-Quiz

1. Sometimes an object appears to be broken when it is seen partly under water, like the spoon shown in the illustration. How might the appearance of the broken spoon best be explained?



- A Water in the glass absorbs the light
 - B The glass is opaque and does not let light through.
 - C The spoon is able to reflect a great deal of light.
 - D Light traveling through the glass into the water is refracted.
2. Which of the following best explains why a person can see an image of their own face in a shiny surface? A shiny surface—
- F is usually made of different kinds of metal.
 - G reflects most of the light energy that strikes it.
 - H heats up more quickly than a dull surface.
 - J absorbs most of the light energy that strikes it.
3. What is the difference between the refraction of light the reflection of light?
- A Reflection is when light bounces off of a surface, while refraction is when light bends as it passes through a different medium.
 - B Refraction is when light bounces off of a surface, while reflection is when light bends as it passes through a different medium.
 - C There is no difference between reflection and refraction.
 - D All of the above.

How Light Travels

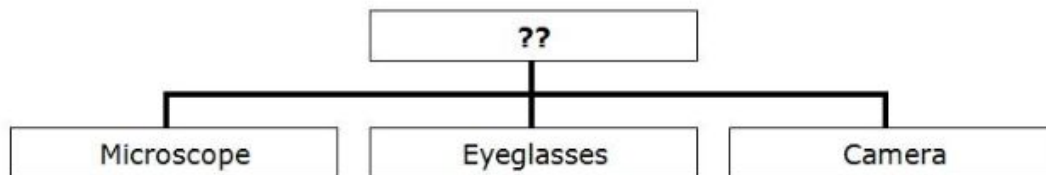
Name: KEY

Evaluation-Quiz, page 2

4. Light travels in a-

- F curved line
- G** straight line
- H narrow line
- J wide line

5. Some students created a graphic organizer after completing an investigation about light.

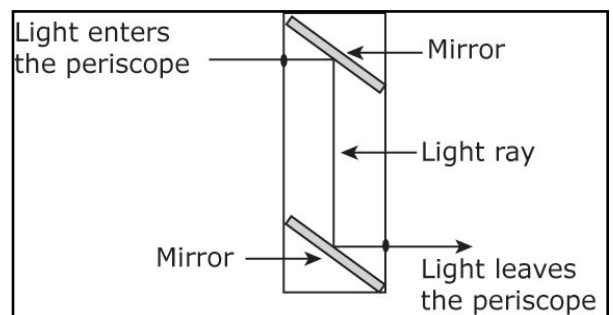


What would be the best title for this graphic organizer?

- A Objects That Reflect Light
- B Objects That Rotate Light
- C** Objects That Refract Light
- D Objects That Bounce Light

6. The diagram to the right shows a tool called a periscope. When light enters the top, it travels through the periscope as shown. After the light leaves the periscope, it travels-

- F** in a straight line.
- G back into the periscope.
- H through the bottom mirror.
- J more quickly through the air.

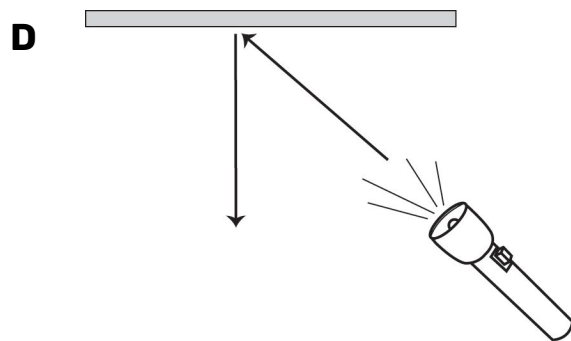
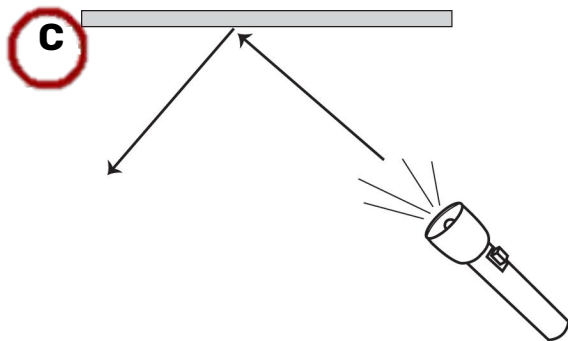
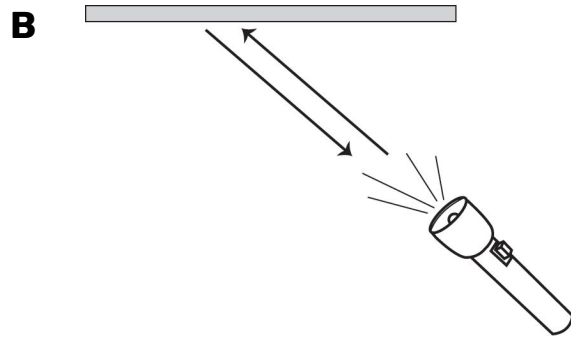
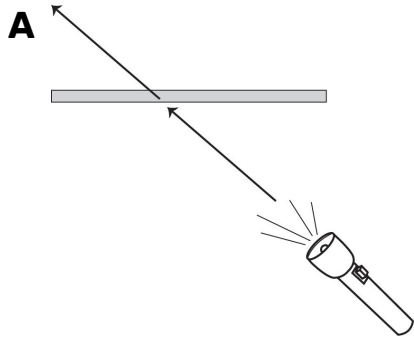
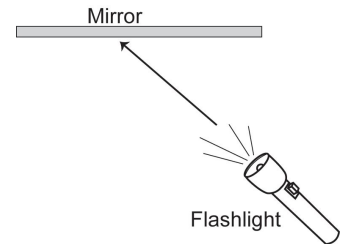


How Light Travels

Name: KEY

Evaluation-Quiz, page 3

7. The diagram shows a glowing flashlight pointing at a mirror. Which of these best shows how the mirror would reflect the light?



8. Which of the following is the best observation of light being refracted?

- F** Looking at oneself in the mirror
- G** Looking at a shadow of an object
- H** Viewing an object through a clear, glass window pane
- J** Viewing an object that is partially under clear water

How Light Travels

Name: KEY

Evaluation-Quiz, page 4

Directions: Study the objects pictured below. Use the pictures to answer questions 8-11.



8. Which object reflects most of the light that strikes it?

- F** Object 1 **G** Object 3
 H Object 4 **J** Object 5

9. Which object absorbs most of the light that strikes it?

- A** Object 2 **B** Object 3
 C Object 4 **D** Object 5

10. Which object emits light?

- F** Object 2 **G** Object 3
 H Object 4 **J** Object 5

11. Which object refracts most of the light that strikes it?

- A** Object 1 **B** Object 2
 C Object 4 **D** Object 5

12. Which object allow most of the light that strikes it to pass through it easily?

- F** Object 1 **G** Object 2
 H Object 3 **J** Object 4

How Light Travels

Name: _____

Engage: What is Light?

1. What is light? _____

2. Why is light important? _____

3. What is the Earth's main source of light? _____

Choose one of these words to fill in each blank below: *reflection*, *light source*, *energy*, or *emit*.

4. _____ To send out light from a light source
5. _____ The ability to do work or cause change in matter
6. _____ Objects or substances that emit light
7. The amount of space an object takes up is its _____.
8. _____ The bouncing back of light rays
9. Look around your classroom. List at least 5 light sources that produce light. _____

How Light Travels

Name: _____

Explore 1: Lining Up Light

1. What do you notice about the light ray that comes from the laser light?

2. Describe how you got the light ray to make a red nose on the smiley face.

3. How does this investigation show that light travels in a straight line?

Directions: Use your observations from the investigation and your knowledge of science to complete the following C - E - R (Claim-Evidence-Reasoning Graphic Organizer).

Question: How does light travel?	Claim:
Evidence:	Reasoning:

How Light Travels

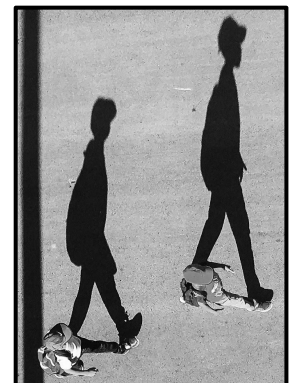
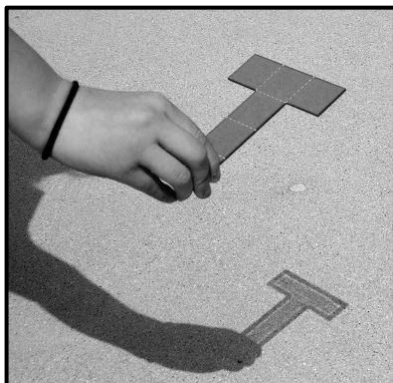
Name: _____

Explore 2: Just Passing Through . . . or NOT!

Directions: First, record your predictions about how much light will pass through each object. Then, test the objects and record your observations. Write one of the following phrases in each box of the table: *almost all of the light*, *some of the light*, or *almost none of the light*.

Object	Prediction	Observation
Clear, plastic glass		
Piece of cardboard		
Paper towel		
Empty glass jar		
Paper plate		
CD or DVD		
Sandwich bag		
Wooden spoon		
Metal Spoon		
Book		

Directions: Identify these objects as *transparent*, *opaque*, or *translucent*.



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Explore 3: A Game of Mirrors

1. Which material do you think will reflect the most light? Why? _____

2. Predict the order of greatest to least amount of reflection. _____

3. Based on your observations, rank the objects in order of greatest to least amount of light reflected. _____

4. What do you see when you look in the mirror? Explain. _____

5. Which eye appears to be blinking in your reflected image? Why? _____

6. Record your observations about your reflected name. _____

7. Sketch the laser beam's path to the target. Make arrows to show the path of the light beam.

Path Without a Mirror

Path With 1 Mirror

Path With 2 Mirrors

Path With 3 Mirrors

How Light Travels

Name: _____

Explore 4: Refraction Action

1. Does the straw in the glass of water look straight, broken, or crooked?

Record your observations. _____

2. Which refracts light more: air or water? How do you know? _____

3. Record your observations of how the straw looks in the clear soda and the cooking oil. _____

4. Which medium (water, clear soda, or cooking oil) refracts the most light?

How can you tell? _____

Light passing from one medium to another can be refracted, or bent. Refraction also magnifies the flower stem, or makes it look larger in the water. Many tools we use that refract light, such as eyeglasses and microscopes, have lenses. A lens is a curved piece of glass or plastic that refracts the light passing through it. Refract means to bend. Different suffixes can be added to *refract* when it is used in a sentence. Write the new word that can be formed when adding the following suffixes to *refract*.



5. -ed The light was _____ as it passed through the glass of water.

6. -ion _____ makes the part of the flower's stem under the water look larger.

7. -ing The water is _____ the light as it passes from the air into the water.

How Light Travels

Name: _____

Evaluation, page 1

Directions: Fill in the blanks using the correct terms from the term bank.

Term Bank	
emits	light energy
light source	straight
reflection	refraction

_____ is a form of energy that allows us to see things around us. Light rays travel in a _____ line from a _____ until they pass through or strike a surface. A light source is a substance or object that _____ light. The bouncing of light off of a shiny surface is called _____. Light _____ occurs when light bends as it moves from one medium to another.



In the space below, explain why the limes behind these pitchers of water appear smaller than they really are.

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Evaluation, page 2

The photograph shows the mirror image of a little girl. Explain why an image forms in the mirror. Tell how the mirror image differs from the little girl.



Directions: Study each image carefully. Decide if the image best illustrates refraction or reflection. Then label photograph as *reflection* or *refraction*.

















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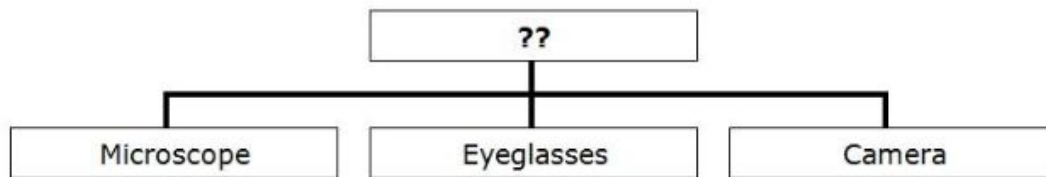
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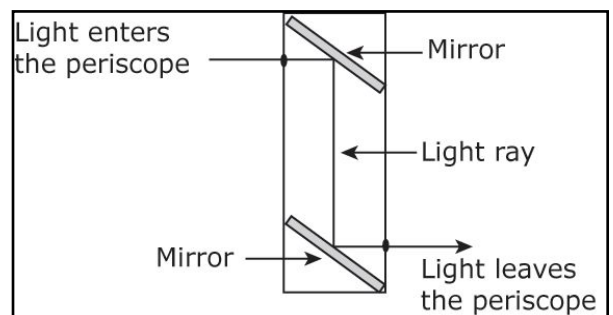
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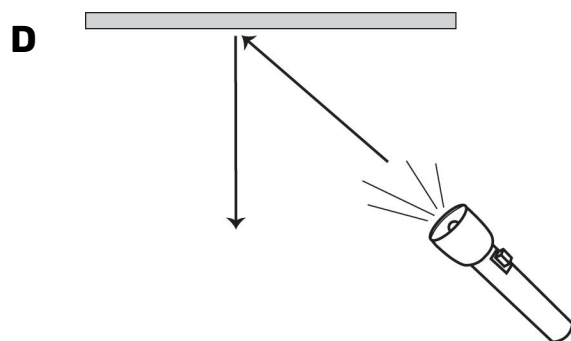
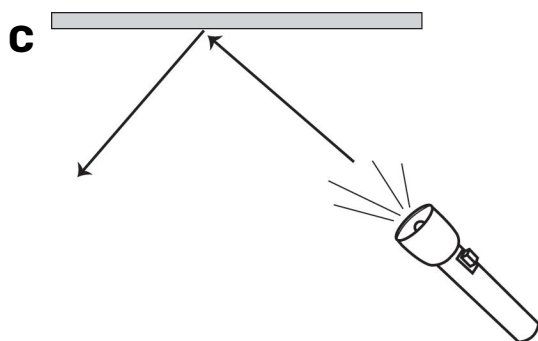
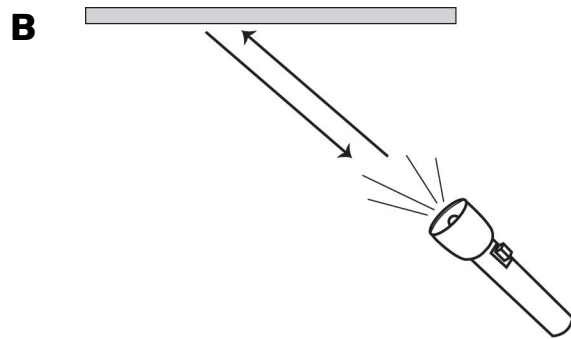
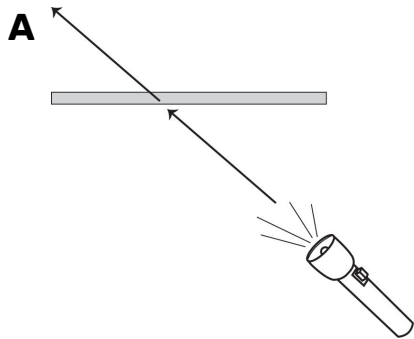
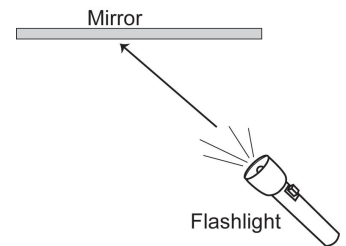


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