

Simplify
Science™

Engineering Challenge

Reflection and Light



Reflection and Light

Engineering Challenge: Model Building

Standards

4-PS4-2: Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

[Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.]

Vocabulary

- visible: *able to be seen*
- vision: *the ability to see*
- light: *a form of energy that allows us to see*
- reflection: *when light hits an object and bounces off*
- refraction: *when light bends passing from one transparent material to another*
- absorption: *the process of soaking up something*
- barrier: *something that blocks the way*
- transparent: *all light passes through; you can see through it*
- translucent: *some light passes through; you can't see through clearly*
- opaque: *no light passes through; you can't see through at all*

Learning Goal

The student will create a 2D model to show that objects are visible only when light reflects off of objects and into the eye.

Success Criteria

- **Criteria 1-** The student creates a model that accurately demonstrates that light reflecting from objects and entering the eye allows objects to be seen.
- **Criteria 2-** The student explains that changing the type of barrier (opaque vs transparent) changes what we see.
- **Criteria 3-** The student explains that you can use mirrors to direct the path of light in order to see a previously unseen object.

Individual Materials

Each student will need:

- engineering challenge recording sheet
- paper
- pen

Optional: scissors, glue, tape, markers

Common Materials

In addition, set out the following suggested materials for students to pick and choose what they will use. If you do not have all these items, feel free to leave out or substitute with similar items.

- cereal boxes
- toilet paper rolls
- paper towel rolls
- construction paper
- poster board
- aluminum foil
- self adhesive mirror sheets
- pipe cleaners
- tooth picks
- popsicle sticks
- pom-poms



Teacher Directions

Reflection and Light Model: Engineering

Before the Challenge (5 minutes)

- *Optional:* divide students into groups or partners.
- Provide each student with a copy of the recording sheet (pg. 5). Set out the common materials for all students to access or consider dividing up the materials and providing each table group with a set of materials. Students will pick and choose what they use.

Challenge Opener (10 minutes)

Explain that objects are only visible when light reflects off of them and into our eyes.

- Read the challenge, which is at the top of the recording sheet.
- Define the word “model” and review the model requirements by referring to the recording sheet, pointing out that students should use the boxes next to the requirements to check off the different parts of their model as they’re creating it.
- If your students need a refresher on how the reflection of light allows us to see, remind them that...
 - light travels in a straight path from its source until it hits something and then either reflects, refracts, or is absorbed.
 - An object is only visible when light reflects off of that object and into our eyes.
 - Mirrors and barriers manipulate light and change what we see. If needed, remind them that sunglasses are an example of a translucent barrier that changes what we see and that submarines use periscopes to see above the water.
- Give students a few minutes to brainstorm individually, with a partner, or as a class before they begin creating their model.
- Review the time limit and available materials with students. Be realistic in your expectations for gathering common materials (one table group at a time, one person at a time, etc.). If time allows, you can have students write out their plans or provide you with a verbal plan before gathering materials.

Challenge (30 minutes)

Monitor and provide support as needed while students create their models.

- If students have trouble getting started, invite them to take a look at the materials and think about what can be used to represent each part of their model (light source, path of light, object to be seen, and the eye). Remind them that mirrors can change the path that light follows.

Reflection (10 minutes)

- Have students answer questions 1-3 in the reflection section of their recording sheet.
- If time allows, a few students can share their responses.
- Emphasize that mirrors can help us see objects out of sight by using reflection to change the path that light follows. Objects can only be seen when light reflects off of that objects and into our eyes.



Teacher Script

Reflection and Light Model: Engineering

Before the Challenge (5 minutes)

- “Let’s make sure your materials are ready. You should have your recording sheet and a pencil. You will be working [alone; with your partner; with your table group].”

Challenge Opener (10 minutes)

- “We have learned that objects are only visible, or able to be seen, when light reflects off (them) and into our eyes.”
- “Follow along on your recording sheet as I read the challenge aloud: ‘You and a friend go to play catch on a sunny day, but you can’t find your ball. You think your ball may be stuck in your neighbor’s tree. The problem is there is a brick wall between your yard and their yard, and you can’t see over the wall and into the tree. Use what you’ve learned about reflection and light to create a model of something you could use to see over a wall and into the tree.’”
- “The word ‘model’ means a visual to show how something works. I can use a model. Your model must include a light source, the object(s) to be seen, the path that light follows, and the eye. Notice the boxes next to these requirements on your recording sheet. Use those boxes to check off the parts of your model as you make it, that way you don’t leave anything out.”
- *[Optional Refresher]* “Remember that light travels in a straight line from the sun until it hits something, and then either reflects, refracts, or is absorbed. An object is only visible when light reflects off of that object and into our eyes. Mirrors and barriers manipulate light and change what we see. Sun shades are an example of a barrier. They make objects appear dimmer. The mirrors in a periscope reflect light to direct the path of light from an object to a person’s eyes.”
- “Take a moment to [think about/discuss with a partner] what you could create to help you see over the wall and into the tree.”
- “You will have 30 minutes to complete this challenge. *You may choose to provide more or less time.*” [I will dismiss [one group/person] at a time to carefully and quietly gather their materials.”

Challenge (30 minutes)

- *[As needed]* “Remember that mirrors can be used to change the path that light follows.”
- *[As needed]* “Take a look at the materials. What could you use to represent the different parts of your model?”

Reflection (10 minutes)

- “Let’s discuss #1 on your recording sheet. Describe how the brick wall interacts with the light from the sun to prevent you from seeing the tree.”
- “Let’s discuss #2 on your recording sheet. What if, instead of brick, the wall was made of glass? Would you still need to build a device to see over the wall? Why or why not?”
- “Let’s discuss #3 on your recording sheet. Did your model represent a way to use light and reflection to help you see an object out of sight? Explain. If not, what could you do to improve your model?” *[Emphasize that mirrors help us see objects out of sight by using reflection to change the path that light follows. Objects can only be seen when light reflects off of those objects and into our eyes.]*

Name: _____

Engineering Challenge

Reflection and Light Model

Challenge:

You and a friend go outside to play catch on a sunny day, but you can't find your ball. You think your ball may be stuck in your neighbor's tree. The problem is, there is a brick wall between your yard and their yard, and you can't see over the wall and into the tree to be sure.



Use what you've learned about reflection and light to create a model of something you could use to see over the wall and into the tree.

Your model must include: a light source; the object to be seen; the eye; the path the light follows

↑
a visual to show how something works; can be 2D or 3D

Time Limit: _____

Extension and Reflection

1. Describe how the brick wall interacts with the light from the sun to prevent you from seeing the tree.

2. What if, instead of brick, the wall was made of glass? Would you still need to build a device to see over the wall? Why or why not?

3. Did your model represent a way to use light and reflection to help you see an object out of sight? Explain. If not, what could you do to improve your model?

Name: _____

Engineering Challenge

Reflection and Light Model

Sample Work

Challenge:

You and a friend go outside to play catch on a sunny day, but you can't find your ball. You think your ball may be stuck in your neighbor's tree. The problem is, there is a brick wall between your yard and their yard, and you can't see over the wall and into the tree to be sure.



Use what you've learned about reflection and light to create a model of something you could use to see over the wall and into the tree.

Your model must include: a light source; the object to be seen; the eye; the path the light follows.

↑
a visual to show how something works; can be 2D or 3D

Time Limit: 30 minutes

Extension and Reflection

1. Describe how the brick wall interacts with the light from the sun to prevent you from seeing the tree.

The light from the sun cannot pass through the brick wall because it is opaque. This is why we can't see the tree.

2. What if, instead of brick, the wall was made of glass? Would you still need to build a device to see over the wall? Why or why not?

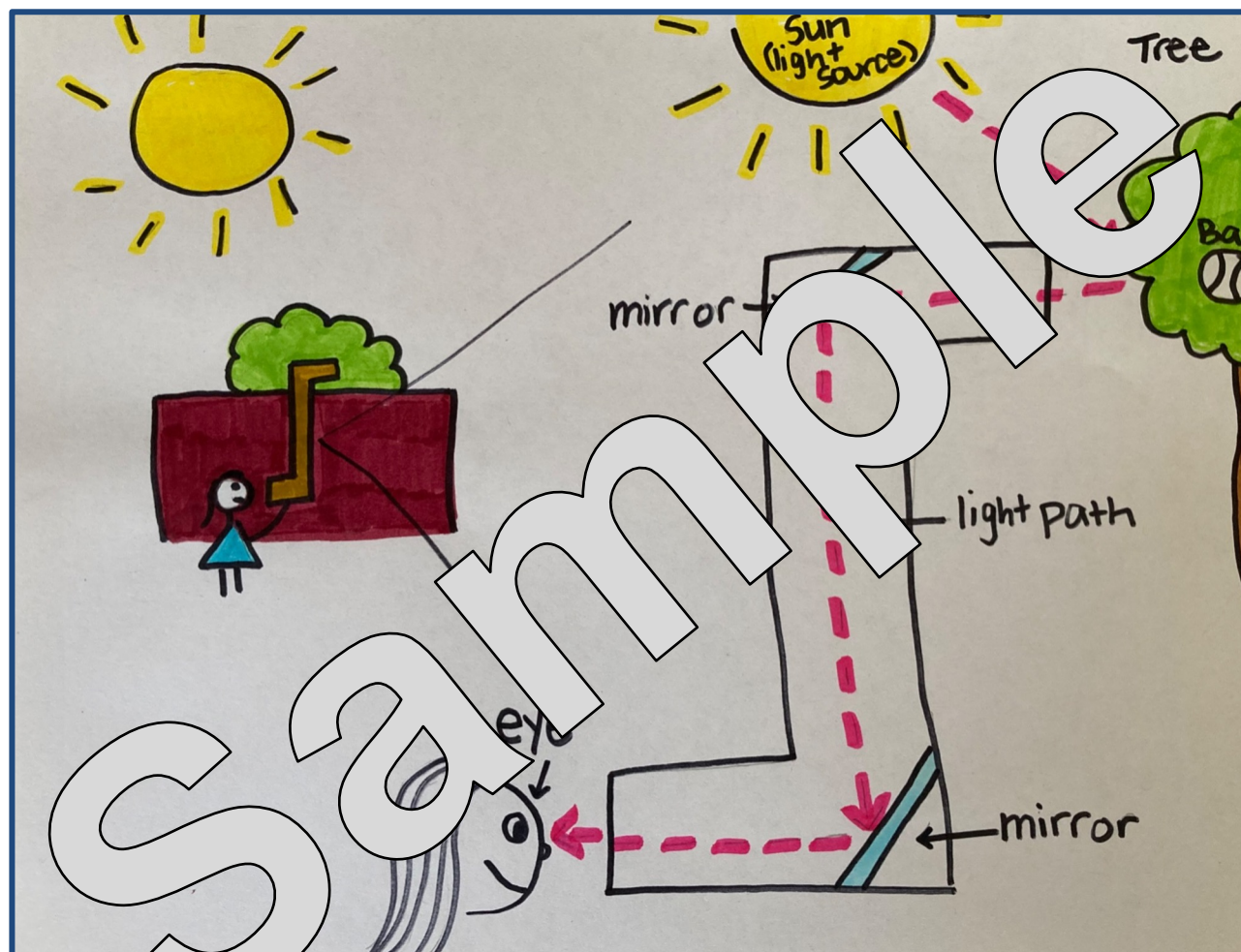
If the wall was made of glass we would not need to build a device to see over the wall. Since glass is transparent, light can pass through it, so we would be able to see the tree through it.

3. Did your model represent a way to use light and reflection to help you see an object out of sight? Explain. If not, what could you do to improve your model?

Yes, my model represented a way to use light and reflection to see an object out of sight. The model used mirrors to reflect the image of the ball in the tree and direct the path of light down a tube into my eyes.

Sample Model

Reflection and Light Model: Engineering



Materials: construction paper and markers

Sample Model

Reflection and Light Model: Engineering



Materials: poster board, pom-poms, cereal box, toilet paper rolls, pipe cleaners, tin foil, masking tape, markers, scissors