Light & Shadows

Reflection, Refraction & How We See

Learning Pack · Color It. Learn It. Explore It.

Ages 6–10 · Grades 1–4 (approximate) · Physical Science / STEM · 30–75 minutes

Name: _____



Inside: facts · words · shadows · mirror ray · pencil in water · quiz · answer key · notes

What you will learn

Learning objectives

- ☐ Explain that light travels through space and through materials.
- ☐ Describe how shadows form.
- ☐ Identify reflection and refraction.
- ☐ Explain why we can see objects.
- ☐ Safely investigate light using simple materials.

Five light facts

Fact 1: What is light?

Light is a kind of energy called electromagnetic radiation. Visible light is the part our eyes can detect. Light helps us see the world around us.

Fact 2: How light travels

In air, water or glass that is the same all the way through, light travels in straight lines. It can change direction when it reflects off a surface or passes into a different material.

Fact 3: How shadows form

A shadow forms when an object blocks some or all of the light traveling toward a surface. Opaque objects block most light. A shadow's size and sharpness depend on where the light, object and surface are.

Fact 4: Reflection

Reflection is light bouncing off a surface and traveling back into the same material. Smooth mirrors make clear images. The light leaves at the same angle to the normal (a line straight out from the mirror) that it arrived at.

Fact 5: Refraction and how we see

Refraction is light changing direction as it passes into a different material at an angle. That is why a pencil in water can look bent. We see things when light from them enters our eyes. A few things, like the Sun, make light; most things reflect it.

Sources (checked October 2026)

Fact 1: NASA Science, Visible Light, science.nasa.gov/ems/09_visiblelight/
Facts 2, 3: Science Learning Hub, Light and shadows, sciencelearn.org.nz/resources/2771-light-and-shadows
Fact 4: The Physics Classroom, The Law of Reflection, physicsclassroom.com/class/refln/Lesson-1/The-Law-of-Reflection
Fact 5: The Physics Classroom, Boundary Behavior (refraction) and The Line of Sight, physicsclassroom.com/class/refrn/Lesson-1/Boundary-Behavior and /class/refln/Lesson-1/The-Line-of-Sight

Light & vision words

Light	A kind of energy that lets us see. It travels very fast.
Light source	Something that makes its own light, like the Sun or a lamp that is switched on.
Shadow	A darker area where an object blocks some or all of the light.
Opaque	A material that blocks light from passing straight through it, like wood or cardboard.
Transparent	A material that lets light pass through so you can usually see clearly through it, like clear glass.
Translucent	A material that lets some light through but scatters it, so you can't see clearly through it, like wax paper.
Reflection	Light bouncing off a surface and going back into the same material, like light off a mirror.
Refraction	Light changing direction as it moves into a different material at an angle, because its speed changes.
Visible light	The light that human eyes can detect.

Your turn: write a sentence using two vocabulary words.

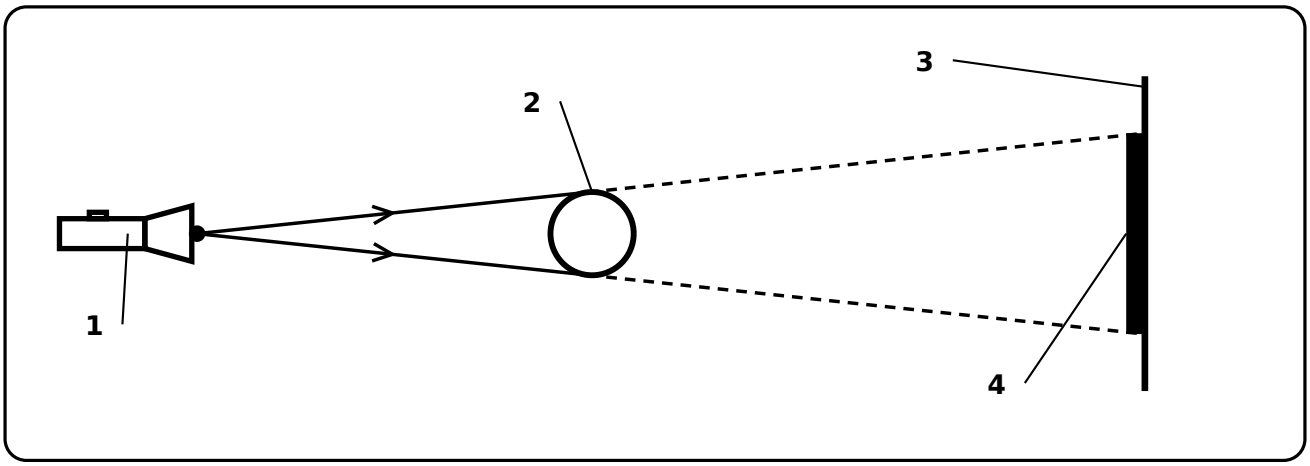
How shadows form

Name: _____ Date: _____

Activity A: Label the shadow diagram

Write the correct word from the word bank on each numbered line. Arrows show which way the light travels.

Word bank: Light Source · Opaque Object · Screen · Shadow



1. _____ 2. _____

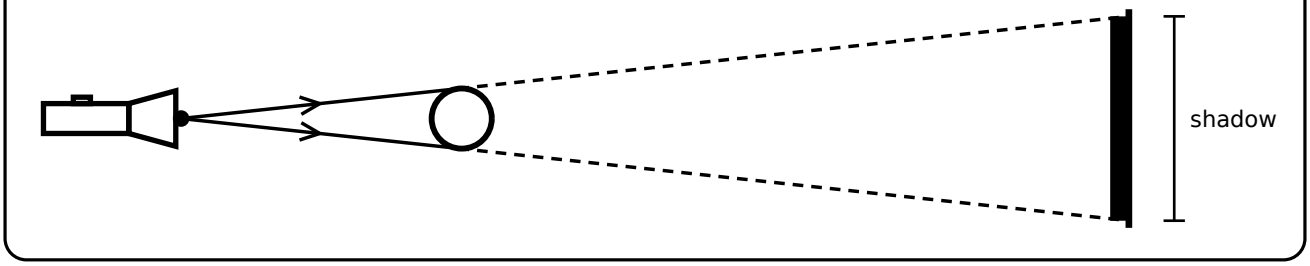
3. _____ 4. _____

Simplified model: the light is drawn as a tiny point, so the shadow has sharp edges. Big lights make softer edges.

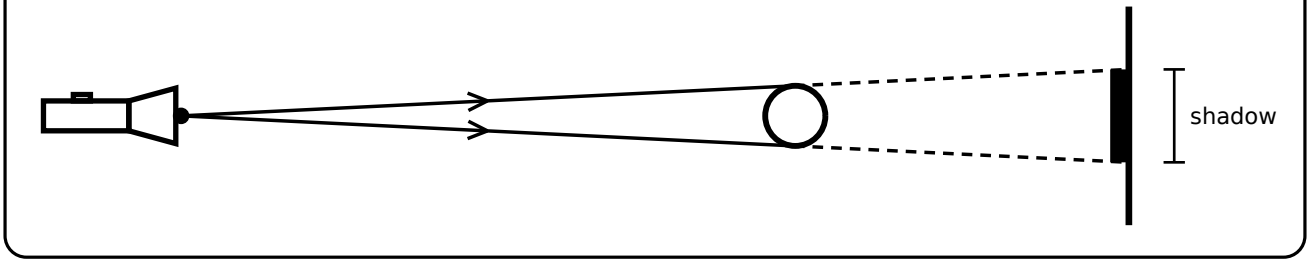
Activity B: Predict the shadow

Same flashlight, same ball, same screen. Only the ball moves.

Setup A: ball close to the light



Setup B: ball farther from the light



Which setup makes the larger shadow on the screen? _____

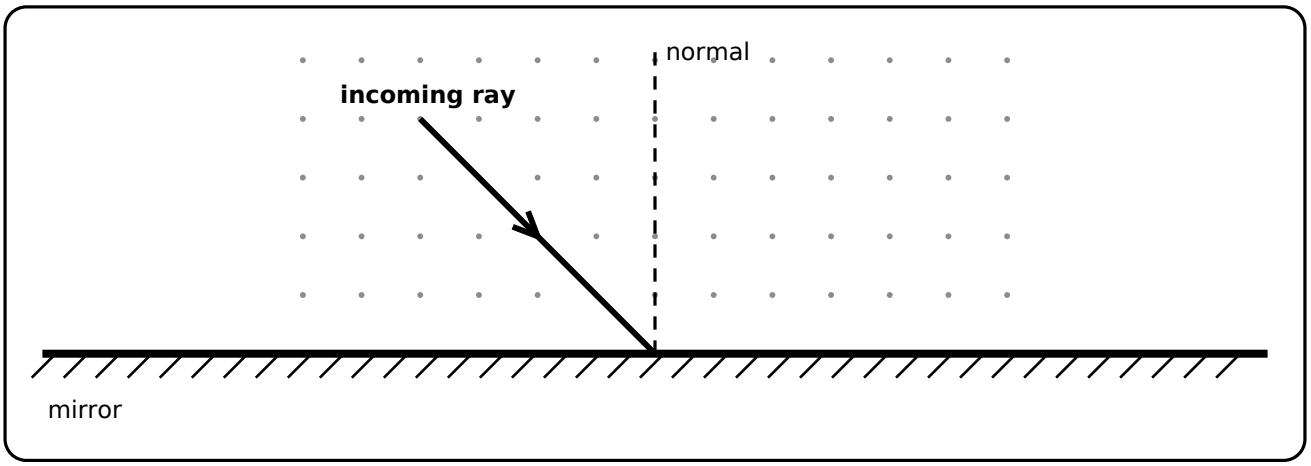
Why? _____

Reflection and refraction

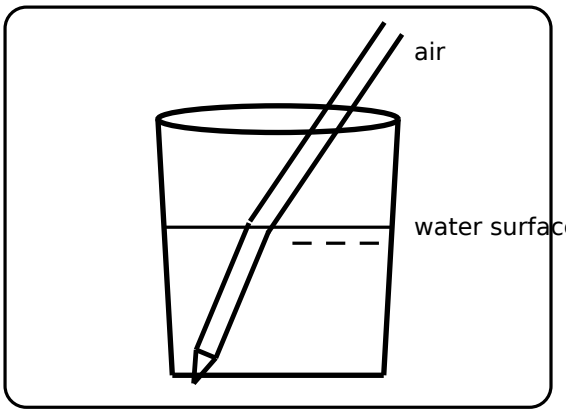
Name: _____ Date: _____

Activity A: Mirror reflection

Draw the reflected ray. Remember: the incoming and outgoing rays make equal angles with the normal. Hint: the incoming ray moves 4 dots across for every 4 dots down. Use the dots.



Activity B: The pencil in water



One whole pencil, seen from the side.

Why might the pencil look bent where it enters the water? Circle one.

A. The pencil really bends in the water.

B. Light changes direction when traveling between water and air.

C. The water makes the pencil shorter.

Circle the example of reflection. Underline the example of refraction.

a) Seeing your face in a mirror

b) A pencil appearing bent in water

Light & shadows quiz

Name: _____ Date: _____

Fill in the circle next to the best answer.

1. What makes a shadow?

- ◯ a) An object blocking some of the light
- ◯ b) Light passing through clear glass
- ◯ c) A mirror making light brighter

2. Which material is transparent?

- ◯ a) A wooden door
- ◯ b) Clear window glass
- ◯ c) A brick wall

3. What is reflection?

- ◯ a) Light being made by the Sun
- ◯ b) Light passing straight through a wall
- ◯ c) Light bouncing off a surface and changing direction

4. Why can a pencil look bent in a glass of water?

- ◯ a) The water softens the pencil
- ◯ b) Light changes direction between water and air
- ◯ c) The water pushes the pencil sideways

5. How do we see most everyday objects, like a book?

- ◯ a) Light bounces off the object into our eyes
- ◯ b) Our eyes send light out to the object
- ◯ c) The object makes its own light

Bonus: A child moves a flashlight closer to a toy. The toy and the wall stay in the same places. What will usually happen to the toy's shadow on the wall? Explain why.

_____

_____

_____

Answer key

Shadow diagram (page 4)

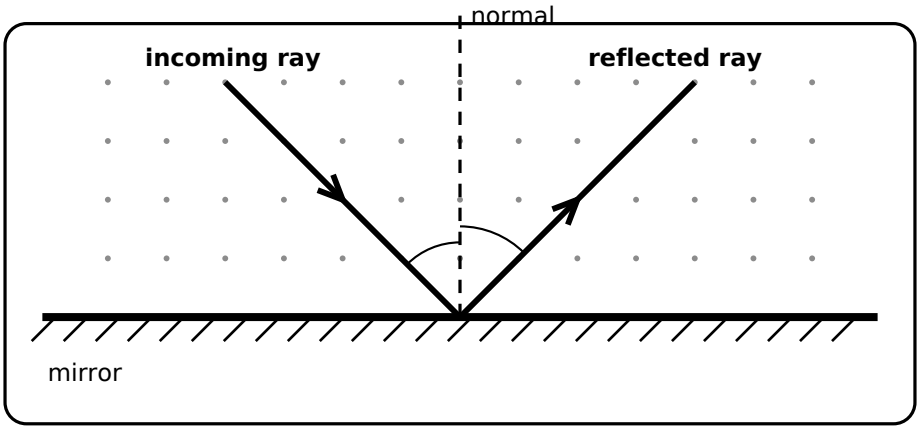
1. Light Source 2. Opaque Object 3. Screen 4. Shadow

Predict the shadow (page 4)

Setup A makes the larger shadow. When the ball is close to a small light, it blocks a wider spread of the light rays, so the dark area on the screen is bigger.

Mirror reflection (page 5)

The reflected ray leaves the same point, on the other side of the normal, going up and to the right: 4 dots across for every 4 dots up. Both rays make the same angle with the normal.



Pencil in water and examples (page 5)

B. Light changes direction when traveling between water and air. The pencil does not really bend or change. a) Seeing your face in a mirror: reflection (circle). b) A pencil appearing bent in water: refraction (underline).

Quiz (page 6)

1. a) An object blocking some of the light
2. b) Clear window glass
3. c) Light bouncing off a surface and changing direction
4. b) Light changes direction between water and air
5. a) Light bounces off the object into our eyes

Bonus: The shadow usually gets larger. Closer to a small light, the toy blocks a wider spread of light, so a bigger area of the wall is left dark. (This assumes the flashlight still lights the whole toy; the edges may also get blurrier.)

Teacher and parent notes

Who it is for

Ages 6–10 (about grades 1–4). Time: 30–75 minutes, depending on the activities selected.

Suggested order

1) Read the five facts. 2) Vocabulary. 3) Label the shadow diagram. 4) Predict shadow sizes. 5) Mirror reflection. 6) Pencil in water. 7) Quiz. 8) Color the cover.

Shadow investigation

You need: a small flashlight, a toy figure or other opaque object, white paper or a wall, a ruler and an adult. 1) Put the flashlight in one fixed spot. 2) Put the paper screen in one fixed spot. 3) Place the toy between them, in the beam. 4) Look at the shadow. 5) Move the toy closer to the flashlight. 6) Look again. 7) Move it farther away. 8) Measure and compare the shadow heights.

Keeping it fair

Same flashlight, same toy, screen and flashlight kept still. Change only where the toy is, keep it in line with the beam and measure the same way each time.

Pencil in water (optional)

Stand a pencil in a clear plastic cup of water and look from the side. It seems to shift where it meets the water, because light changes direction as it passes from water into air. The pencil itself is unchanged.

Safety

Never look directly at the Sun. Never use lasers. Never shine a flashlight into anyone's eyes. Use cool, low-voltage, battery flashlights. Keep water away from electrical equipment and use a plastic cup. Avoid sharp or breakable objects, work away from stairs and have an adult present.

No materials?

Use the printed diagrams on pages 4 and 5 to compare shadow sizes and to find reflected and refracted light. Nothing needs cutting out.

A note on the science

Shadows form where light is blocked. Opaque, translucent and transparent describe how much light passes through and how much is scattered; even clear glass reflects and absorbs a little. Reflection follows the law of reflection. Refraction happens when light crosses into a material where it travels at a different speed. Most objects are seen by light they reflect into our eyes. Large light sources make shadows with soft edges.