

THINKING AND ACTING LIKE A SCIENTIST

TEACHER'S GUIDE

Block That Light

How do different materials affect a beam of light?

GRADE 1

Physical Science





Block That Light

Grade Level/ Content	1/Physical Science
Lesson Summary	In this lesson, students will learn about light by investigating how different materials affect a beam of light.
Estimated Time	2, 45-minute class periods
Materials	flashlight, plastic lid, 15 cm × 15 cm squares of clear plastic wrap, waxed paper, cardboard, and aluminum foil, Investigation Plan , Observation Form , journal
Secondary Resources	Is It Translucent or Opaque? By Susan Hughes Translucent , Transparent , Opaque (video) ADLC - Elementary Science: Translucent, Transparent, Opaque (video)
NGSS Connection	1-PS4-3 Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.
Learning Objectives	<ul style="list-style-type: none">• Students will design and perform an experiment to test how different types of materials affect a beam of light.• Students will provide evidence that different materials affect light differently.• Students will define and understand the terms <i>translucent</i>, <i>transparent</i>, <i>opaque</i>, and <i>reflect</i>.
Cross-Curricular Project Connections	In the Dark, Stained Glass

How do different materials affect a beam of light?

Different types of material affect light in different ways. Materials that are opaque block light completely, whereas materials that are translucent block some of the light. Transparent materials allow almost all light to pass through. Designers choose certain materials for window coverings depending upon the amount of light they want to allow through. Bottle designers also choose materials specific to the bottle's purpose. Some bottles are opaque to keep all light out so it does not affect the substance inside.

In this lesson, students will test different materials to determine how each affect a beam of light. They will also learn to use the terms *translucent*, *transparent*, *opaque*, and *reflect* to describe different materials.

Investigation is based on the Van Andel Education Institute (VAEI) Instructional Model for Inquiry-Based Science.

In all investigations:



Students don't know the "answer" they are supposed to get.



Students play a driving role in determining the process for learning.



Teachers and students construct meaning together by journaling.



Students are working as hard as the teacher.

Part 1

INVESTIGATION SETUP

Cut squares of each type of material for each group. Check flashlights to be sure each is working properly. Assemble a set of materials for each group. Be sure students will be able to conduct the investigation in a room dark enough for them to clearly compare the amount of light that each material transmits.

Students will need:

- Flashlight
- Plastic lid
- Clear plastic wrap (15 cm × 15 cm square)
- Waxed paper (15 cm × 15 cm square)
- Cardboard (15 cm × 15 cm square)
- Aluminum foil (15 cm × 15 cm square)
- [Investigation Plan](#)
- [Observation Form](#)
- Journal

Part 2

INVESTIGATION FACILITATION



Question

Introduce the investigation question.

How do different materials affect a beam of light?

CURIOSITY

Ask students to think about windows they have seen at home or around town. Ask students to describe the windows (*no shade, with blinds, with curtains, etc.*). Discuss how the materials might block light differently. Display the words *transparent, translucent, opaque, and reflect*. Explain to students that, by the end of this lesson, they will understand what these terms mean. Next, introduce the investigation question.



Personal Knowledge

Students capture what they already know about light.

- Find out what students already know about light.
- Ask students to draw two pictures. The first picture should show a room in their home with the lights on, and the second picture should show the same room at night with the lights off. (*Drawings with the lights on should include various objects, such as a bed, books, etc. Drawings in the dark might be portrayed as just black.*)
- Ask students to place their drawings on a t-chart on the board labeled “light” and “dark.”

DISCOURSE

Conduct a *Think, Write, Pair, Share* to ensure all students participate. Ask them what they know about the terms *transparent, translucent, opaque, and reflect*. Give them time to think. Then, have them write down at least three things they know. Have them share their thoughts with a partner, and then call on a few pairs to share their thoughts with the class.

RISK-TAKING

Record all ideas, even misconceptions, to a class list. If something is questionable, place a question mark next to it, and explain that the class should revisit it later. Telling students their personal knowledge is incorrect does not cause them to change it. Instead, confront misconceptions at the appropriate time in the investigation. Often, this will be during data analysis and explanation.



Prediction

Students communicate an expected outcome, based on prior knowledge.

Explain to students that they will shine light through various materials. Ask them to think about what will happen to the light. Have students record their predictions on the [Observation Form](#) before they test the materials.



Investigation Plan

Students conduct trials to determine how different materials affect light.

Introduce the investigation.

- Display the different materials that students will have available to test in their investigation.
- Remind students that this is a group activity and all group members need to be active participants.
- Explain to students that they need to use the materials in a way that will test how different materials affect a beam of light.
- Establish that the flashlight is the light source, and the plastic lid and squares are materials that they will shine light through.
- Form teams of 3 or 4 students. Give each team their set of materials.
- Challenge teams to use these materials to observe how the various materials affect the beam of light. Refer them to the [Investigation Plan](#). Point out that each team will have to decide how to set up the materials and flashlight for the tests.
- Have students complete two trials for each material.

INVESTIGATION PLAN
BLOCK THAT LIGHT

1. Write the name of each material you will test in your **Observation Form**.
2. Predict what will happen when you shine a light through each material. Write your predictions on the form.
3. Decide with your team how you will test the materials. Answer these questions:
 - Where will you place the flashlight?
 - Where will you place each material?
 - How will you hold the material so that light shines on it?
 - How far will the material be from the flashlight?
 - How will you decide how the material affects the light?
4. Make sure the room lights are dim before you start the tests.
5. Test each material two times. Record your observations.

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Investigation Plan

CRITICAL THINKING

Use the [Fair Test](#) checklist to help students think critically about the investigation plan. Help them understand that a good investigation plan must include a test that is repeatable, generates quality data, and minimizes error. The more critically students think about their investigation plan, the more confident they can be in their results.

COLLABORATION

Encourage students to continue with the test of each material until each member of the team has an opportunity to decide how the material affects light. Suggest that they take turns holding the flashlight and the materials during their tests.



Observation

Students record their observations about the amount of light that each material allows through.

- Have students use the **Observation Form** to record the outcome for each of the different materials. This form can be cut out and placed in their science journal.
- Students should observe that the cardboard is opaque, the plastic lid and waxed paper are translucent, the clear plastic wrap is transparent, and the aluminum foil is opaque and highly reflective.

OBSERVATION FORM
BLOCK THAT LIGHT

NAME: _____
DATE: _____

Write the name of each material you will test. Then, predict what will happen when you shine light through each material.

After you test each material, describe its effect on the light for each trial.

Material	Prediction	Trial 1	Trial 2

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Observation Form



Data Analysis

Students make sense of their data by organizing it and representing it visually.

Have students analyze the data they recorded on the **Observation Form**. They may wish to use the [Data Analysis](#) prompt as a guide.

- Have students **evaluate** their data for trustworthiness by comparing the two trials for each material. If they obtained different results, suggest that students consider their procedures and then repeat the test.
- Then, have them **analyze** their data to find patterns and trends. Students can organize their data based on how much light each material let through.
- They may also want to **represent** their data visually (drawing, chart, etc.).
- Then, have them **interpret** their data to identify the effect of different materials on light.
 - Review with students the meanings of the terms *transparent*, *translucent*, *opaque*, and *reflect*. Ask them to identify each material they tested as *transparent*, *translucent*, or *opaque*. Then have them determine which material reflected the most light.

COLLABORATION

Have students join with another team to compare and combine observations. Have students answer the following questions: *What results were the same? What results were different? How were our investigation plans alike and different?*



Secondary Knowledge

Students use secondary sources to understand how different materials affect a beam of light.

- Use these resources (or your own) to help develop students' understanding of how different materials affect beams of light.
 - [Is It Translucent or Opaque?](#) By Susan Hughes
 - [Translucent, Transparent, Opaque](#) (video)
 - [ADLC - Elementary Science: Translucent, Transparent, Opaque](#) (video)
- After reviewing the videos of other students working with different materials, students should understand that opaque materials, such as cardboard, block all light; translucent materials, such as waxed paper, block some light; and transparent materials, such as clear plastic wrap, allow almost all light to pass through.

PERSEVERANCE AND CURIOSITY

Use secondary knowledge during and after the investigation as appropriate. If students had success using their materials to discover how they each affect light, then use these resources after the investigation to satisfy their curiosity about other materials. If students struggled with designing a way to use the materials to observe the effect of light, use this knowledge to encourage persistence as students observe other students using a backdrop to project the light on.



Explanation

Students write a claim and provide evidence and reasoning to support it.

- Have students use what they've discovered from their analyzed data to write an explanation that answers their investigation question. Students may wish to use the [Explanation](#) prompt as a guide. Have them write their explanation in their Lab Journal.
- Have students develop a **Claim** to answer the question: How do different materials affect a beam of light?
- Then, have them add **Evidence** (the analyzed data) to support their claim.
- Finally, have them add **Reasoning** to their claim. Reasoning should include the information obtained from this investigation as well as science principles they have learned.

Claim

When we shine a beam of light on different materials, some let all light through. Some let a little light through. Some block all the light. Some materials reflect light, and others do not.

Evidence

The effect on the beam of light was different with each material. The cardboard blocked all the light. The clear plastic wrap allowed the light to pass through it. The aluminum foil directed the light somewhere else. The plastic lid and the waxed paper dimmed the light.

Reasoning

Investigation: We did two trials of each material. We found in our investigation that different materials have different effects on light. They can have no effect, a dimming effect, a reflective effect, or completely block the light.

Science: We learned from readings and class discussion that opaque materials block out light. Translucent materials allow some light to pass through. Transparent materials allow almost all light to pass through. Mirrors and shiny materials, such as aluminum foil, reflect light.

- Once the explanation is written, have students discuss their results using a [Present and Defend](#).

DISCOURSE

Have students conduct a [Present and Defend](#) to develop presentation skills as well as audience participation. Research teams present a summary of their investigation to the class. The class analyzes the information presented and asks clarifying questions, challenges and/or supports the arguments made, and even presents alternative explanations as appropriate. Research teams defend their explanation with evidence and reasoning. If students are doing the same investigation plan, choose 1 or 2 groups to share.



Evaluation

Students reflect on the investigation.

- Ask students how confident they are in their results.
- Ask students what question they would like to explore about light next.

Part 4

INVESTIGATION ASSESSMENT AND EXTENSION



Application

Students demonstrate understanding of how different materials affect light by applying their learning in multiple contexts.

- Have students apply their learning by looking around the classroom and identifying other materials that are opaque, translucent, transparent, and reflective.
- Have students describe ways that certain objects they use in everyday life are useful because they are either opaque, translucent, transparent, or reflective.

Assessment

- Students provide an explanation (**claim, evidence, and reasoning**) that clarifies the effect of different materials on a beam of light.
- Students design and perform an experiment to test how different types of materials affect a beam of light.
- Students provide evidence that the cardboard is opaque, the plastic lid and waxed paper are translucent, the clear plastic wrap is transparent, and the aluminum foil is opaque and highly reflective.
- Students define and properly apply the terms *translucent*, *transparent*, *opaque*, and *reflect*.

Take This Lesson Across the Curriculum

Illumination

Students show an understanding of how objects need light to be illuminated.

Reading/Language Arts	Math	Science	Social Studies
<p>In the Dark</p> <p>Read <i>We're Going on a Bear Hunt</i> by Helen Oxenbury and Michael Rosen and discuss how light illuminates objects in the cave.</p> <p>ELA-LITERACY.R.L.1</p>	<p>Where Did They Go?</p> <p>Students put the places the kids went in the book in sequential and numerical order.</p> <p>CCSS.MATH.CONTENT.1.NBT.B.2</p>	<p>Cave Discovery</p> <p>Students use their knowledge of light to create illustrations of a cave with and without a beam of light.</p> <p>NGSS: 1-PS4-2</p>	<p>Find That Cave</p> <p>Students will brainstorm a list of areas where they might find a cave. They can then make a map showing the locations.</p> <p>NCSS: D2.Geo.2.K-2</p>

Stained Glass

Students will create their own stained glass window.

Reading/Language Arts	Math	Science	Social Studies
<p>Window Description</p> <p>Students write a short description that explains their stained glass window design.</p> <p>CCSS.ELA-LITERACY.W.1.2</p>	<p>Name That Shape</p> <p>Students identify the types of two-dimensional shapes in their design.</p> <p>CCSS.MATH.CONTENT.1.G.A.2</p>	<p>Stained Glass Design</p> <p>Students use their knowledge of how materials affect light to design a stained glass window out of colored tissue paper.</p> <p>NGSS: 1-PS4-3</p>	<p>How Much Is That Window?</p> <p>Students make an advertisement for their stained glass window.</p> <p>NCSS: D2.Eco.4.K-2</p>

For additional lessons or to customize this lesson, go to www.nexgeninquiry.org.



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