



LESSON PLAN

WAVE REFLECTION, ABSORPTION, AND TRANSMITTANCE • GRADES 6-8

SUMMARY

Students observe light phenomena and draw models of what they think is happening.



MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials

Science & Engineering Practices		Connections to Classroom Activity	
Developing and Using Models Using Mathematics and Computational Thinking		<ul style="list-style-type: none"> Students observe light phenomena and develop individual and group consensus models to explain what is happening. 	
Disciplinary Core Ideas		Connections to Classroom Activity	
PS4.A: Wave Properties A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1) A sound wave needs a medium through which it is transmitted. (MS-PS4-2)		<ul style="list-style-type: none"> Students individually, and in groups, build consensus models that explain how waves transfer energy from one object to another and how material properties determine whether light will reflect, absorb, or transmit through an object. 	



PS4.B: Electromagnetic Radiation

When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2)

The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS-PS4-2)

A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2)

- Students also explain how light bends when moving through different mediums (like air and water, for example).

Cross Cutting Concepts

Patterns
Structure and Function

Connections to Classroom Activity

- Students observe phenomena and identify patterns in what they observe, building individual and group consensus models based on those patterns.

DURATION

45 min.



ENGAGE

Phenomenon 1

Students will observe a pencil submerged in water and then record what they notice and wonder when they place the pencil in the cup of water.

Have students place the pencil in a cup of water. Tell them to look through the cup at eye level and move the pencil from left to right as well as front to back in the cup. Have students write down what they notice and also what they wonder as they observe the pencil in the water. Tell students to use any “science words,” or vocabulary, they remember from previous grades when studying waves.

Students should observe the pencil “breaking” because of refraction. Refraction is a new concept that is not covered in a previous grade level but will be introduced in the Generation Genius video.

Phenomenon 2

Students will place a piece of black paper and white paper near a heat lamp. The two pieces of paper need to be the same distance away from the lamp. Have students follow the instructions below:

MATERIALS

- Pencil
- 2 clear plastic cups filled with water (per 3–4 students)
- Heat lamp (set up by the teacher)
- White paper (one per group; will need new paper each time)
- Black paper (one per group; will need new paper each time)
- Thermometers (2 per group)



1. Place the thermometers on the paper, one on each color.
2. Document the temperature before you put the papers under the lamp.
3. Set a timer for 1 minute.
4. Turn on the heat lamp.
5. Students will take readings each minute for 3 minutes.
6. Repeat steps 1–5 two more times using new sheets of paper and new thermometers.
7. Turn off the heat lamp after recording the third trial.

A new piece of paper and new thermometers will need to be used for each trial to get accurate data because the thermometers and paper stay heated up for a time after they have been used).

The students should notice that the temperature increases more on the thermometer placed on the black paper because of absorption.



EXPLORE

Tell students they are going to model what happened to the objects and light when they put the pencils in the water and also when they took their temperature measurements. Ask students to individually summarize and explain what they observed and also what was happening with the light. This allows students to individually think about and reflect on what they have experienced. Encourage them to use “science words,” or vocabulary they are familiar with from previous grades. Ask students to think of a situation where they have, or would, observe the same phenomena.

After students have documented their individual ideas, let them share their ideas with other students to build a group consensus model. A group consensus model is the combination of all student ideas in the group; the model focuses on the things all students in the group agree on. Give students time to discuss the parts of their model and how they will show the interaction between the components of the model. Remind students to work together as a team to build their model.

After students have assembled their group consensus models, have them share with the class. Ask students probing questions such as the following: *How do you think light travels in your investigation? Can we figure out which way the light is traveling? What do you think happens when the light hits a solid or liquid? What evidence makes you think that?*



EXPLAIN



WATCH THE GENERATION GENIUS WAVE REFLECTION, ABSORPTION, AND TRANSMITTANCE VIDEO AS A GROUP



ELABORATE

Ask students to make connections between light and sound. Tell them to think about similarities and differences they notice between light and sound. Have students go back to their groups and revise their group consensus models after watching the Generation Genius video. Encourage students to include what they learned about sound and how it is both similar to and different from light. Tell students to use vocabulary they learned from the video, including but not limited to *absorption*, *reflection*, and *transmittance*. Encourage students to apply what they learned from the video about the properties of waves and how different properties will affect things like volume (sound) and color (light).



EVALUATE

There are multiple ways to assess your students' understanding of this topic. The exit ticket is an opportunity for students to use the science ideas they built in the lesson in a new context. Alternatively, you can use the Kahoot! quiz (which provides downloadable scores at the end of the game) and/or the paper quiz. All these resources are located right below the video in the assessment section.



EXTENSION

Have students use a magnifying glass and make observations of small objects or fine print in a book or newspaper. Have students model and explain how the light is refracting to produce a magnified image compared to what they observe with the naked eye. Encourage students to think about the properties of light they have learned about and how it would produce a visibly larger image by looking through a magnifying glass.

