

See The Light

Purpose

- To introduce students to properties of light
- To demonstrate that white light is made up of seven colors that represent different wavelengths.
- To illustrate why the sky is blue during the day and red at sunset.

Overview

Students will use prisms and glue sticks to explore the properties of light. The activities demonstrate how white light is made up of a series of colors across the visible spectrum, and how these colors can be scattered. Students will observe how light exiting different mediums, such as prisms and glue sticks, changes the color of the light they see. Students will compare their observations in the classroom with their knowledge of sky color and rainbows in the natural environment.

Student Outcomes

Students will learn how light can be affected when it passes through a medium, and will directly observe that white light is made up of many colors across the visible spectrum. Students will learn that blue wavelengths are the shortest of the visible spectrum and red are longest. They will be able to construct an explanation of how rainbows form and why the sky color appears blue during the day and red or orange at sunset.

Estimated Time

- One 45 minute class period

Level

Primary (most appropriate for grades K-5)

Materials

Part 1:

- Optional Video: *Our World: Sunsets and Atmospheres* can be viewed online: <http://science.larc.nasa.gov/skycolor/video/>

Part 2:

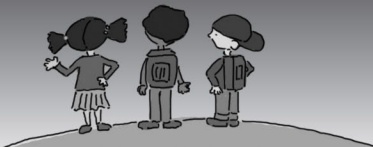
Per Group

- *See The Light Student Activity Sheet 1*
- 1 Prism
- Colored Pencils

Part 3:

Per Group

- *See The Light Student Activity Sheet 2*
- 1 Hot Glue Stick
- 1 Penlight
- White Paper
- Colored Pencils



Preparation

- Gather materials for the prism and glue stick activities. You'll need enough materials so that students can work together in small groups.
- *Optional:* Access the short video online and have it loaded on a shared screen, so the class can watch it together. The video is just under five minutes long. The first two minutes describes how light is made up of seven colors of different wavelengths.

Teacher's Notes

The light from the Sun is made up of all of the colors of the rainbow: red, orange, yellow, green, blue, indigo, and violet (the popular mnemonic "ROY G BIV"). When viewed together the color that we see is white, but when viewed through a prism the colors are separated out into the different colors of the visible spectrum. The prism slows down light and causes it to change directions, or bend. This property is called refraction. When white sunlight enters a prism, the various colors slow down to different speeds and are bent at different angles. This process spreads out white light into a rainbow.

A rainbow occurs in the sky as light passes through rain droplets, mist or water particles in the sky after a storm. The light is scattered through the water droplet in the same way it is separated when viewed through a prism.

Light will travel in a straight line unless something gets in its way to: reflect it (like a mirror), bend it (like a prism), or scatter it (like molecules of the gases in the atmosphere). Sunlight reaches Earth's atmosphere and is scattered in all directions by all the gases and particles in the air. Blue light is scattered in all directions by the tiny molecules of air in Earth's atmosphere. Blue is scattered more than other colors because it travels as shorter, smaller waves. This is why we see a blue sky most of the time. (Just as blue light is most readily scattered from white light in the glue sticks.) As the Sun gets lower in the sky, its light

is passing through more of the atmosphere to reach you. Even more of the blue light is scattered, allowing the reds and yellows to pass straight through to your eyes. Just as the light traveling along the glue stick gets more red as the length of the glue stick path got longer, so the sunset is red when the atmospheric path through which the sunlight travels gets longer. Particles (aerosols) in our atmosphere can scatter certain wavelengths of light causing the sky color to look different.

Safety Considerations

- Make sure to warn students against shining the penlight in anyone's eyes.

What To Do and How To Do It

Part 1: Discuss Light

1. Ask students to describe the color of light.
2. Ask students how many light sources they can think of (for example: sun, star, flashlight, fireflies, light bulb)?
3. *Optional:* Show students the short video, *Our World: Sunsets and Atmospheres*.
4. Tell students that during this activity they are going to explore properties of light.

Part 2: Bending Light with Prisms

1. Before you pass out materials for the activity warn students about the danger of shining the penlight into their eyes or someone else's eyes.
2. Place the students in groups based on the number of materials you have. Tell students that they are going to use the prisms to bend light.
3. Give students at least five minutes to engage with the prisms and penlight.
4. Instruct the students to draw what they see, particularly the layers of color.



5. Have a class discussion about the following ideas:

- What happened to light as it passed through a prism?
- What colors did you see? In what order did they colors occur?
- Did everyone have the same order of colors?
- How did your observation resemble a rainbow like the ones that we see in the sky?
- Based on what you learned through this activity, describe how a rainbow is made.
- What colors were you surprised to see?

Part 3: Atmosphere as a Glue Stick

1. Pass out materials for the glue stick activity.
2. Have each group tape a sheet of white paper to the wall in the classroom.
3. Instruct the groups to point one end of the glue stick toward the white paper about 1 cm away, then shine the penlight through the opposite end of the glue stick.
4. Instruct the students to observe the colors at each end of the glue stick, and have each student draw what they see.
5. Have a class discussion about the following ideas:
 - What colors did you see at each end of the glue stick?
 - Which color in the visible spectrum (ROY G BIV) is the shortest wavelength?
 - Which is the longest?
 - How does the glue stick represent the atmosphere?
 - Based on what you learned about different wavelengths of light, describe why the sky often looks blue during the day and red or orange at sunset?

Adaptations for Younger and Older Students

Depending on the age of the students these activities could also be done as a teacher demonstration. Older students can be asked to label the colors identifying the smallest and largest wavelengths.

Further Investigations

- **Electromagnetic Spectrum:** Visible light is a relatively small section of the electromagnetic spectrum. Have the students conduct research about the electromagnetic spectrum. Additional NASA resources include: *Why Wavelength Goes with a Color* http://science-edu.larc.nasa.gov/EDDOCS/Wavelengths_for_Colors.html and *Tour of Electromagnetic Spectrum* <http://missionscience.nasa.gov/ems/>.
- **Our World from Space:** In the video *Our World: Sunsets and Atmospheres*, students learned about an instrument onboard the International Space Station that measures ozone and aerosols. NASA's SAGE instruments have been collecting data on our planet since the 1970's. Have students learn more about the instrument online at: <http://sage.nasa.gov/>. Ask students why long term data records are important to understanding our atmosphere?

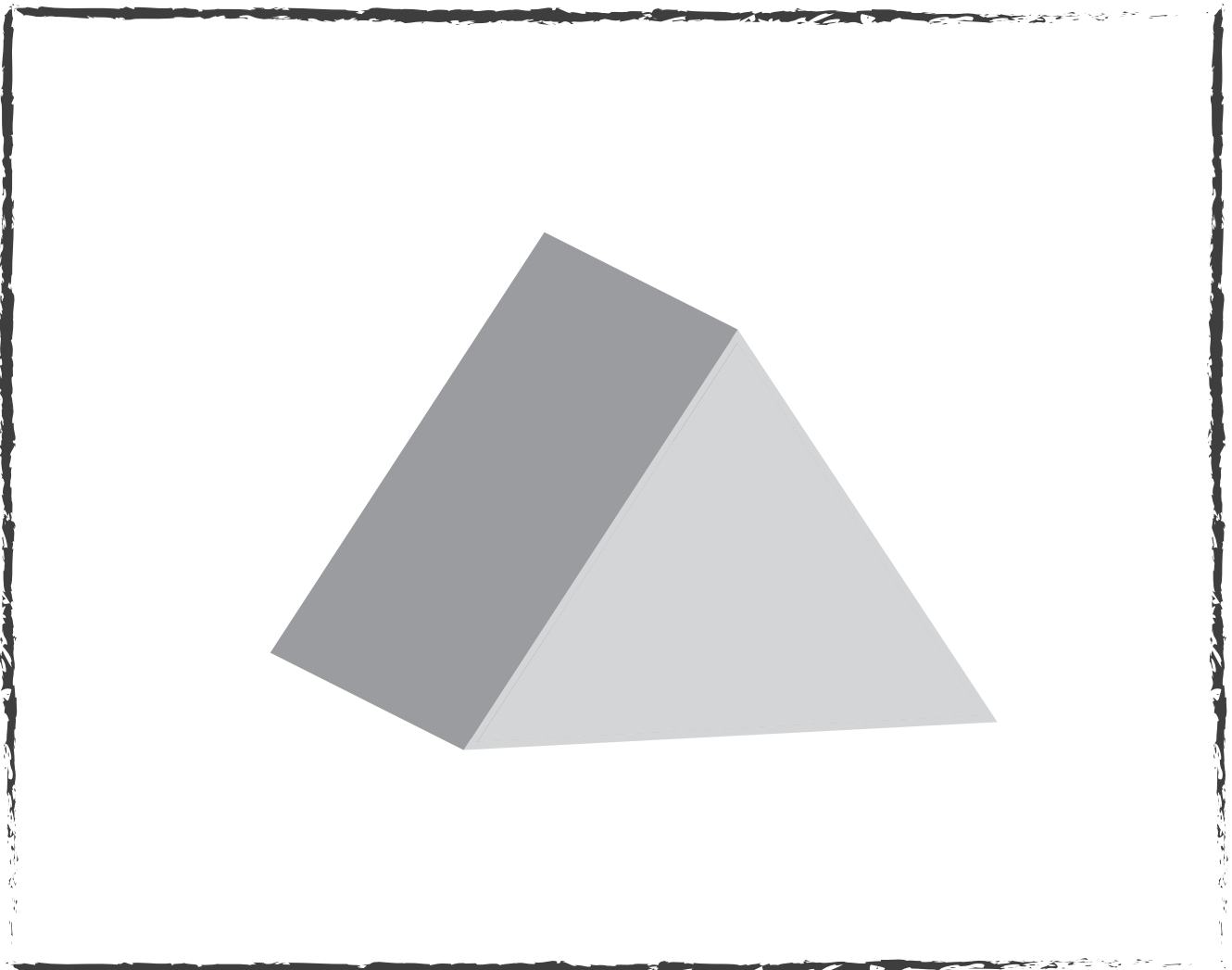


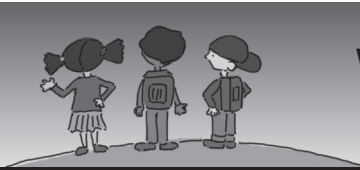
See the Light Student Activity Sheet 1

Name: _____

When I shine a penlight through a prism I see:

Draw what you see through the prism:





See The Light Student Activity Sheet 2

Name: _____

When I shine a penlight through a glue stick I see:

Draw what you see through the glue stick:

