

Strand: <b>8.2</b>	Standard: <b>8.2.4</b>	Episode 5	<b>Big Idea:</b> The amplitude of a wave is related to the energy of the wave.
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<b>Title:</b> Can You See Me Now?	<b>Time:</b> 45-60 min	CCCs: <u>Developing and using models</u> <u>Planning and carrying out investigations</u>	Practices: <b>Cause and Effect</b> <b>Mathematical and computational thinking</b>
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**Episode Snapshot:** In this episode students will observe that visible light can be split into different colors. They will use a video and a computer simulation **model** to discover that the types of energy that are part of the electromagnetic spectrum, including visible light, are different only because of their wavelengths. The students will use **computational thinking** to plan and conduct an experiment to discover how changing the amplitude of a light wave **causes** us to see it differently.

### **Gather**

Ask the students to write down their predictions for the following questions on their [student sheet](#): How does changing the amplitude or wavelength of a light wave change the way our eyes see it?

Provide each student with a pair of diffraction glasses. These can be obtained for about \$0.50 each on amazon. Try to find light sources of various colors, including a white light. Let the students look at the different colored lights through the glasses first and finally at the white light. They will record their observations on the student sheet. Briefly discuss their predictions.

Write the following words on the board: X-Ray, Microwave, Visible Light, Radio Waves, Infrared, Gamma Rays, Ultra-violet. Ask the students what all those things have in common. Discuss with the students what they know about these types of radiation. What is it that makes them all different? What is it that makes them similar? They will explore the answers to these questions through the following activities.

Give the students [this link](#) to a simulation about the electromagnetic spectrum. They will use this simulation to discover what the electromagnetic spectrum is and that the types of radiation that are part of the spectrum are all light energy; the difference between them is their wavelengths.

Show the students the first three minutes of this [video clip](#) about the electromagnetic spectrum. Briefly discuss how wavelength is involved in the electromagnetic spectrum. What makes one color of light different than another?

If changing the wavelength of light energy changes the color of light that we see, what happens if we change the amplitude of the light?

To explore what you see as the amplitude of a light wave changes, students will collect data using a monitor and light probe. In this experiment they will discover that as you get farther from a light source, intensity or energy of the light wave decreases. Since the color of the light did not change, what else about the wave could change to account for the energy loss?

**Teacher Note:** If Vernier monitors are too costly for your school, a stand-alone, inexpensive light probe such as [this one](#) will work for this experiment. You may also consider using a light probe app for phones.

Set up groups according to the numbers of monitors and probes available. Turn the lights off and collect the data!

### **Reason**

As a lab group, use **computational thinking** to graph the data. Analyze the resulting graph looking for patterns. Complete the analysis section of the lab and prepare to share your group's conclusions.

Class Discussion: Invite each lab group to share one of their findings from the lab. Students should focus on presenting evidence collected from the lab.

Give each lab group 3-4 minutes to come up with a valid explanation for the phenomenon of the diffraction glasses and write it on a group whiteboard, researching it if necessary. Let 2-3 groups share information. Clear up misconceptions. Then have each student summarize the information in their Science Journal.

Students will complete the light portion of the [Wave Energy foldable](#) demonstrating their understanding of a wave's wavelength relationship to color, and amplitude to the perceived brightness of a light. They will glue the foldable into their journal.

### **Communicate**

The students will complete this [exit ticket](#) to demonstrate their understanding of waves and energy.

The students will now return to the Nakalele Blowhole phenomenon. Give them a few minutes to summarize what they have learned on the [phenomenon final explanation](#) sheet, and explain how it relates to the phenomenon. Discuss it as a class. Blowholes like this one happen when there is an on-shore opening to a cave that also connects to the ocean. When the surf is heavy enough (wind energy has made waves with amplitudes of high enough energy), water will be forced out of the hole as the surf enters the cave below. The higher the amplitude of the waves, the more energy the water has and the higher it will shoot into the air.

**Assessment:** Student will complete an exit ticket to demonstrate their understanding of waves and energy.

Students will also explain the phenomenon of the Nakalele Blowhole based on what they have learned in this standard.

#### **Materials, resources, handouts, etc:**

- Spectrum diffraction glasses for each student
- Light Waves [Student Sheet](#)
- Computers
- [Electromagnetic Spectrum Simulation](#)
- Light probe (reads light intensity) and monitor (Vernier monitors); one per group
- Light source (inside a paper box) per group
- meter sticks - 2 per group
- masking tape
- [Wave Energy Foldable](#)
- [Waves and Energy Exit Ticket](#)
- [Waves and Energy Phenomenon Final Explanation Sheet](#)