

## Activity 10: Comparing Colors

**Guiding Question:** How are the colors of the visible light spectrum similar to and different from each other?

**Key Words:** *evidence, frequency, trade-off, visible light spectrum, wavelength*

### **Get Started:**

1. Have you ever seen a rainbow? What causes the colors of the rainbow?

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In order for a rainbow to appear, there must be water droplets in the air and sunlight to pass through the droplets. This phenomenon is called refraction.

2. Read the introduction and Guiding Question to Activity 10, “Comparing Colors,” in your Student Book.

### **Do the Activity:**

1. Read procedure Part A: The Visible Light Spectrum. Your classmates performed this experiment.
2. Watch the LABsent video (found here: <http://tinyurl.com/Waves10A>), and record your data. Each time the video says to record, you may want to pause the video to give you ample time to complete your observations. In the video you will observe a diffraction grating being held up in a beam of white light. The film with grating on it can make a rainbow by splitting up the white light that passes through it. Diffraction is a result of white light being spread out when it is transmitted through very fine slits.

### **Data:**

*Procedure step 2: List the colors that you see in the video in the order that they appear.*

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Note: The order of the visible light spectrum always shows in the same order regardless of how it is diffracted or refracted.

Name \_\_\_\_\_

Date \_\_\_\_\_

*Procedure step 3: Describe whether the colors blend from one to the next or have distinct boundaries between them.*

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*Procedure step 4: Which color of light seems to be*

- a. the brightest?*
- b. the least bright?*

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3. Notice that the rainbow is not formed in front of the grating, but is instead angled toward the side of it. What does this tell you about the light that goes through the grating?

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4. Read procedure Part B: Colored Light in your Student Book. Your classmates performed this experiment.

5. Do you think microwaves are harmful to humans? Do you think x-rays are harmful to humans?

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6. Watch the second LABsent video (found here: <http://tinyurl.com/Waves10B>). You may need to pause the video to record the required data. Record the data in the spaces provided. Note: Each colored film on the colored-film card isolates a single color of light.. The films do not add any color to white light.

Name \_\_\_\_\_

Date \_\_\_\_\_

*Procedure step 5: Sketch and record what you observe.*

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*Procedure step 8: Record your observations.*

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*Procedure step 10: Describe or sketch what you see. Rank the colors from brightest to least bright.*

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Name \_\_\_\_\_

Date \_\_\_\_\_

*Procedure step 11: Describe or sketch what you predict you will observe if you repeat Steps 6-8 using the colored-film card instead of the card with the star-shaped cutout.*

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*Procedure step 13: Rank each color and cutout shape according to how brightly it caused the strip on the bottom of the Phospho-box to glow.*

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*Procedure step 14: Describe or sketch what you predict you will observe if you repeat Steps 6-8 with the colored-film card, but this time let the sunlight hit the bottom of the box for 40 seconds.*

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*Procedure step 15: Record your results.*

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Name \_\_\_\_\_

Date \_\_\_\_\_

7. Why don't all of the colors make the strip glow?

**Analysis:**

1. What is the purpose of the card with the star-shaped cutout?

2. How do you think the colored-film card changes the white light into colored light? Describe how you might test your ideas to see if they are correct.

3. Why do you think only some colors make the strip on the bottom of the Phospho-box glow? Explain.

Name \_\_\_\_\_

Date \_\_\_\_\_

*Evidence* is information that supports a claim. *Opinion* is the view someone takes about a certain issue based on their own judgment, often without the support of factual evidence.

4. Is there enough evidence - information that supports or refutes a claim - that supports the idea that the higher-energy colors of white light are damaging Tia Ana's eyes? Explain your answer.

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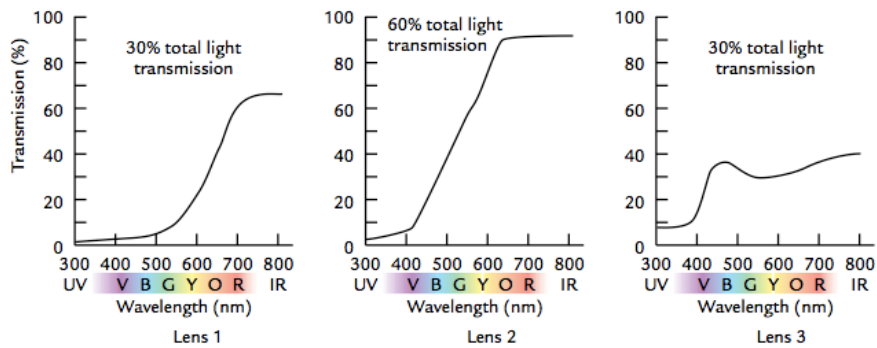
5. Which characteristic of a light wave explored in this activity affects the amount of energy that it carries?

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6. Sunglass lenses are an example of a material that blocks some white light and some other short-wavelength light that is harmful to the eyes. Examine the transmission graphs about three pairs of sunglasses below.



a. Which lens has the best protection for the eyes against high-energy waves? Explain how you decided.

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Name \_\_\_\_\_

Date \_\_\_\_\_

b. The price for each pair of sunglasses is shown below. Which pair would you buy? Why? Describe any trade-offs you made in your choice. A trade-off is an outcome given up to gain another outcome.

Lens 1: \$80

Lens 2: \$10

Lens 3: \$20

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**Build Understanding:**

1. Which color light is more likely to damage eyes due to its higher energy?

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2. What are other examples of the crosscutting concept of structure and function involving selective transmission?

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3. Brainstorm a list of decisions that you make everyday that involves trade-offs.

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