Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Student Exploration: Color Absorption**

**Vocabulary:** absorb, primary colors, reflect, transmit, transparent

**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)

A set of **primary colors** can be mixed to form all other colors. The three primary colors of pigment are cyan (light blue), magenta (neon pink), and yellow. If possible, get three crayons – light blue, pink, and yellow.

1. What color do you get when you mix cyan (light blue) and yellow? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What color do you get when you mix cyan and magenta (pink)? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. As you add more colors, does the resulting color get lighter or darker? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Gizmo Warm-up: Mixing Light**

In the *Color Absorption* Gizmo, you can mix different colors of light instead of pigments (like paints or crayons).

1. Observe the three primary colors of light. What are they?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. You can click on the lights to turn them on or off. What colors are formed by the following light combinations?

Red and green light: \_\_\_\_\_\_\_\_\_\_\_\_\_ Red and blue light: \_\_\_\_\_\_\_\_\_\_\_\_\_

Green and blue light: \_\_\_\_\_\_\_\_\_\_\_\_\_ Red, green, *and* blue light: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. As you add more colors of light, does the resulting color get lighter or darker? \_\_\_\_\_\_\_\_\_\_\_
2. How is mixing the primary colors of light related to mixing the primary colors of pigment?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| **Activity A:** **Absorption and Transmission** | Get the Gizmo ready: * Check that all three lights (red, green, and blue) are turned on.
 | 652SE2 |

**Introduction:** If light is blocked by an object, it is either **reflected** or **absorbed**. If light passes through an object, it is **transmitted**. Objects that transmit light without blurring are **transparent**.

**Question: How does colored glass transmit and absorb light?**

1. Observe: Drag each shade of colored glass into the light box, one at a time. What do you notice? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Predict: What color of light will be transmitted by the **Dark red, thick** glass? \_\_\_\_\_\_\_\_\_\_\_\_\_
2. Experiment: For each glass color, turn on the red, green, and blue lights separately. Record the color that results from each combination of glass and light.

|  |  |  |  |
| --- | --- | --- | --- |
| **Glass** | **Red light only** | **Green light only** | **Blue light only** |
| Dark red, thick |  |  |  |
| Dark green, thick |  |  |  |
| Dark blue, thick |  |  |  |

1. Analyze: If a color of light passed through a piece of glass, it was transmitted. If most of the light was blocked by the glass, it was absorbed. Fill in the blanks below.
	* 1. Red glass transmits \_\_\_\_\_\_\_\_\_ light and absorbs \_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_ light.
		2. Green glass transmits \_\_\_\_\_\_\_\_\_ light and absorbs \_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_ light.
		3. Blue glass transmits \_\_\_\_\_\_\_\_\_ light and absorbs \_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_ light.
2. Draw conclusions: How can you predict what colors will be transmitted and absorbed by certain color of glass? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| **Activity B:** **Making colors** | Get the Gizmo ready: * Turn on all three lights.
* Remove all the glass from the light box.
 | 652SE3 |

**Question: How can you filter light to create different colors?**

1. Observe: Experiment with different combinations of lights and pieces of glass. See what colors you can create!
2. Challenge: Try to create the following colors using the Gizmo. Use the **R G B** graph to see that each color matches the goal. (Hint: You don’t have to start with all three lights on.)

When you solve one of the challenge colors, click the camera icon to take a snapshot, and then paste the image into a blank word-processing document. Record your solutions below.

|  |  |
| --- | --- |
| **Challenge** | **Solution** |
| **Color** | **R** | **G** | **B** | **Lights used** | **Glass used** |
| Orange | 100 | 50 | 0 |  |  |
| Deep purple | 70 | 0 | 70 |  |  |
| Dark gray | 25 | 25 | 25 |  |  |
| Brown | 50 | 25 | 0 |  |  |
| Sea foam | 0 | 50 | 50 |  |  |

1. Analyze: Is there more than one way to make a particular color? Try to find at least two ways to make “sea foam.” If possible, see if your classmates found a solution that you did not.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Extend your thinking: Use the Gizmo to create your favorite color. Take a snapshot of your color and paste it into your document. Describe your color and how you made it.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| **Activity C:** **Color analysis** | Get the Gizmo ready: * Turn on all three lights.
* Remove all of the glass from the light box.
 | 652SE4 |

**Question: How much light is absorbed by different types of glass?**

1. Observe: Compare the effects of thick vs. thin glass, and dark vs. light glass.
2. Form hypothesis: How do the thickness and darkness of glass affect the amount of light that is transmitted? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Experiment: The bar graph shows the amount of red, green, and blue light measured by the probe. Use the graph to help you answer the following questions. Be sure all lights are on.
	* 1. How many pieces of thin, light glass have the same effect as one thick, light glass?

\_\_\_\_\_\_\_\_\_ Explain: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + 1. How many pieces of thin, light glass have the same effect as one thin, dark glass?

\_\_\_\_\_\_\_\_\_ Explain: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + 1. How many pieces of thin, light glass will have the same effect as one thick, dark glass? (Hint: More than are available in the Gizmo!)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Extend your thinking: Water is just a little bit blue in color. Why does a glass of water appear to have no color at all, but the ocean is a deep blue color?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_