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deSTEMber

SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

Shadow Colors

What color is your shadow? Did you know not all shadows are black?! Explore the additive properties of light and observe how colorful shadows can be.

TEKS:

SCI 3.6 A: The student is expected to explore different forms of energy, including mechanical, light, sound, and thermal in everyday life.
SCI 5.6 A: The student is expected to explore the uses of energy, including mechanical, light, thermal, electrical, and sound energy.

Materials:

- Blue light bulb
- Green light bulb
- 3 light sockets with cords
- Pencil
- Power strip
- Red light bulb
- White poster board for background

How To:

1. Plug the red, blue, and green lights into the power strip so they shine simultaneously, and their light is directed onto the poster board. Turn off all other lights in the room so that it is as dark as possible.
2. Line up your light bulbs so that the green bulb is between the red and blue bulbs and all bulbs are approximately the same distance from the poster board. The combination of the red, blue, and green light should appear white on the poster board.
3. Hold your pencil fairly close to the poster board. Adjust the distance until you are able to see three distinct colored shadows on the poster board.
4. Remove the pencil, turn off the green light, and notice how the color of the light on the poster board changes. With only the red and blue light shining, the light should appear magenta.
5. Put the pencil in front of the poster board again and notice the red and blue shadows.

6. Move the pencil closer to the poster board until the shadows overlap and notice that the combined shadows are black.
7. Repeat steps 4-6, alternating which bulb is turned off while the other two remain on. When you turn off the blue light, the light will appear yellow while your shadows are red and green. When you turn off the red light, the light will appear cyan and your shadows will be blue and green.
8. Repeat again with only one color turned on at a time, and then with all three on. Take note of any differences.
9. For additional exploration, try the same process with different sized objects, and change the distance from the poster board.

STEM Explanation:

The three primary colors of light are red, green, and blue. When all three are combined, they cancel each other out to make white light. When you place an object in front of the poster board, it covers up the light directed from that angle. The shadow produced would then be the product of the remaining lights shining on the poster board. For example, if you had only the red and blue lights shining on the poster board, you would have two shadows: a red shadow and a blue shadow. The red shadow would come from the blue light being blocked and the blue shadow would come from the red light being blocked. When all three lights are turned on, you would see three different colored shadows: yellow, magenta, and cyan. These three shadows are each the products of two different colors combined—whichever two colored lights are not being blocked by the object.

Career Connection:

Electrical lighting technicians are involved with designing stage and location sets and controlling artificial and electric lights for art and entertainment venues (theatre or live music venues) and video, television, or film production.

Resource:

https://www.exploratorium.edu/snacks/colored-shadows

