

Light and Color

Overview

Two simple activities introduce the fundamentals of light and color to grade school students. See how white light is composed of many colors, and how several colors combine to make white light.

Materials

(for each group of 3-5)

- White LED Light
- 3 Light Blox with slit caps
- 10 diffraction gratings
- Room lights
- Sun light
- White paper
- Crayons or markers



Time: 30-45 minutes
Grades: K-6

Setting Up

1. Divide students into 5 groups and give each group 2 diffraction gratings to share.
2. From the front of the room, turn on the white LED light and point it towards the students.

Background for teachers

Rainbow glasses and diffraction slides contain a series of very narrow lines called a diffraction grating. Though the effect is similar to looking through a glass prism, they actually work very differently.

Light can be bent in two different ways: by refraction or by diffraction. Refraction occurs when light enters and exits transparent materials such as glass and water. Diffraction occurs when light bends around objects as it passes by them.

Both refraction and diffraction can be used to spread light into a spectrum. Refraction produces a spectrum because shorter wavelengths bend at sharper angles than longer wavelengths.

Creating a spectrum through diffraction is more complicated. When light passes through a series of tiny slits or grooves called a diffraction grating, light fans out from each slit. The light waves from neighboring slits overlap and interact with each other, creating an interference pattern. Though the process is very different, the result is similar to refraction: white light is spread out into a spectrum according to wavelength.

Separating White Light in to a Rainbow

1. Ask students to observe the color LED light through the diffraction grating. Ask: What do you see?? Help them find the rainbows to the edges of the diffraction grating.
2. Have students look around the room at other sources of light. Instruct students never to look directly at the sun in this or any other activity.
3. Ask students how the colors are arranged? Which color is closest to the light source? Which is farthest away? Are the colors always in the same order, no matter what light they look at, or do the colors change position?

4. Ask students to draw a picture of the light and the rainbow(s) they see, with the colors in the correct order.
5. Next, set up the light blox, with slit caps on, at the front of the room.
6. Turn on the red, green and blue light blox and ask students to repeat the exercise with each color- view the lights through the diffraction grating and report what they observe.
7. Explain that colored LED lights contain just a handful of colors - not a full spectrum so they should see narrow stripes of specific colors.

Discussion and Transition to Next Activity

Ask - Where do the colors in the rainbow come from? Explain - the colors were already there - hidden in the white light and the diffraction grating separated them out into their individual colors. Raindrops can also separate the sunlight into many colors so that we can see a rainbow. These colors are always there, inside the "white" light we see all the time, but we cannot see them because they are usually mixed together to give us the white light we are used to.

What happens when you put all the colors back together?

1. Remove the slit caps from the Light Blox so that they project wide swaths of colored light.
2. Set the Light Blox up on a bench or table with a screen or white wall in front so that the students can see the projected light.
3. Turn on the red and blue and ask students to predict what color they will see when you combine them.
4. Mix the red and blue light blox to reveal pink or magenta.
5. Turn on the blue and the green Light Blox and ask students to predict what color they will see when you combine them.

6. Mix green and blue to reveal light blue or cyan.
7. Turn on the green and the red Light Blox and ask students to predict what color they will see when you combine them.
8. Mix the red and the green Light Blox to reveal yellow.
9. Turn on all three of the Light Blox and ask students to predict what color they will see when you combine them.
10. Mix all three Light Blox to reveal white light!