Newton's Color Wheels

Additive Color Mixing

Introduction

What is color? Why do we see different colors? In this demonstration, the concept of color will be demonstrated using a centrifuge device.

Concepts

- Reflection of light
- Primary colors
- Colors of light
- White light
- Persistence of vision

Materials

Battery, D
Bracken's Demonstration Spinner
Candle or burner
Filter paper, 3 pieces
Paper clip or dissection needle
Permanent markers
Plastic disk
Scissors

Safety Precautions

Make sure the paper disc is securely connected to the rotating platform so that it does not fly off during the demonstration. Allow the rotating platform to come to a complete stop before changing the disc. Do not touch the motor axle while rotor is spinning. Remove battery from Bracken's Demonstration Spinner when not in use and during storage.

Preparation

1. Prepare three color wheels using different sizes of filter paper and permanent markers.
2. Make one large blue and green color wheel with the colors in alternating quarters.
3. Make two consecutively smaller color wheels—one that is green and red, and one that is blue and red. Alternate the colors as in step 2.
4. Heat a paper clip or dissection needle with a candle or burner.
5. Melt holes in the centers of all of the color wheels and the given plastic disk, making sure that the holes of each disk fit snugly over the axle of Bracken's Demonstration Spinner.

Procedure

1. Place the plastic disk onto Bracken's Demonstration Spinner so that the motor axle extends through the middle of the disk.
2. Place the large green and blue color wheel onto Bracken's Demonstration Spinner so that the motor axle extends through the disk.
3. Instruct students to look at the colored sections as they appear on the disk. Then start the motor and have students observe the resulting color of the spinning disk. Turn off the motor.
4. Place the medium-sized green and red color wheel on top of the green and blue disk, and start the motor. Have students observe the resulting color of the spinning disks. Turn off the motor.
5. Place the smallest wheel (the blue and red wheel) on top of the green and red disk, and start the motor. Have students observe the colors formed by all three spinning color wheels. Turn off the motor. Repeat the demonstration, if necessary.

Publication No. 10473
061616

Tips

- Bracken's Demonstration Spinner, Flinn Catalog No. AP6202, is required and sold separately.
- White light (or nearly white light) may be produced by spinning a disk sectioned in thirds and colored with green, pink, and blue highlighting markers.

Discussion

Persistence of vision allows humans to combine the colors of the light as the disc is spinning. The white light from the classroom hits the surface of the spinning disc but reflects back to our eyes in different colors based on the color of the disc pattern. White light is composed of light energy from the entire visible spectrum. The visible spectrum includes the colors red, orange, yellow, green, blue, indigo and violet.

The color of a substance results from the reflection of light from that substance. A red shirt appears red when exposed to "white" light because the red-colored light waves are reflected from the surface of the shirt and the other wavelengths are absorbed. However, most materials do not reflect a pure single-frequency color and absorb all the other frequencies.

A disc containing alternating blue and green colored sections will appear to be a single different color if the disc is rotated fast enough because the human eye cannot distinguish between the colors. Human eyes will perceive this as a cyan-colored disc as if they were being excited by simultaneous beams of blue and green light. Likewise, a spinning red and blue disc will appear magenta, and a spinning red and green disc will appear yellow.

An object can only reflect the light frequencies that are present in the light that illuminates it. Since most objects do not completely absorb all the light frequencies, the color of the object will depend on the light source.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Systems, order, and organization
Evidence, models, and explanation
Content Standards: Grades 5–8
Content Standard B: Physical Science, transfer of energy
Content Standard C: Life Science, structure and function in living systems
Content Standards: Grades 9–12
Content Standard B: Physical Science, interactions of energy and matter
Content Standard C: Life Science, the cell

Acknowledgments

Flinn Scientific would like to thank Jeff Bracken, chemistry teacher at Westerville North High School in Westerville, Ohio for sharing this original idea. Jeff would like to thank Matt Cocuzzi, his student laboratory assistant, for his numerous creative suggestions during the development of this classroom demonstration.

References

Gore, G. R. *The Physics Teacher*, **1982,** *20*, 101.

Hewitt, Paul G. *Conceptual Physics*, 3rd ed.; Addison Wesley: Longman: CA, 1999; pp 422–424.

Bartels, R. A. *The Physics Teacher*, **1986,** *24*, 564–565.

Newton's Color Wheels is available as a demonstration kit from Flinn Scientific, Inc.

Catalog No.	Description
AP6162	Newton's Color Wheels
AP6202	Bracken's Demonstration Spinner
AP1425	Battery, Replacement, D

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.