Experiment 1: Color Addition

Required Equipment from Basic Optics System

Light Source

Convex Lens from Ray Optics Kit

Other Required Equipment

Red, blue, and black pens

Blank white paper

Purpose

In Part 1 of this experiment, you will discover the results of mixing red, green, and blue light in different combinations. In Part 2, you will compare the appearance of red, blue, and black ink illuminated by red and blue light.

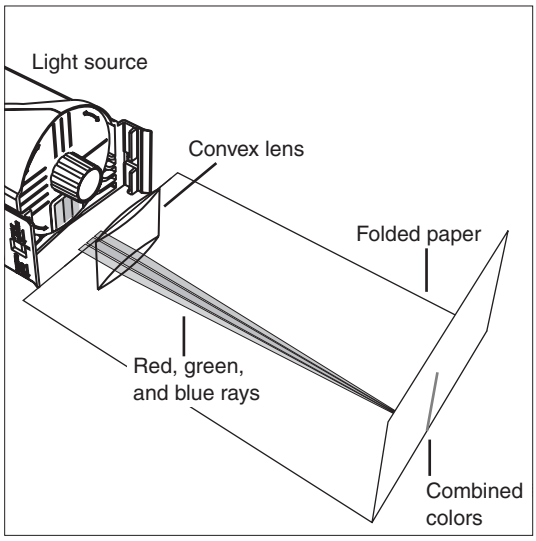

Figure 1.1: Color addition

Part 1: Addition of Colored Light

Procedure

1. Turn the wheel on the light source to select the red, green, and blue color bars. Fold a blank, white sheet of paper, as shown in Figure 1.1. Lay the paper on a flat surface and put the light source on it so that the colored rays are projected along the horizontal part of the paper and onto the vertical part.

2. Place the convex lens near the ray box so it focuses the rays and causes them to cross at the vertical part of the paper.

   Note: The lens has one flat edge. Place the flat edge on the paper so the lens stands stably without rocking.

3. What is the resulting color where the three colors come together? Record your observation in Table 1.1.

4. Now block the green ray with a pencil. What color results from adding red and blue light? Record the result in Table 1.1.

5. Block each color in succession to see the addition of the other two colors and complete Table 1.1.

Table 1.1: Results of Colored Light Addition

Colors Added	Resulting Color
red + blue + green	
red + blue	
red + green	
green + blue	

Questions

1. Is mixing colored light the same as mixing colored paint? Explain.

2. White light is said to be the mixture of all colors. In this experiment, did mixing red, green, and blue light result in white? Explain.

Part 2: Observing Colored Ink Under Colored Light

Procedure

1. While you look away, have your partner draw two lines—one red and one black—on a sheet of white paper. One of the lines should be labeled A, and the other B, but you should not know which is which.

   Before you look at the paper, have your partner turn off the room lights and cover the red and green bars so the paper is illuminated only with *blue* light.

   Now look. What colors do the two lines appear to be? Do they appear to be different colors? Record your observations in Table 1.2.

   Finally, observe the lines under white light and record their actual colors in Table 1.2.

2. Repeat step 1, but this time have your partner draw lines using blue and black ink (labeled C and D), and observe them under *red* light.

3. For Trial 2, switch roles and repeat steps 1 and 2 with your partner observing lines that you have drawn. Record the results in Table 1.2. (For this trial, you may try to trick your partner by drawing both lines the same color—both red or both black, for instance.)

Table 1.2: Colored Ink Observed Under Colored Light

Trial 1: Name of observer: _____

Color of Light	Line	Apparent Color of Ink	Do they look different?	Actual Color of Ink
Blue Light	A			
	B			
Red Light	C			
	D			

Trial 2: Name of observer: _____

Color of Light	Line	Apparent Color of Ink	Do they look different?	Actual Color of Ink
Blue Light	A			
	B			
Red Light	C			
	D			

4. Look at red and black lines under red light. Which line is easier to see?

   _____

Questions

1. What makes red ink appear red? When red ink is illumined by blue light, is most of the light absorbed or reflected?

2. When illumined with red light, why is red ink on white paper more difficult to see than black ink?