Laboratory Investigation | Name ______________________________

Physics@Frisch: Form L9.1A | Date __________________ Period ____

Color and Vision

Problem

How do we see color?

Introduction

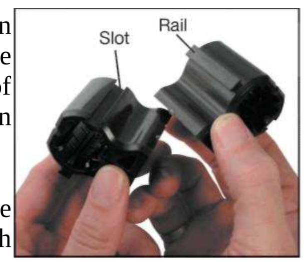
All the colors of visible light can be created artificially using a combination of three primary colors: red, blue, and green. You will use a white light source and color filters to discover what happens when you mix different colors of light. You will also learn how those filters work. Most of the light we see is made of a mixture of different colors. Diffraction grating glasses can separate out those different colors. If you look at a bright light through the diffraction grating glasses, you see rainbows on all sides. The rainbows spread out all the colors that are present in the light coming through the bright spot in the center. Technically, the rainbows are called a **spectrum**. A spectrum shows the different colors of light make up a particular sample of light. In this investigation, you will: show that white light can be made from red, green, and blue light; and explain the colors we see in terms of subtracting colors from white light.

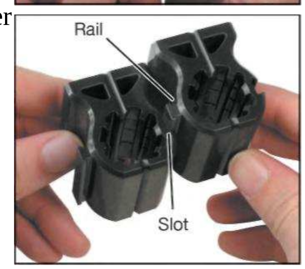
Materials *(per group)*

Diffraction glasses; Flashlight holders; Flashlights with red, green, and blue filters; Laser flashlight; Lens with light blue holder.

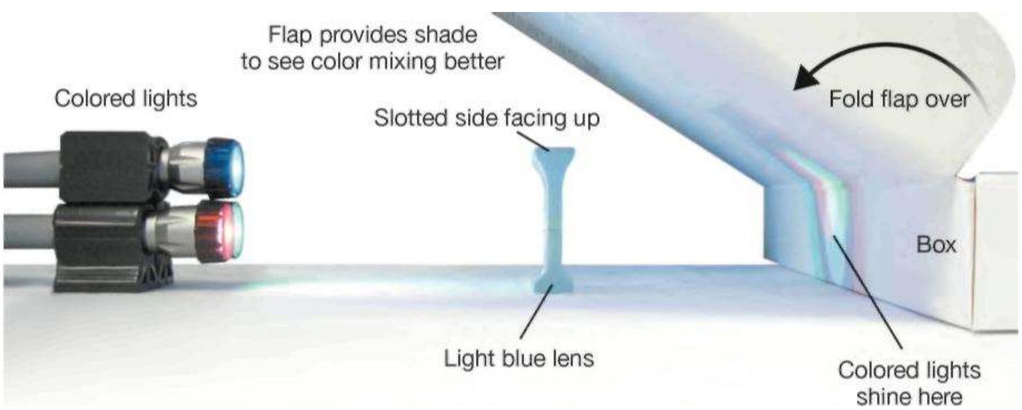
Procedure

1. Slide all three flashlights and their colored filters into their own holders. Connect the red and green flashlights by sliding their holders together using the rail and slot connectors on the side. Place the blue flashlight on top of the red and green lights, making a small pyramid stack. Set the blue light on top of the other two with the holder on its side, so the rail on the holder fits in the small groove created between the holders of the red and green lights.



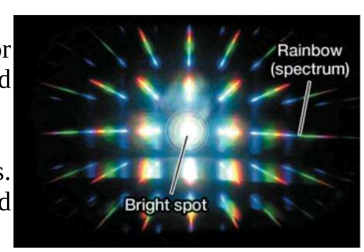


2. Set the light blue lens just in front of the lights so they shine through it. Place the lens so the slotted side is facing up. This will increase the visibility of the color mixing. Set the white box that the Optics with Light & Color kit comes in on the opposite side of the lens from the lights. Fold the top of the box over to shade the area where the three colored lights will shine on the side of the box.



3. Turn the flashlights on. Slowly move the lens away from the lights and toward the box until you see the three spots of color (red-green-blue) overlap on the box.

4. In the table on the next page record the color you see when you mix red and green light, the color you see when you mix green and blue light, the color you see when you mix blue and red light, and the color you see when all three colors of light are equally mixed.



5. Look at each different colored flashlight (red, green, and blue) through diffraction grating glasses. Be sure to observe one at a time. Note which colors you see, and their relative intensity and record your observations in the data table on the next page. Place an asterisk (*) by the brightest color.

6. Take the filter cap off of one of the flashlights. Look through the diffraction glasses at the light produced by the white LED and record your observations in the table below.

7. Shine the red laser onto the box. *Caution: Do NOT look directly at the laser beam.* Look at the spot on the box through the diffraction glasses and record your observations in the table below.

OBSERVATIONS

Mixing primary colors of light	
LED color combination	**Color you see**
Red + Green	
Green + Blue	
Blue + Red	
Red + Green + Blue	

Diffraction Pattern	
Color of light	**Colors you see**
Red	
Green	
Blue	
White	
Red laser	

CONCLUSIONS

1. Describe the similarities and differences you observed in the spectra from the white, red, blue, and green LEDs.

____

____

2. Describe the spectrum you saw looking through the diffraction grating glasses at the spot made by the red laser on the screen. How is it different from the spectrum of the red LED? ______________________________

____

3. Based on your observations, explain how the colored filters transform the white light of the LEDs inside the lamps into red, green, and blue. ______________________________

____

____