Name _____ Section _____ Date _____

CONCEPTUAL PHYSICS	Activity

Diversion into Dispersion

Purpose

To produce a spectrum from white light and understand how it comes about

Apparatus

ray box (Rive or equivalent)
blank sheet of white paper
triangular or trapezoidal ray box prism

Discussion

One of the most famous images of Isacc Newton shows him using a prism to separate sunlight into a spectrum of colors. (See page 505 of *Conceptual Physics* 12th edition.) This process is called ***dispersion***. Pure white light consists of all the colors of the spectrum. But different colors refract to different extents. This allows the prism to separate (disperse) the colors through differential refraction. The prism is capable of a wide dispersion when the differential refraction of light upon entering the prism is enhanced by differential refraction upon exiting the prism. Album cover designer, Storm Thorgerson, created an iconic image for the cover of Pink Floyd's *Dark Side of the Moon* depicting dispersion in a prism. Lab manual author, Dean Baird, painted Thorgerson's design onto a 10' x 30' wall outside his classroom at Rio Americano High School in Sacramento, California.

Procedure

SETUP

Step 1: Arrange the ray box so that a single beam of white light is emitted.

Step 2: Place the sheet on the table. Place the ray box on the sheet.

Step 3: Place the prism—***dull side down***—on the paper.

CREATING A SPECTRUM

Step 1: Experiment with different arrangements (different angles of incidence on different sides of the prism) until you can produce a spectrum of colors. Your spectrum will not be wide, but you will be able to distinguish colors. Once you have it, turn up a corner of your paper to see the spectrum more clearly. Show your instructor your configuration.

If using a trapezoidal prism, use only the triangular section; there should be no light beams in the square section.

Step 2: In the space at the top of the next page, draw a ***magnified*** diagram of the configuration (incident ray and any refracted rays, the prism, and the emerging spectrum) as seen from directly above. Do not draw the light source in your diagram. Pay particular attention to the arrangement of the colors in the emerging beam; label red, violet, and yellow in your diagram. Include arrows to indicate the direction of travel of the beams. Use all the space; make your diagram ***big!***

Step 3: Label the following on your diagram.

- **incident ray** (air to plastic)
- **internal ray** (in plastic)
- **exit ray** (with spectrum)
- **normals** (one at the air to plastic boundary for the first refraction, and one at the plastic to air boundary for the second refraction)

Step 4: Put your head down on the table and arrange the apparatus so that the emerging spectrum goes into your eye directly. Move your head around so that you see different colors one at a time.

What do your partners see while you're doing this?

Summing Up

1. In what direction is the beam refracted as it passes from air to plastic? Mark your selection and include a diagram.
   __toward the normal
   __away from the normal
   __not at all

2. In what direction is the beam refracted as it passes from plastic back to air? Mark your selection and include a diagram.
   ___toward the normal
   ___away from the normal
   ___not at all

3. Which color undergoes the greatest amount of refraction (is bent the most in the process) and which color undergoes the least amount of refraction?

4. Which color travels the fastest in the prism (glass or plastic), and which color travels slowest?

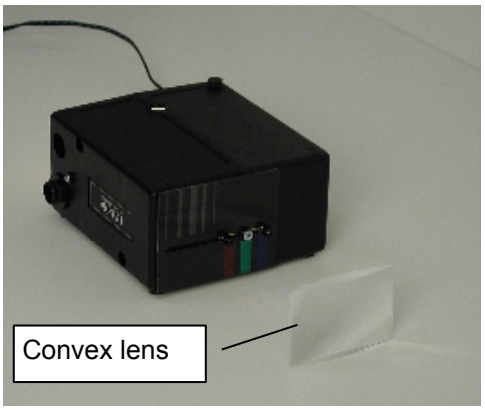
Lab 14 Attachment

Perform the following experiment after you are done with the “Diversion into Dispersion” Conceptual Physics activity.

Experiment 2: White Light From Colors

Procedure

1. On the light source, slide the mask in front of the light to produce rays of red, green, and blue.
2. Place the convex lens in front of the color rays as shown in the illustration.
3. Place the sheet of paper behind the convex lens.
4. Slowly move the viewing screen until you find the position where all three colors intersect. Write a description of what you see.



Analysis

Write or draw a description of how the convex lens affects the path of the colored light rays.

What do you see at the point where all three colors intersect?

What do you see when you place the sheet of paper beyond the intersection point?