Refraction of Light Activity

Purpose: To demonstrate and explore the refraction of light as a light beam travels between two media of different optical densities

Materials:

- ray box plus accessories kit
- two worksheets for drawing rays
- one piece of blank paper
- semi-circular Plexiglas prism
- pencil

Procedure:

Part #1

1. Obtain a semi-circular Plexiglas prism.

2. Place the semi-circular prism on the worksheet such that the prism neatly covers the bottom half of the 360° protractor

3. Draw five different rays using the steps in #4, #5 and #6 below. Use incident angles of approximately 15°, 30°, 45°, 60°, 75°. Label the incident rays and the refracted rays. Be sure to include directional arrows

4. Direct the light rays such that they contact the prism at the centre of the 360° protractor

5. Use a pencil to indicate where the ray will travel both before entering the semi-circular prism and after it leave the prism.

6. Record the angle of incidence and the angle of refraction in the table provided.

7. Repeat steps #4 to #6 as required.

Part #2

8. Now, using a second worksheet, place the semi-circular prism on the top half of the 360° protractor.

9. In a similar manner come up with 4 rays that produce a refracted ray and one ray that experiences total internal reflection. Use angle measures for your 4 rays that divide up the available angles in a even fashion.

10. Draw all five rays and label. Be sure to include a separate label for the ray that results from total internal reflection. Record your results in the table provided

Part #3

11. On a blank piece of paper, draw a diagram of a how a ray passes through a thick block of plexiglass. Add normals to this diagram at the appropriate locations. Label completely.

12. Return all equipment and clean up your work station.

Concluding Questions:

1. Add the media type to your first two diagrams from above. This means to add the word "Plexiglas" and "air" to the appropriate regions of your diagrams. What are the optical densities of these two substances. Which substance has the greater optical density.

2. What happens to a light ray as it travels from a more optically dense media to a less optically dense media?

3. What happens to a light ray as it travels from a less optically dense media to a more optically dense media?

4. Why do you not need to consider the refraction effect as the light either enters or leaves the circular surface of the semi-circular prism? Be precise.

5. Give one practical application of refraction that is in common use.

6. What is does the term "total internal reflection" mean? What must be true about the light ray and the optical media involved for total internal reflection to occur? What does the term "critical angle" mean.

(search: "bending light phet")