Snell's Law (Index of Refraction) Lab #29

Pre-Lab Discussion

Snell's Law compares the absolute indices of refraction of light in two different media based on the measured angle of incidence and the angle of refraction given the equation:

$n_1 \sin \theta_1 = n_2 \sin \theta_2$ Where: n = absolute index of refraction
θ = angle

Research Question

How can the index of refraction of a block of glass or Lucite be determined experimentally?

Materials

glass block pins board ruler protractor

Method and Data Collection

1. Place a piece of blank paper on a pin board. Lay a glass block on the paper and carefully outline the shape of the block.
2. Draw a line normal to one of the long sides of the block and place a pin at the edge of the block on the normal line and label this point I (for incident).
3. Measure an angle between 10 and 15° from the normal line and place a pin at this point at a distance 6-8 cm from the block and label the point A (for angle).
4. Look through the edge of the block opposite pins A and I. Line these two pins up with a third pin on the near edge of the block that appears to be in a straight line. Label this point R (for refracted ray).
5. Place a fourth pin 6-8 cm from pin R in what appears to be a straight line as viewed through the edge of the glass block. Label this point E (for exit ray).
6. Remove the block and pins and draw in line segments for AI, IR, and RE. Use arrows to show the path of the light rays through the air, glass, and air.
7. Repeat steps 1 through 6 twice creating incident angles of between 20 and 25° for Trial II and between 30 and 35° for Trial III.

Data Processing

1. For each trial, calculate the index of refraction for the glass block using Snell's Law. Show the result for each trial and the average value for the index of refraction.

2. Using the average value for the index of refraction, calculate the speed of light in the glass block.

3. Determine the wavelength of red light and violet light in the glass block using values of 7.00×10^{-7} m for red light and 4.00×10^{-7} m for violet light in a vacuum.

4. Calculate the critical angle for the glass block.