Name:

PHYS 167

April 26th, 2018

Lab #17

Lab Title: Refraction

Partners: d

Section: 167-84

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Introduction:

In this laboratory exercise students will be able to not only analyze, but measure the angles of incidence and refraction at a boundary between transparent media. In addition to this, the critical angle between these boundaries will be calculated. The overall mission of this exercise is to actively test Snell's Law , which dictates that the angle of incidence generated by a beam of light, changes as it enters a new medium, which ties in to the angle of refraction entrance. By analyzing this theory students will be able to test the various changes of incidence and refraction, based on the changing angles produced by the changing medium.

Equations utilized in this exercise:

- Snell's Law of Refraction equation n1sin(°)i = n2sin(°)r
- n2 = (n1sin(°)i)/(sin(°)r)
- n2 = (1)/(sin(°)c)
- n= [sin (α + δm/2)] / [sin (α/2)]
- Average value: x = (x1+x2+x3…+xn)/(n)
- n= (c/v)
- Percent Error equation: [(measured value-accepted value)]/[(accepted value)]*100

Experimental Data:

Measurement	***Value (in degrees)***
Angle of incidence (first surface)	50°
Angle of refraction (first surface)	51°
Angle of incidence (second surface)	76°
Angle of refraction (second surface)	85°
Critical Angle	41.8°
Angle of minimum deviation (narrow	67°

end)	
Angle of prism (narrow end)	53°
Angle of minimum deviation (wide end)	25°
Angle of prism (wide end)	81°

Calculations and Analysis:

1. To calculate the index of refraction for the obtained data of our first and second surface, we must use Snell's Law of Refraction equation n1sin(°)i = n2sin(°)r. Where n1 represents the refraction of the air and n2 of our prism. The equation utilized was n2 = (n1sin(°)i)/(sin(°)r).
   A. First Surface: n2 = ((1)sin(50°))/(sin(51°)) = 0.985
   B. Second Surface: n2 = ((1)sin(76°))/(sin(85°)) = 0.956

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2. In order to obtain the critical angle of our prism, w must utilize the index of refraction equation n1sin(°)i = n2sin(°)r, to arrange it to this equation: Critical Angle: n2 = (1)/(sin(°)c)
   A. n2 = (1)/(sin(41.8)) = 1.64

3. To obtain our new index of refraction with our measured angles from the minimum deviation and of the prims, we utilized the equation n= [sin (α + δm/2)] / [sin (α/2)]
   A. Narrow End: n= [sin (67+53/2)] / [sin (53/2)] = 2.00
   B. Wide End: n= [sin (25+81/2)] / [sin (81/2)] = 1.24

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4. To find the average of all the index of refraction from our prism, we used the equation: Average value: x = (x1+x2+x3…+xn)/(n).
   A. (2.00 + 1.24 + 0.985 + 0.956 +1.64) / (5) = 1.36

5. To measure the velocity of light from our prism, we must use the formula n= (c/v) to rearrange to utilize our known value for the speed of light in a vacuum and our average refractive index. Our equation was rearranged to v= (c/n).
   A. (3*10^8)/(1.36) = 2.19*10^8 m/s

6. To analyze the value of our experimental data compared to the accepted value, we must utilize the percent error equation. Percent Error equation: [(measured value-accepted value)]/[(accepted value)]*100

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A. Accepted value for the refractive index of Lucite prism: 1.50
   a. [(1.36-1.50)]/(1.50)*100 = 9.33%

Conclusion:

The main purpose of this exercise was to analyze both the velocity and index of refraction of our Lucite prism, under various conditions. To accomplish this we had to fully visualize and analyze Snell's Law of Refraction, in which the angle of incidence created by light changes as it enters a transparent medium. For our results, we obtained an average refractive index of 1.36, and a velocity of 2.19*10^8 m/s within our light in prism. Throughout this experiment we had a lot of challenges and difficulties. One such occasion was having a hard time tracing the exact location of our angle of refraction. Seeing as our refractive index varied within the 1.50 range, and obtained a relatively acceptable percent error of 9.33%, we did a good job of understanding the purpose of our exercise. Factors that could have caused us from having more errors within our data, could have been the difficulty in pinpointing our angle of refraction. This factor could have well affected us in obtaining an accurate reading our prism refractive index, and velocity of light through our prism. Another factor that could have affected the accuracy of our data, could have been certain environmental factors. Such as perhaps having a better tool in calculating our change in angle. A way to improve this exercise, would perhaps be to add multiple trials, in order to decrease the amount of discrepancy within our results. Overall, our experiment was mainly successful in supporting our analysis on the theory of refraction, based on our obtained data and amount of discrepancies.