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Lab 08 – Reflection/Refraction

Complete this lab worksheet and turn it in for credit. Show all your work including the calculations you performed (attach additional sheets if necessary).

~~Which Data Set are you working with? _____~~

8.4.1 Law of Reflection $n = \frac{c}{v}$

Read section 8.4.1 of the procedure demo and watch video 8.1 and 8.2.

1. Measure and record the incident and reflection angles for the three trials. Compute the error for each trial.

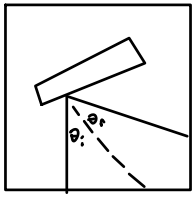
we don't do errors

Trial	Incident angle (degrees)	Reflected angle (degrees)	Error (degrees)	Percent error
1	18°	18°		
2	24°	24°		
3	30°	30°		

26°

36°

46°



1. What is the average error in your angle measurements?

Professor said no errors

Average error (degrees): _____

Average % error: _____

1. Comment on the sources of these errors.

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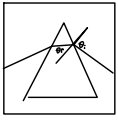
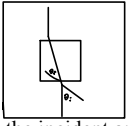
8.4.2 The Index of Refraction of Glass

Read section 8.4.2 of the procedure demo and watch video 8.3 (this video also covers the next

section)





$n_1 \sin\theta_1 = n_2 \sin\theta_2$

1. Measure and record the incident and refracted angles for the block. Then compute the index of refraction of glass in both cases.

$n_{\text{crown glass}} = 1.52$

object	incident angle (degrees)	refracted angle (degrees)	n_{glass}
block	12°	7°	1.71
Prism	12°	8°	1.49

$1 \cdot \sin 12 = n \sin 7 \Rightarrow n = \frac{\sin 12}{\sin 7} = 1.71$

$1 \cdot \sin 12 = n \sin 8 \Rightarrow n = \frac{\sin 12}{\sin 8} = 1.49$

1. Compute the percent difference between your two computed values of the index of refraction

$\text{diff} = \left| \frac{x_1 - x_2}{\left(\frac{x_1 + x_2}{2}\right)} \right| \cdot 100\%$

$\frac{1.71 - 1.49}{\left(\frac{1.71 + 1.49}{2}\right)} = \frac{11}{80} = .1375 \times 100\% = 13.75\%$

1. Compute the percent error between your two measurements separately and the value given in the lab manual for crown glass.

Professor said no errors

1. Compare the two values of the index of refraction to each other, and to the values given in the manual. Comment on the percent errors. How do they compare to what you found in 8.4.1.

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8.4.3 Critical Angle for Glass-Air Interface

Read over section 8.4.3 in the procedure demo, and watch video 8.3.

1. Measure and record the incident angle that corresponds with a refracted angle of 90°.

$\theta_{c,meas}$ = 32°

$\theta_c = 32°$

1. Compute the critical angle using eq. 8.4 in the lab manual using the ideal index of refraction for crown class.

$\theta_{c,ideal}$ = 32°

1. Compute the critical angle using eq. 8.4, and the index of refraction you measured in **8.4.2**

$\theta_{c,calc}$ = 54° $\theta_c = \arcsin\left(\frac{n_2}{n_1}\right)$

1. Compare these values for the critical angle. Compute the percent error between each, and discuss the agreement.

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8.4.4 Multiple Refractions

Read section 8.4.4 of the procedure demo. Watch videos 8.4 and 8.5

1. Measure the incident and refracted angles at the two interfaces. Use those angles, and the given index of refraction of air, to determine the index of refraction of water at both interfaces.

$n_1 \sin\theta_1 = n_2 \sin\theta_2$

interface	incident angle (degrees)	refracted angle (degrees)	n_{water}
1	28°	18°	1.51
2	27°	16°	1.64

$1 \cdot \sin 28 = n \sin 18 \Rightarrow \frac{\sin 28}{\sin 18}$

$1 \cdot \sin 27 = n \sin 16 \Rightarrow \frac{\sin 27}{\sin 16}$

1. What is the average of your two measurements of the index of refraction of water?

$\frac{1.51 + 1.64}{2} \approx 1.58$

1. Compare to the value of n_{water} given in the lab manual. Compute the percent error between the two and comment on the agreement.

No percent error

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Bonus

Go to the PHET simulation at:

https://phet.colorado.edu/sims/html/bending-light/latest/bending-light_en.html,

Open the prisms simulation and determine the index of refraction of mystery. For full credit you must describe how you determined the index of refraction (it might be helpful to include drawings or screenshots).

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

$$\theta_2 = \text{Arcsin}\left(\frac{n_1}{n_2}\right)$$