$n_2 = \frac{\sin\theta_1}{\sin\theta_2}$

Data:
Table 1

Trial	n_{glass}	θ_1 (degrees)	θ_2 (degrees)	Sin θ_1	Sin θ_2	n_2
1	1.50	30	20	0.50	0.34	1.47
2	1.50	35	21	0.57	0.36	1.58
3	1.50	40	25	0.64	0.42	1.52
4	1.50	50	30	0.77	0.50	1.54
5	1.50	60	35	0.87	0.57	1.53

Observations and Calculations:

1. Classify the bending of light as exhibited by the ray diagrams. According to your data, is light refracted away from or toward the normal as it passes at an angle into a medium with a higher index of refraction?
   Light is refracted towards the normal as it passes at an angle into a medium with a higher index of refraction.
2. Calculate sin θ_1 and sin θ_2 for each trial. Record the results in Table 1.
3. Calculate n_2 for each trial. Record the results in Table 1.
4. Compare the values for index of refraction of glass for each trial (values in last column). Is there good agreement between them? Would you conclude that index of refraction is a constant for a given medium?
   yes there is a good agreement between them. They are all around $n_2 = 1.50$, therefore the index of refraction is constant for a given medium.
5. Compare your calculated n_2 with the given index of refraction, n_{glass}. Do they agree? Explain why it does or doesn't.
   yes, they agree because the index of refraction for glass is 1.50, and all the calculated indexes of refraction are around 1.50.

Procedure: Part B Setup

1. Reset simulation and choose "Mystery A" if you are at an even lab station or choose "Mystery B" if you are at an odd lab station.
2. Choose the protractor and set the laser to an angle of incidence, θ_1, at 30°.
3. Ignore the reflected ray (the ray that remains in air). Using the protractor, measure the angle of refraction, θ_2, of the laser and record in Table 2.
4. Repeat steps 2 and 3 for angles of incidences of 50° and 70° of your own choosing. Record the results in Table 2.
5. Calculate sin θ_1 and sin θ_2 for each trial. Record the results in Table 2.

Table 2

Trial	θ_1 (degrees)	θ_2 (degrees)	Sin θ_1	Sin θ_2
1	30	20	0.50	0.342
2	40	26	0.643	0.438
3	50	32	0.766	0.530
4	60	37	0.866	0.602
5	70	41	0.940	0.656

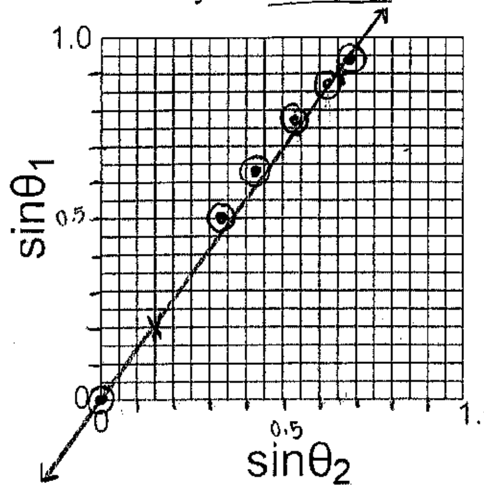
$\frac{y_2 - y_1}{x_2 - x_1}$ = slope

6. Draw a graph of the **Sin θ₁ vs. Sin θ₂** on the grid below. Draw in your best-fit line and find the slope. Show slope work below.

$\frac{9-2}{6.5-1.5} = \frac{7}{5} = 1.4$

m = 1.4

(points chosen over there →)



(1.5, 2) & (6.5, 9)

7. What does your slope represent?

The slope represents n_2 because n_2 is $\frac{\sin\theta_1}{\sin\theta_2}$ and so is the graph.

8. Using the chart below of various indices of refraction for various media, identify your mystery material you had in your experiment.

Index of Refraction for various media

Media	Index of Refraction
Vacuum	1.00
Air	1.0003
Carbon dioxide gas	1.0005
Ice	1.31
Pure water	1.33
Ethyl alcohol	1.36
Quartz	1.46
Vegetable oil	1.47
Olive oil	1.48
Acrylic	1.49
Table salt	1.51
Glass	1.52
Sapphire	1.77
Zircon	1.92
Cubic zirconia	2.16
Diamond	2.42
Gallium phosphide	3.50

According to the chart, the mystery material is Ethyl alcohol, because the experimental index of refraction is 1.4, and the index of refraction for ethyl alcohol is 1.36, which is the closest.

9. Find the percent error of your observed value (slope) using the identified index of refraction as your accepted value.

$$\% \text{ Error} = \left|\frac{\text{measured - accepted}}{\text{accepted}}\right| \times 100$$

$n_{observed} = 1.4$

$n_{ethyl\,alcohol} = 1.36$

$\% \text{ error} = \left|\frac{1.4 - 1.36}{1.36}\right| \times 100$

% error = 2.9%

Analysis Questions:

1. Substitute the average value of the index of refraction that you measured in Part A into the equation for index of refraction and calculate the speed of light in the glass. Show work.

① $c = 3.00 \times 10^8$ m/s
$v = ?$
$n = 1.50$

② $n = c/v$
$1.50 = \frac{3.00 \times 10^8}{v}$

③ **$v = 2.00 \times 10^8$ m/s**

2. What if you conducted this experiment (Part A) under water? Compare and contrast the results you get in such a situation to the results you have from this lab.

If this experiment was conducted underwater, the difference between the indexes of refraction would be less than the difference in the indexes of refraction between air and glass. This means there would be less bending of light than in Part A.