Data Collection—Table 1: From Air (index of refraction = 1.00)

Medium	Angle of Incidence	Index of Refraction	Angle of Refraction
Water	30 degrees	1.33	22.0 degrees
Glass	30 degrees	1.50	19.4 degrees

Table 2: From Air (index of refraction = 1.00)

Medium	Angle of Incidence	Angle of Refraction
Mystery A, Trial 1	40 degrees	15.4 degrees
Mystery A, Trial 2	35 degrees	13.7 degrees
Mystery A, Trial 3	30 degrees	11.9 degrees
Mystery B, Trial 1	40 degrees	27.3 degrees
Mystery B, Trial 2	35 degrees	24.2 degrees
Mystery B, Trial 3	30 degrees	21.0 degrees

Table 1 Analysis: Use Snell's law to verify data for Table 1 (see step 5 in procedure).

Water:

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

$$n_2 = \frac{\sin(30)}{\sin(22)} = 1.334$$

$$\boldsymbol{n_2 = 1.33}$$

Glass:

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

$$n_2 = \frac{\sin(30)}{\sin(19.4)} = 1.505$$

$$\boldsymbol{n_2 = 1.50}$$

Table 2 Analysis: Calculate the indices of refraction for each trial for Mystery A and Mystery B. There should be six calculations.

Trial 1 (Mystery A):

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

$$n_2 = \frac{\sin(40)}{\sin(15.4)} = 2.420$$

$$\boldsymbol{n_2 = 2.42}$$

Trial 2 (Mystery A):

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

$$n_2 = \frac{\sin(35)}{\sin(13.7)} = 2.421$$

$$\boldsymbol{n_2 = 2.42}$$

Trial 3 (Mystery A):

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

$n_2 = \frac{\sin(30)}{\sin(11.9)} = 2.424$

$\boldsymbol{n_2 = 2.42}$

Trial 4 (Mystery B):

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

$n_2 = \frac{\sin(40)}{\sin(27.3)} = 1.401$

$\boldsymbol{n_2 = 1.40}$

Trial 5 (Mystery B):

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

$n_2 = \frac{\sin(35)}{\sin(24.2)} = 1.399$

$\boldsymbol{n_2 = 1.40}$

Trial 6 (Mystery B):

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

$n_2 = \frac{\sin(30)}{\sin(21)} = 1.395$

$\boldsymbol{n_2 = 1.40}$

Questions (complete sentences):

1. **Determine the average of the three trials for each material.**

   Index of Refraction:

   Mystery A = **2.42** **(same for all three trials)**
   Mystery B = **1.40** **(same for all three trials)**

   Angle of Incidence:

   Mystery A = 35 degrees
   Mystery B = 35 degrees

   Angle of Refraction:

   Mystery A = 13.7 degrees
   Mystery B = 24.2 degrees

   In which material would light travel faster, Mystery A or Mystery B? Explain.

   The light would travel faster in the *Mystery B* material. The greater the index of refraction of the material, the slower the light travels in that material. Therefore, since the index of refraction in the Mystery B material is smaller than that of in Mystery A, the light would travel faster in the Mystery B material.

2. **As the index of refraction for the second medium is increased, what effect does this have on the angle of refraction?**

   As the index of refraction for the second medium is increased, the angle of refraction *increases*. Specifically in terms of the lab, the line continues to move to the right as the angle increases.

3. **Write a conclusion for this lab.**

   The purpose of this lab was to help provide a hands-on approach in understanding how light rays are bent as they pass at an angle from one medium to another. It also helped to enforce the idea of how to measure the angle of incidence and refraction, as well as calculate the index of refraction; to further then determine which material travels the fastest.

   The indices of refraction and angles of refraction appear to have a direct linear relationship in which as the index increases, so does the angle. As well, if the index decreases, so does the angle respectively.

   Through the analysis of the data, I was able to learn about the relationship between the angle of incidence, angle of refraction, and index of refraction; and how they affect each other and are affected depending on the material.