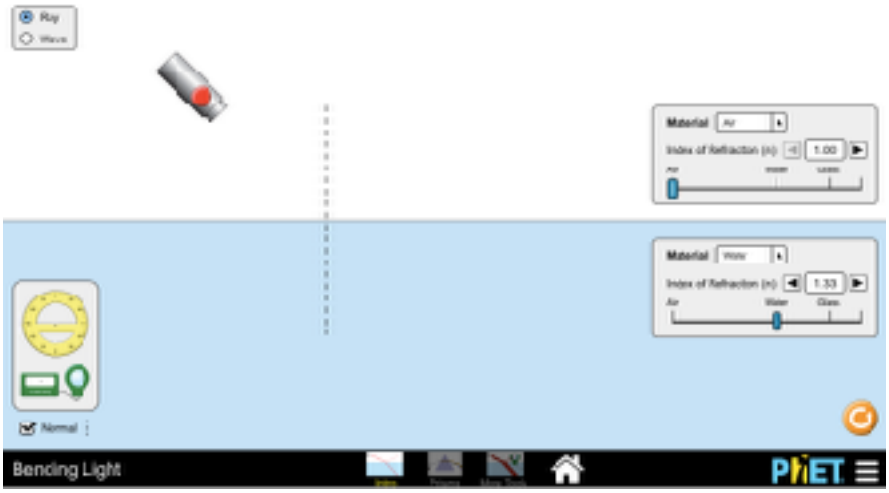
Refraction & Snell's Law

In this activity students will be exploring the speed and intensity of light in a variety of media using the "Bending Light" PhET simulation.

Open the simulation by clicking on the link:

https://phet.colorado.edu/en/simulation/bending-light

Take a look at the explanatory video via YouTube:
https://youtu.be/v_Y4O73XdQc

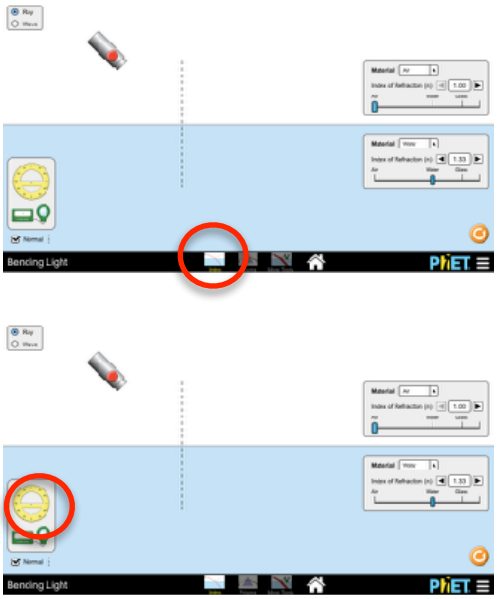


Learning Objectives

By the end of these activities it is hoped that students will have an acquired the following skills:

- Following explicit instructions to gain acquired knowledge.
- Measuring the angles of incidence and refraction.
- Processing data in the production of a straight line graph.
- Using straight line gradient to determine refractive index and Snell's law equation.
- Comparison of known data and experimental data.

Activity: Speed of light as it passes through a denser medium.



- Make sure you have pressed the “Intro” button on the bottom of the page so the screen looks like the image opposite.
- Note the “**Normal**” is the hatched vertical line at 90° to the boundary. Make sure you have **AIR** at the top and **WATER** below it.
- Drag and drop protractor onto the “**Normal**”.
- Place the light source so the incident ray is running down the 10° angle, ϑ_i. Note: **TO** the **Normal**.
- Measure the angle of refraction, ϑ_r, for the ray in the water again **TO** the **Normal**. Place this value in Table 1.
- Continue moving the light so it shines down incident angles of **20°; 30°; 40°; 50°; 60°; 70°; 80°** and measure the corresponding refractive angle then add these values to **Table 1**.

Table 1:

ϑ_i	10°	20°	30°	40°	50°	60°	70°	80°
ϑ_r								

Processing the data

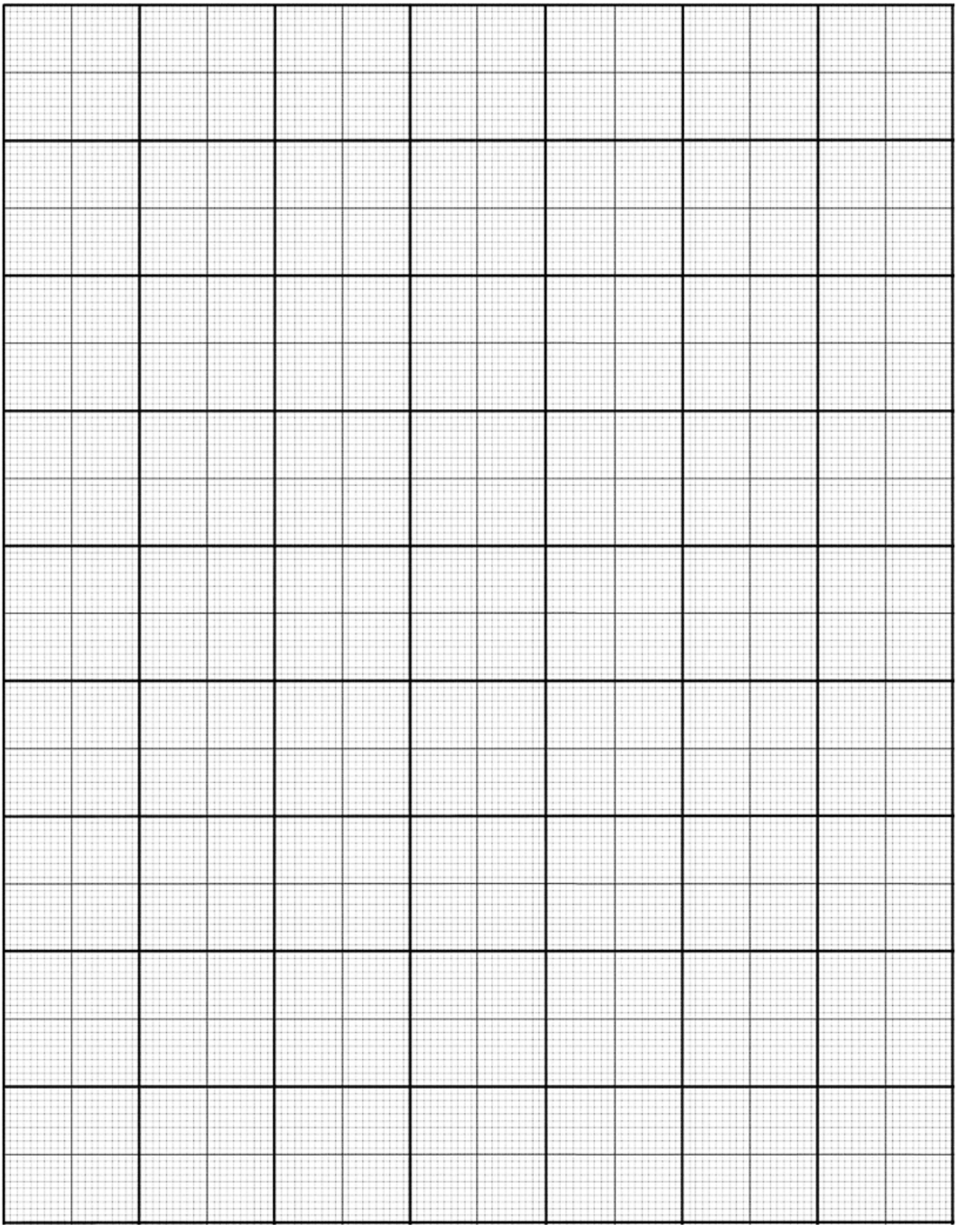
- Convert the data into sine value and add the values to **Table 2**.

Table 2:

$\sin\vartheta_i$								
$\sin\vartheta_r$								

- Now plot the data from table 2 on the graph provided with

$$y = \sin\vartheta_i \text{ and } x = \sin\vartheta_r$$



- On plotting the data draw a line of best fit.
- **Determine the gradient of your line.**

- **What does the gradient of a $\sin\vartheta_i$ vs $\sin\vartheta_r$ represent?**

- **The equation of a straight line is described mathematically as y = mx + c. Use this generic formula to find the mathematical formula of your graphs line.**

- **The refractive index for water is stated as being 1.33. Compare this to the value you obtained , what do you notice?**

- **Is there any difference between the values you stated above?**

  If so come up with possible reasons as to how this could have occurred.

- **Glass has a refractive index of 1.5 how would you expect this line to look when compared to that formed by the water data?**

SUMMARY:

- **How can you determine the refractive index of a media from a set of incident and refractive angle?**

- **What law does the equation of a $\sin\vartheta_i$ vs $\sin\vartheta_r$ represent?**
