### Unit 1 Physics Refraction of light - Using the Hodson Light Box

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**Background**

When light travels from one medium to another, it appears to bend. This is due to the different optical properties of the two media. In this experiment the relationship between the angle of incidence and the angle of refraction for two given media, air and glass, will be investigated.

As always, the outcome of an experiment depends upon the accuracy of the results. Ensure all lines are drawn with a sharp pencil, all images are carefully lined up with their objects and that all angles are measured carefully and checked. It should be possible to measure to the nearest degree.

**Equipment**

Hodson Light box, glass/Perspex block, A4 sheet of white paper

**Method**

Set up the apparatus as shown below, on a sheet of paper. Draw a dashed line to represent the normal.

Carefully place the glass/Perspex block onto the sheet of paper, with the dashed line perpendicular to the side of the block.

Glass of Perspex block

Normal

Incident ray

Refracted ray

*θ*i

*θ*r

1. Carefully draw the outline of the glass/Perspex block.
2. Aim the ray from the Hodson Light Box so that it strikes the glass slab at the point of contact with the normal line.
3. Using small and accurately positioned pencil dots, mark the location of the incident ray and the exit point of the refracted ray as it exits the slab.
4. Remove the slab and rule in and label the lines corresponding to pairs of incident and refracted rays.
5. Repeat this procedure for a minimum of 10 different angles up to an angle of incidence of about 70°. It would be an advantage to start at *θ*i = 5.0° and go up in 5.0° steps.
6. Measure the angles made by the incident and refracted rays and the front of the slab, and record the angles of incidence and refraction in the rows below. columns A and B of your spreadsheet, under the heading Method 1.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Angle of Incidence |  |  |  |  |  |  |  |  |  |  |
| Angle of refraction |  |  |  |  |  |  |  |  |  |  |

**Results**

Open the provided excel spreadsheet titled ‘REFRACTION OF LIGHT’ and place in your recorded data values for the angle of incidence and refraction.

The cells for the ratios of the trigonometric values shown below will self populate.

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| --- | --- | --- | --- | --- | --- |
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1. Following your teachers guidance, construct a separate graph for each of the following using excel.

*θ*i. vs *θ*r. b) cos *θ*i. vs cos *θ*r. c) sin *θ*i. vs sin *θ*r.  d). tan *θ*i. vs tan *θ*r.

1. Ensure each graph axes are labelled and graphs are adequately titled.
2. Analyse each graph, and determine if a straight line or a curved line of best fit can be drawn that best represents the data. Draw in this line using either pencil or computer generation.

Using either excel functioning or a pencil, draw in a line or curve that best suits any trend in the data points for each graph.

**Analysis**

1. Analysing the data values in orange coloured columns , which of these shows a ***nearly*** constant numerical value for the trigonometric ratio. Discuss your observations of these columns.

Sin\_i / Sin\_r is relatively constant compared to the other trigonometric ratios. All of the other ratios seem to have more change in general for their ratios, such as tan, cos and θ.

1. Anlayse each graph and decide if the graph displays an observable relationship. Describe your observations with reference to Snell’s Law.

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1. From your tabled or graphed data for column E, approximate to a set value.
2. Using Snells law, derive a relationship that is equivalent to the ratio shown in column E.

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1. Research the refractive index values for persepx and air, and use these to determine the relative refractive index for light going from air into perspex.

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1. How does your answer for question 5 compare to your answer to question 3. Discuss.

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1. Does this practical experiment confirm Snell’s law.

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1. What is the uncertainty in the measurement of the angles?

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1. Comment on the reliability of both sets of data.

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