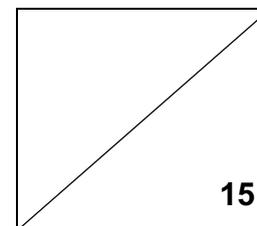




2019 Sec 3 Physics Practical 8
Waves: Refraction of Light
Marking Scheme



15

Record of i and r (total 3 marks)

- Neat table drawn with the headings and units: $i / ^\circ$, $r / ^\circ$, $\sin(i / ^\circ)$, $\sin(r / ^\circ)$. [1]
- At least 6 sets of evenly spread readings of i taken from 20° (inclusive of 20°) to 80° with minimum range of 50° . [1]
- i and r tabulated to zero d.p, (whole numbers); $\sin i$ and $\sin r$ to 2 or 3 s.f. (consistently) [1]

Ray Diagram (total 2 marks)

- Pins separation between P_1 and P_2 , and between P_3 and P_4 , must be at least 5.0 cm [1]
- Refracted ray drawn must be through the centre of the pinholes of P_3 and P_4 . [1]
- Labelling of all angles of incidence & refraction.

Graph (total 4 marks)

- **S:** Suitable scale used. [1]
- **P:** All points correctly plotted. [1]
- **L:** Line of best fit passing through the origin (or close to origin). [1]
- **A:** Axes correct ($\sin i$ on y-axis and $\sin r$ on x-axis); correctly labelled (with or without units) from origin with values labelled at regular intervals on both axes. [1]

Calculation of gradient (total 4 marks)

- On the graph
 - **C:** Coordinates of two suitable points clearly indicated. [1]
 - **T:** Large triangle drawn using the two chosen points along line of best fit. [1]
- Calculation of gradient using the coordinates on the graph
 - Show working $(y_2 - y_1) / (x_2 - x_1)$
 - Answer = 1.5 ± 0.1 (2 s.f.) [1]

Conclusion

Refractive index of glass = gradient m of the graph [1]

Questions

- 1 State **one** precaution that you have taken in this experiment. [1]
 - The optical pins must be inserted vertically to ensure the correct alignment of the pins P_3 and P_4 with the images of P_1 and P_2 . [1]
 - The pins P_3 and P_4 must be as far as possible (at least 5.0 cm apart) to reduce the number of possible refracted ray that can be drawn through these pinholes.
 - The glass block was ensured to be in the accurate position throughout the experiment.
- 2 State **one** source of error in this experiment. [1]
 - The low precision of the protractor used (to a whole degree).
 - Human judgement error in aligning the positions of the images and pin accurately.
 - The holes made by the pins P_3 and P_4 are larger than the lines to be drawn.