



2023 Sec 3 Physics Practical 03

Refraction of Light

Marking Scheme

Record of i and r (total 3 marks)

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

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
- Refracted ray drawn must be through the centre of the pinholes of P_3 and P_4 .
- Labelling of all angles of incidence & refraction.

Graph (total 4 marks)

- **S:** Suitable scale used.
- **P:** All points correctly plotted.
- **L:** Line of best fit passing through the origin (or close to origin).
- **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.

Calculation of gradient (total 4 marks)

- On the graph
 - **C:** Coordinates of two suitable points clearly indicated.
 - **T:** Large triangle drawn using the two chosen points along line of best fit.
- Calculation of gradient using the coordinates on the graph
 - $\text{gradient} = (y_2 - y_1) / (x_2 - x_1)$ (show working)
 - $= 1.5 \pm 0.1$ (2 s.f.)

Conclusion

Refractive index of glass = gradient m of the graph OR 1.5

Questions

- 1 State **one** precaution that you have taken in this experiment. [elaborate each point!]
 - 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 .
 - 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 rays that can be drawn through these pinholes.
 - The glass block was ensured to be in its outline position when locating positions of P_3 and P_4 .
- 2 State **one** significant source of error in this experiment. [elaborate each point!]
 - Human judgement error in aligning the positions of the images and pins accurately.