Chapter 15 Seeing the light

Short investigation 15.1: Snell's Law

Name: .....

Aim

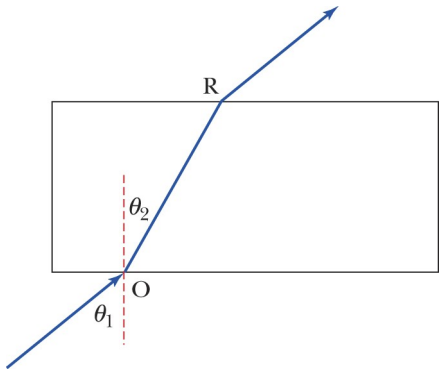
To observe the refraction of light and to use Snell's Law to determine the refractive index of a medium

Materials

Power supply, ray box with single slit card, rectangular Perspex or glass block, ruler, protractor, pencil, blank A4 paper, drawing board, drawing pins

Method

1. Use drawing pins to attach the A4 paper to the drawing board, which should be lying flat on the bench.
2. Place the block in the middle of the page. Use a pencil to draw around the block so that it can always be returned to the same position. Mark a point on the boundary and label it as O.
3. Reduce the amount of light in the room (by drawing curtains etc.). Turn on the ray box and direct a single ray of light so that it enters the block at point O at an angle and emerges on the other side of the block.
4. Without moving the ray or the block, mark 3 points along each of the incident ray and the emerging ray. Place a mark at the block boundary at the point where the light ray emerges from the block and label this R.
5. Turn off the ray box and remove the block from the paper. Using your pencil marks as guides, use a ruler to draw the path of the incident ray into the block, joining points O and R, and to draw the path of the emerging ray. Draw normals to the surface at points O and R.
6. Use your protractor to measure the angle of incidence θ_1 and the angle of refraction θ_2 as shown in the figure below. Enter these values into table 15.1A.



7. Repeat steps 1–6 for three other incident angles.

Results

Table 15.1A

θ_1 (degrees)	θ_2 (degrees)

Analysing the results

1. For each of the angles in table 15.1A, complete table 15.1B below.

Table 15.1B

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

2. Snell's Law states that $n_1 \sin \theta_1 = n_2 \sin \theta_2$. Given that $n_1 = 1.00$ (air), what variable does the ratio $\frac{\sin \theta_2}{\sin \theta_1}$ represent?

3. What is the approximate refractive index of the block?

4. In each case, is the ray refracted towards the normal or away from the normal as it passes into the block?

5. What do you notice about the angles of the incident ray entering the block at O and the ray emerging from the block at R?

Conclusion

State the relationship between the refractive index of the block, the angle of incidence and the angle of refraction in this investigation.

Notes:

