4 A student investigates how light behaves as it leaves a clear plastic block.

Figure 4 shows some of her equipment and the path of a ray of light through the block.
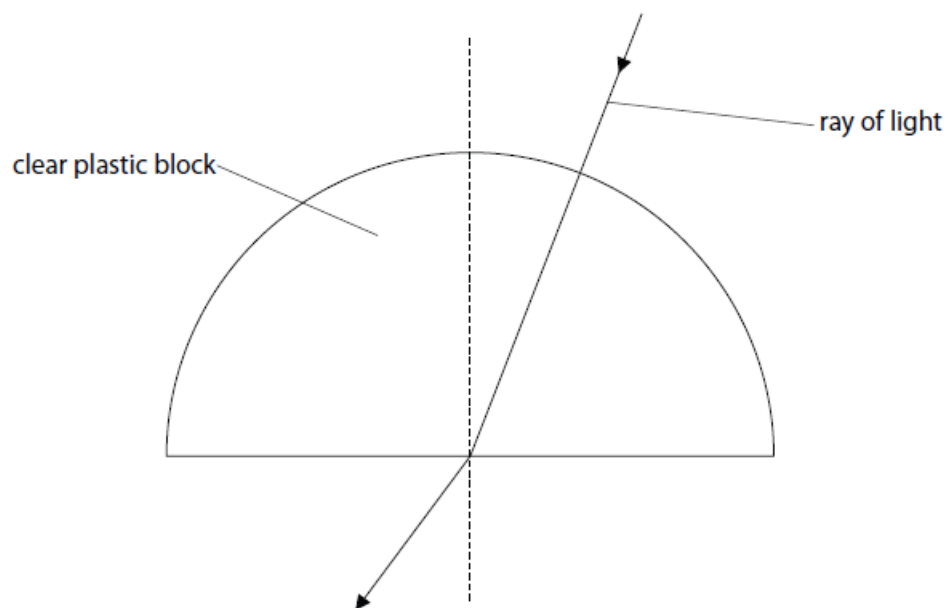

ray of light

clear plastic block

Figure 4

(a) Describe how the student can make sure the light does not change direction as it enters the block.

(2)

_____

_____

_____

_____

(b) She varies the angle of incidence inside the block and records the angle of refraction.

Figure 5 shows her results.

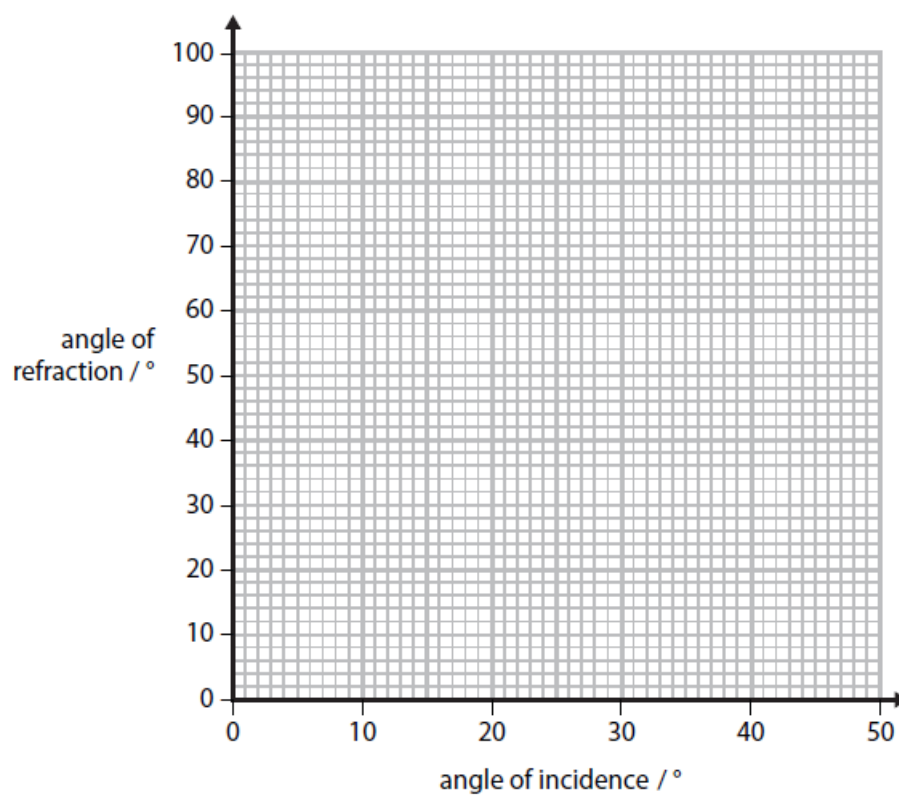| angle of incidence (°)	angle of refraction (°)
5	7
15	22
30	46
40	69
42	76

Figure 5

(i) Plot the points on the grid below.

(2)

(ii) Draw the best fit smooth curve through the points.

(1)

(iii) Estimate the angle of incidence which gives an angle of refraction of 90°.

(2)

angle of incidence = ...

(c) Describe what happens to the ray of light when the angle of incidence is increased beyond the critical angle.

(2)

....

....

....

....

(Total for Question 4 = 9 marks)

Question number	Answer	Additional guidance	Mark
4(a)	An answer that combines the following points of understanding to provide a logical description: • shine the light along a radius (1) • by marking it on the paper before putting the block down (1)	allow shine the ray at the centre of the straight edge before putting the block down	**(2)**

Question number	Answer	Additional guidance	Mark
4(b)(i)	all points correctly plotted to +/− half a square (2)	4 points plotted correctly (i.e. one error) (1)	**(2)**

Question number	Answer	Mark
4(b)(ii)	smooth curve through at least 3 of the points (1)	**(1)**

Question number	Answer	Additional guidance	Mark
4(b)(iii)	• continues line as far as 90° (1) • estimate between 43° and 47° (1)	award full marks for correct numerical answer without working	**(2)**

Question number	Answer	Mark
4(c)	An answer that provides a description by making reference to: • (all) light reflected (1) • back inside block (1)	**(2)**