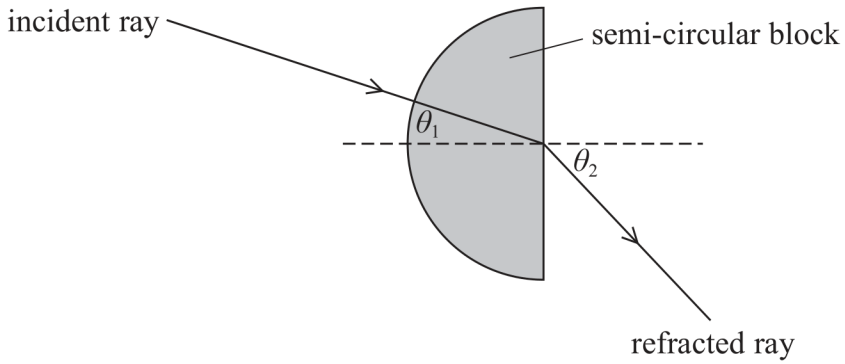
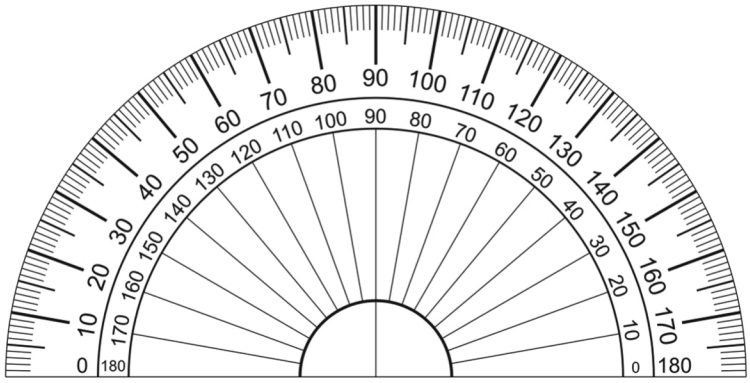
2 A student directed a ray of light from air into a semi-circular block of transparent material as shown.



He varied the angle of incidence θ_1 and measured the corresponding angles of refraction θ_2. He used the protractor shown below.



(Source: PAL)

(a) When the measured value of θ_1 is 35°, the measured value of θ_2 is 62°.

Calculate the percentage uncertainty in each of these values.

(3)

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Percentage uncertainty in θ_1 = ...

Percentage uncertainty in θ_2 = ...

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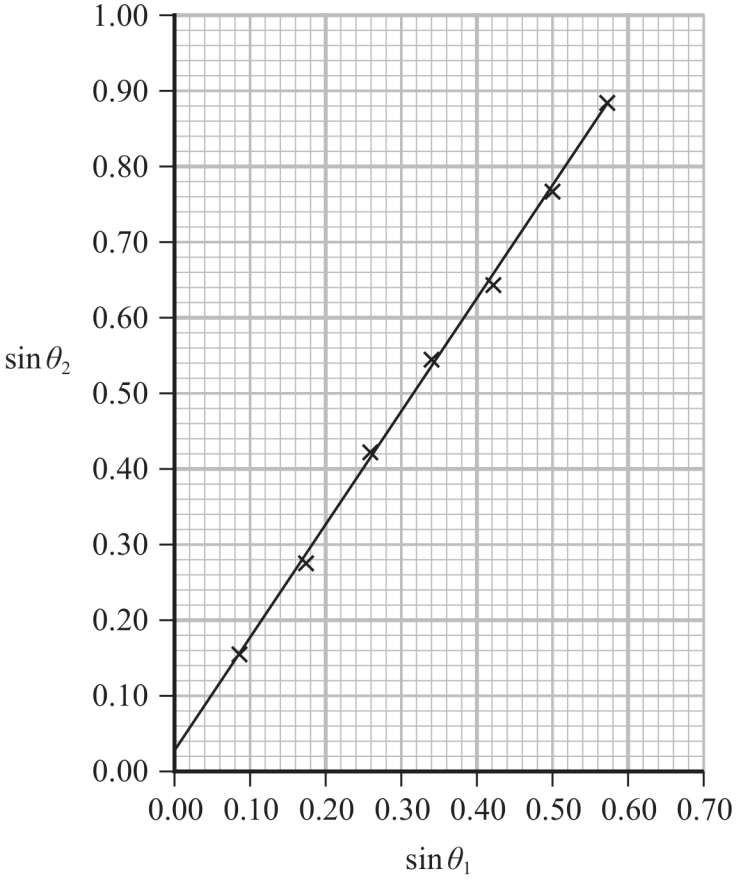
(b) The student plotted a graph of $\sin\theta_2$ against $\sin\theta_1$ as shown.



(i) Explain why the gradient of this graph can be used to determine the refractive index of the transparent material.

(3)

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(ii) Determine the refractive index of the transparent material.

(2)

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Refractive index = ...

(c) The line of best fit on the graph does not pass through the origin.

Describe a possible cause for this error, and how the student could reduce the effect of this error.

(2)

(Total for Question 2 = 10 marks)