MEASUREMENT OF THE REFRACTIVE INDEX OF A MATERIAL

Specification reference: **AS Component** **2.5 – Wave properties**

A level Component **3.2 – Wave properties**

Theory:

The refractive index, n, of a material can be determined from the equation $\sin\vartheta_i = n\sin\vartheta_r$ where n = refractive index, ϑ_i is the angle of incidence and ϑ_r is the angle of refraction. The above equation assumes that the incident ray is travelling in air. A graph of $\sin\vartheta_i$ (y-axis) against $\sin\vartheta_r$ (x-axis) will give a straight line through the origin and the gradient is equal to the refractive index, n.

Apparatus:

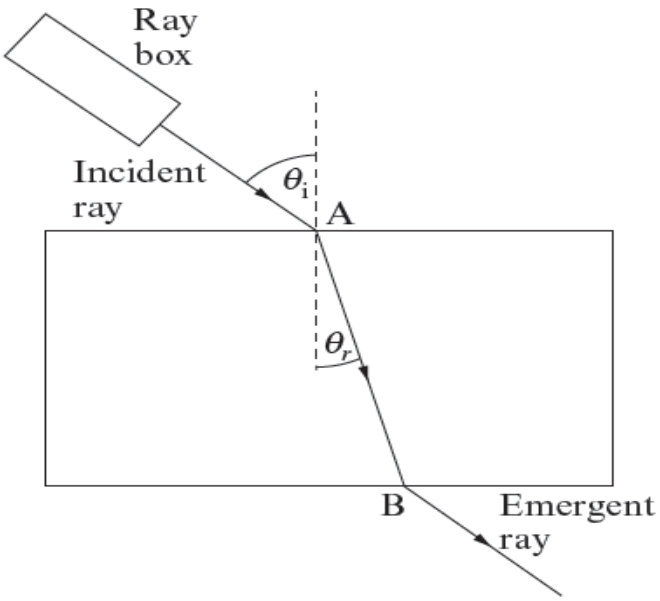
Suitable white light source e.g. ray box fitted with a single slit to produce a narrow parallel beam of light
Power supply for ray box and connecting leads
Rectangular block of glass or Perspex
1 or 2 sheets of plain paper
Protractor
30 cm ruler

Further guidance for technicians:

The investigation may be conducted in normal laboratory lighting. A dark room is not required.

Experimental Method:

The following arrangement should be set-up.



The angle of refraction ϑ_r can be measured by drawing in the line joining the incident and emergent rays for different values of the angle of incidence. The angles can be measured using the protractor after drawing in the normals. A graph of $\sin\vartheta_i$ (y-axis) against $\sin\vartheta_r$ (x-axis) can be plotted which should give a straight line. A value of n can then be determined from the gradient.

Practical techniques:

- Use appropriate analogue apparatus to record a range of measurements (to include length/distance, temperature, pressure, force, angles, volume) and to interpolate between scale markings.
- Use laser or light source to investigate characteristics of light, including interference and diffraction.

Relevant previous practical past papers:

- PH3 2012 Task A2