



General Certificate of Education
Advanced Subsidiary Examination
June 2014

Physics

PHY3T/Q14/TN

Unit 3 Investigative and Practical Skills in AS Physics

Investigative Skills Assignment (ISA) Q

Teachers' Notes

Confidential

The Exams Officer should make two copies of these Teachers' Notes; one copy for the Head of A-level Physics and one for the technician.

These copies can be released to the Head of A-level Physics and the technician at any point following publication but must be kept under secure conditions at all times.

Teachers can have sight of the Teachers' Notes but no further copies should be made.

All teacher-assessed marks to be submitted by 15 May.

ISA on Refraction ISA(Q)

Centre instructions for the investigation

In this ISA, candidates will be expected to measure angles of incidence and distances travelled by a narrow beam of light passing through a rectangular glass or Perspex block, using a white lamp with a colour filter (or a monochromatic source).

Information for centres

Candidates should be told approximately one week before undertaking Stage 1 of the ISA that the investigation will be about refraction through a glass or Perspex block, the laws of refraction and measurement of wavelength using a diffraction grating.

Candidates will be expected to use a calculator in 'degree mode' in both Stage 1 and the written test.

Apparatus

Centres should ensure that the apparatus provided can be used safely. Each candidate will need:

- (a) a rectangular Perspex or glass block of suitable size (eg $10\text{ cm} \times 4\text{ cm} \times 1\text{ cm}$)
- (b) 12 V lamp (or other compact light source) preferably in a 'ray box'
- (c) suitable power supply for the lamp
- (d) colour filter (preferably green)
- (e) slit to provide a narrow beam of light
- (f) A4 size white paper (at least 2 sheets per candidate)
- (g) drawing board or similar smooth flat surface
- (h) protractor, 1° or 0.5° precision
- (i) sharp pencil
- (j) a 30 cm ruler.

Partial black-out of the laboratory is desirable.

Task Sheet

You are going to investigate the refraction of light by a rectangular glass or Perspex block.

- Place the block on the paper and draw round its outline.
- You are going to take a set of readings of the angle of incidence, θ , on the block for a range of θ as shown in **Figure 1**.
- Draw the normal to the surface of the block at the point of incidence.
- Mark the path of the light beam entering the block at an angle θ of 70° .
- Set up the apparatus so that a narrow beam of coloured light passes through the block.
- Mark the point at which it leaves the block and then remove the block.
- Using a 30 cm ruler, measure the distances, d and h .
- Repeat the experiment for angles of incidence in the range between 70° and 10° .
- On fresh paper, repeat the measurements for the same angles of incidence.
- Tabulate all your results in a single table.
- Calculate $\sin \theta$ and $\frac{d}{h}$ for each angle of incidence and include these values in your table.
- Plot a graph of $\frac{d}{h}$ on the vertical-axis against $\sin \theta$ and draw the straight line of best fit.
- Record the precision of your protractor.

Figure 1

