



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

**PHYSICS**

**5054/03**

Paper 3 Practical Test

**October/November 2007**

**2 hours**

Additional Materials: As listed in the Confidential Instructions.

**READ THESE INSTRUCTIONS FIRST**

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

Do not use staples, paper clips, highlighters, glue or correction fluid.

**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.

For each of the questions in Section A, you will be allowed to work with the apparatus for a maximum of 20 minutes. For the question in Section B, you will be allowed to work with the apparatus for a maximum of 1 hour.

You are expected to record all your observations as soon as they are made.

An account of the method of carrying out the experiments is **not** required.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.



This document consists of **5** printed pages, **3** blank pages and **1** Answer Booklet.



## Section A

Answer **all** questions in this section.

- 1 *In this experiment you will make measurements on a wooden block floating in water.*

You have been provided with a wooden block whose upper surface has been labelled 'top', a glass beaker containing water, and a half-metre rule.

- (a) Take measurements to determine the thickness  $d$  as shown in Fig 1.1. Record your measurements on page 2 of your Answer Booklet.

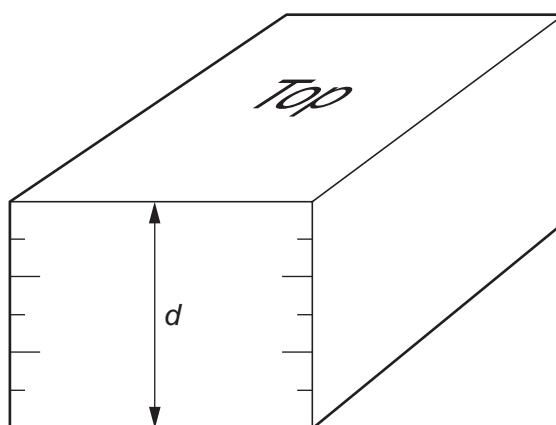


Fig. 1.1

[1]

- (b) Place the wooden block in the beaker of water with the top face uppermost. Draw a diagram to show what you observe when the block is resting in equilibrium in the water. [1]
- (c) There are scales with 5 mm divisions on each corner of the block. Use these scales to determine the average depth  $d_s$  to which the wooden block sinks into the water. You should aim for as much precision as possible when taking your measurements. Explain how you made sure that your value for  $d_s$  was as accurate as possible. [2]
- (d) Calculate  $\frac{d_s}{d}$ . [1]

2 In this experiment you will determine the refractive index of a transparent block.

You have been provided with a transparent block, four optics pins, a protractor and a soft board (or polystyrene tile).

(a) Place the transparent block on page 3 of your Answer Booklet as shown in Fig. 2.1. Draw the outline of the block on the page.

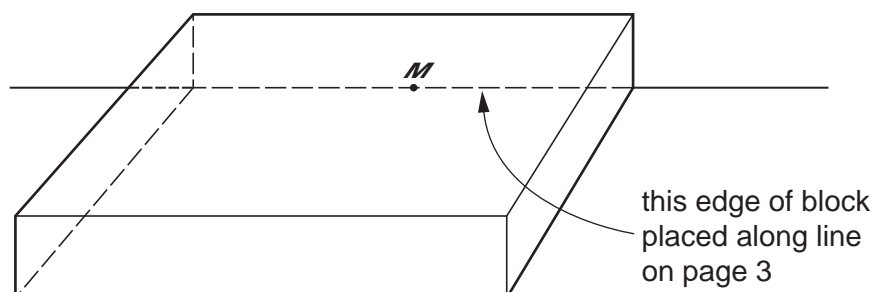


Fig. 2.1

(b) Remove the block from the page.

(i) Draw an incident ray reaching the block at M at an angle of incidence  $i$  of  $60^\circ$ .

(ii) Place page 3 of your Answer Booklet on the soft board.

(c) Replace the block in its original position. Place two optics pins vertically into the page and on the incident ray. View the two pins through the block from the bottom edge of the page. Place two further pins in line with the images of the pins seen through the block. These indicate the position of the emergent ray. Remove the block, pins and soft board. [2]

(d) Draw the emergent ray. Draw the line of the refracted ray inside the block.

(e) Measure the angle of refraction  $r$  at the point M. [1]

(f) Calculate the refractive index  $n$  of the block given that

$$n = \frac{\sin i}{\sin r} .$$

[2]

- 3 *In this experiment you will determine the position of the centre of mass of a triangular piece of card.*

You have been provided with a triangular piece of card which has holes punched at each of the three corners, a plumb line, a half-metre rule, a block of wood containing a nail from which to suspend the card, and a stand, clamp and boss.

- (a) Clamp the block of wood about 60 cm above the bench so that the nail is horizontal.
- (b) Suspend the card from the nail at the point labelled A. Using the plumb line, mark on the card the position of the line along which the centre of mass lies. [2]
- (c) Repeat the procedure in (b) for the points labelled B and C. Hence determine the position of the centre of mass. Label this X on your card. [1]
- (d) Measure the distance from the corner at B to X. [1]
- (e) Describe a different experiment to confirm that X is the centre of mass. [1]

**At the end of the examination, tie the card to your Answer Booklet between pages 4 and 5 with a piece of string.**

## Section B

- 4 *In this experiment, you will investigate the output voltage from a potential divider circuit when different resistors are used in the potential divider.*

You have been provided with an electrical circuit containing a resistor  $X$  whose value has been obscured. There is a gap in the circuit between points A and B. You have three extra resistors and some extra connecting leads.

- (a) In the space on page 5 of your Answer Booklet, draw a circuit diagram of the circuit that has been set up for you. [1]
- (b) Connect points A and B together. Close the switch and measure the potential difference  $V_0$  across  $X$ . Record  $V_0$  on page 6 of your Answer Booklet. Open the switch and separate points A and B. [1]
- (c) With the voltmeter still connected across  $X$ , connect one of the extra resistors between points A and B. Close the switch. Record the resistance  $R$  of the extra resistor and the voltmeter reading  $V$ . Open the switch and disconnect the extra resistor. [2]
- (d) Repeat part (c) with
- (i) the other two extra resistors used on their own,
  - (ii) all possible series combinations of the extra resistors.

Tabulate all your values of  $R$  and  $V$  in the table on page 6 of your Answer Booklet. Include your results from (c). Include units for  $R$  and  $V$  in your table. [4]

- (e) Using the grid on page 7 of your Answer Booklet, plot a graph of  $V/V_0$  on the  $y$ -axis against  $R/k\Omega$  on the  $x$ -axis. [4]
- (f) (i) Use your graph to determine the value of  $R$  that gives a value for  $V$  of  $0.5V_0$ . [1]
- (ii) State the resistance of  $X$  and explain the reason for your answer. [2]





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