UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

PHYSICS **5054/32**

Paper 3 Practical Test **October/November 2011**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams, graphs or rough working.
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 these observations are made.
You may lose marks if you do not show your working or if you do not use appropriate units.
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.

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1	
2	
3	
4	
Total	

This document consists of **10** printed pages and **2** blank pages.

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Section A

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Answer **all** questions in this section.

1 *In this experiment, you will determine the density of paper.*

You have been provided with
- a single sheet of paper labelled A,
- a stack of 100 sheets of paper,
- a 30 cm ruler,
- a set square.

(a) (i) Determine average values for the length l and the width w of the sheet of paper labelled A.

l = ...

w = ...
[1]

(ii) Explain, with the aid of a diagram, how you ensured that the average values of l and w were determined as accurately as possible.

.....

.....

..... [1]

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(b) (i) The stack contains 100 sheets of paper. Measure accurately the total thickness t_S of the stack.

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t_S = ...

(ii) Hence determine the average thickness t of a single sheet of paper.

t = ...
[1]

(c) (i) The mass m of the sheet of paper labelled A is written on the paper. Calculate the density of paper using the relationship

$$\text{density} = \frac{m}{l\,w\,t}.$$

density = ... [1]

(ii) State the assumption that you have made in determining the density of the paper.

.....

.....

..... [1]

[Total: 5]

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2 *In this experiment, you will compare the loss of gravitational potential energy with the gain in kinetic energy when a trolley moves down a ramp.*

You have been provided with

- a ramp,
- a trolley,
- a stopwatch,
- a metre rule,
- a set square,
- a block of wood to stop the trolley at the end of the ramp,
- adhesive tape.

(a) The ramp has been set up for you. **Do not adjust the slope of the ramp**.

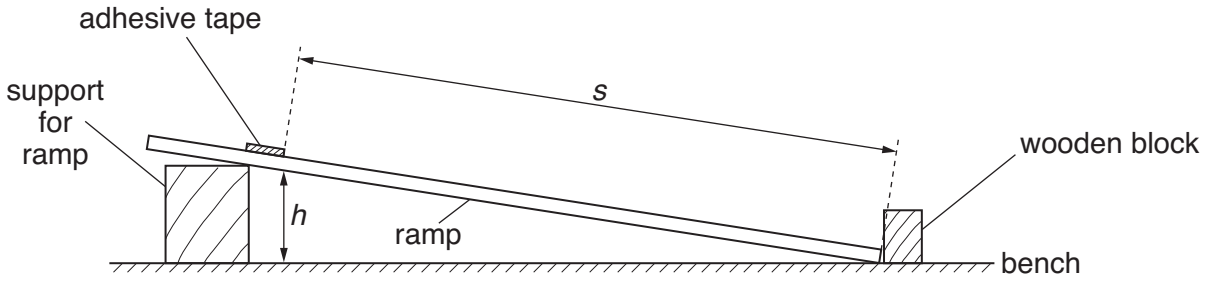


Fig. 2.1

Position a piece of adhesive tape at a distance *s* of 0.700 m from the bottom of the ramp as shown in Fig. 2.1. The edge of the tape, at 0.700 m from the bottom of the ramp, is the start position of the trolley. At this position measure the vertical height *h* from the bench to the underside of the ramp as shown in Fig. 2.1.

h = ... [1]

(b) The **front** of the trolley is released from the start position. It rolls down the ramp. The gravitational potential energy E_P lost by the trolley is given by the relationship

$$E_P = mgh.$$

The mass *m* of the trolley is given on the card. Assume that the gravitational field strength *g* is 9.81 N/kg.

(i) Record the value of *m* given on the card.

m = ...

(ii) Calculate E_P.

E_P = ...
[1]

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(c) (i) By releasing the trolley from the start position, determine the average time t taken for the trolley to travel to the bottom of the ramp.

$t =$ ..... [1]

(ii) Calculate the final velocity v of the trolley when its front reaches the bottom of the ramp, using the relationship

$$v = \frac{2s}{t}.$$

$v =$ .....

(iii) Calculate the final kinetic energy E_K of the trolley as it reaches the bottom of the ramp using the relationship

$$E_K = \tfrac{1}{2} m v^2.$$

$E_K =$ .....
[1]

(d) Comment on the values that you have obtained for E_P and E_K.

.....

.....

..... [1]

[Total: 5]

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3 *In this experiment, you will determine a refractive index by tracing a ray of light through a transparent block.*

You have been provided with
- a rectangular block,
- an illuminated slit,
- a protractor.

(a) Fig. 3.2 is on page 7 of your question paper. On Fig. 3.2,

(i) draw a normal to the line XY at the point M, above and below the line XY,

(ii) draw a line from the top left of the page to M at an angle of 50° to the normal. Label this line L.

[1]

(b) Place the block on Fig. 3.2 with a long straight side on line XY, the centre of the straight side at M and the block below XY. This is shown in Fig. 3.1.

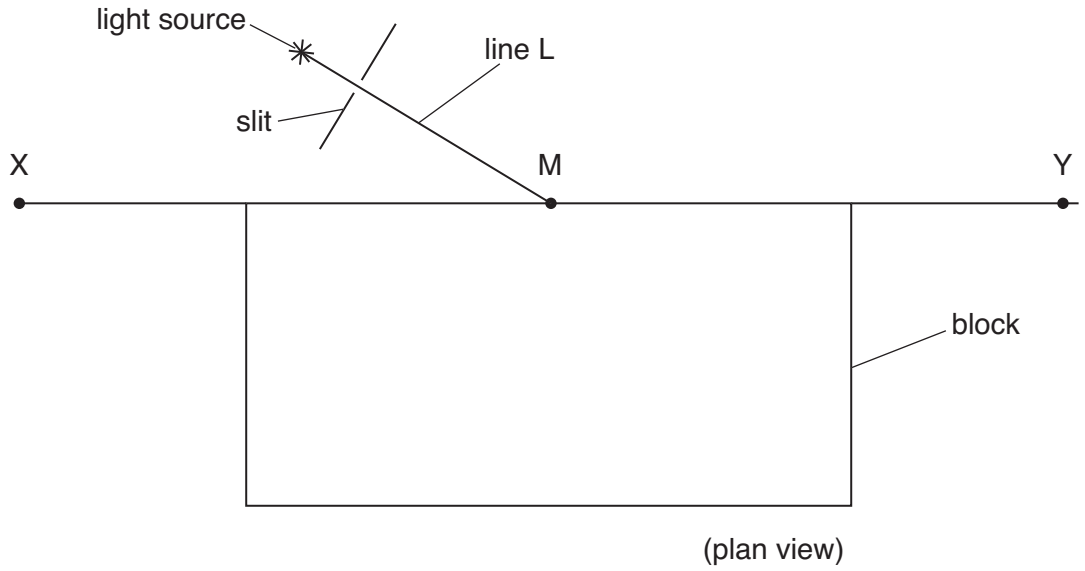


Fig. 3.1 (not to scale)

(c) **(i)** On Fig. 3.2, draw the outline of the block.

(ii) Position the light source and slit so that a ray of light passes along the line L towards M.

(iii) Mark and label two points P_1 and P_2 on the ray that leaves the block.

[2]

(d) **(i)** Remove the block. Draw a line through P_1 and P_2 that just touches the outline of the block at a point. Label this point N.

(ii) Draw a straight line from M to N.

(iii) Measure the angle of refraction *r* at M.

r = ...

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(iv) Calculate the refractive index n of the material of the block using the relationship

$$n = \frac{\sin 50°}{\sin r}.$$

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n = ...
[2]

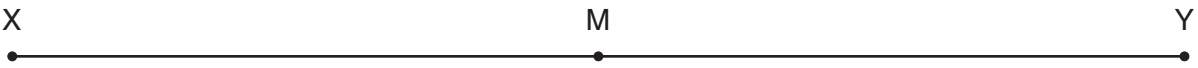


Fig. 3.2

[Total: 5]

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Section B

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4 *In this experiment, you will investigate the electrical heating of water.*

You have been provided with a circuit consisting of
- a power supply,
- a heater coil in a beaker,
- an ammeter,
- a voltmeter,
- a switch.

You have also been provided with
- a thermometer in a stand, boss and clamp,
- a stirrer,
- a supply of water at room temperature,
- a measuring cylinder,
- a stopwatch.

In this experiment, the heating coil will become very hot and must not be touched.

(a) In the space below, draw a circuit diagram of the circuit that has been set up for you.

[2]

(b) (i) Measure 50 cm^3 of water and pour this into the beaker containing the heater coil.

(ii) Close the switch and quickly record the current I in the circuit and the potential difference V across the heater. **Immediately after taking your readings**, open the switch.

I = ...

V = ...

[2]

(c) Calculate the power P of the heater using the relationship $P = I V$.

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P = ... [1]

(d) (i) Measure and record the initial temperature θ_0 of the water in the beaker.

θ_0 = ...

(ii) Close the switch and **at the same time** start the stopwatch.
Over a period of 5 minutes, record, in a table, the temperature θ of the water and the time t on the stopwatch. Include the result from **(d)(i)** in your table.

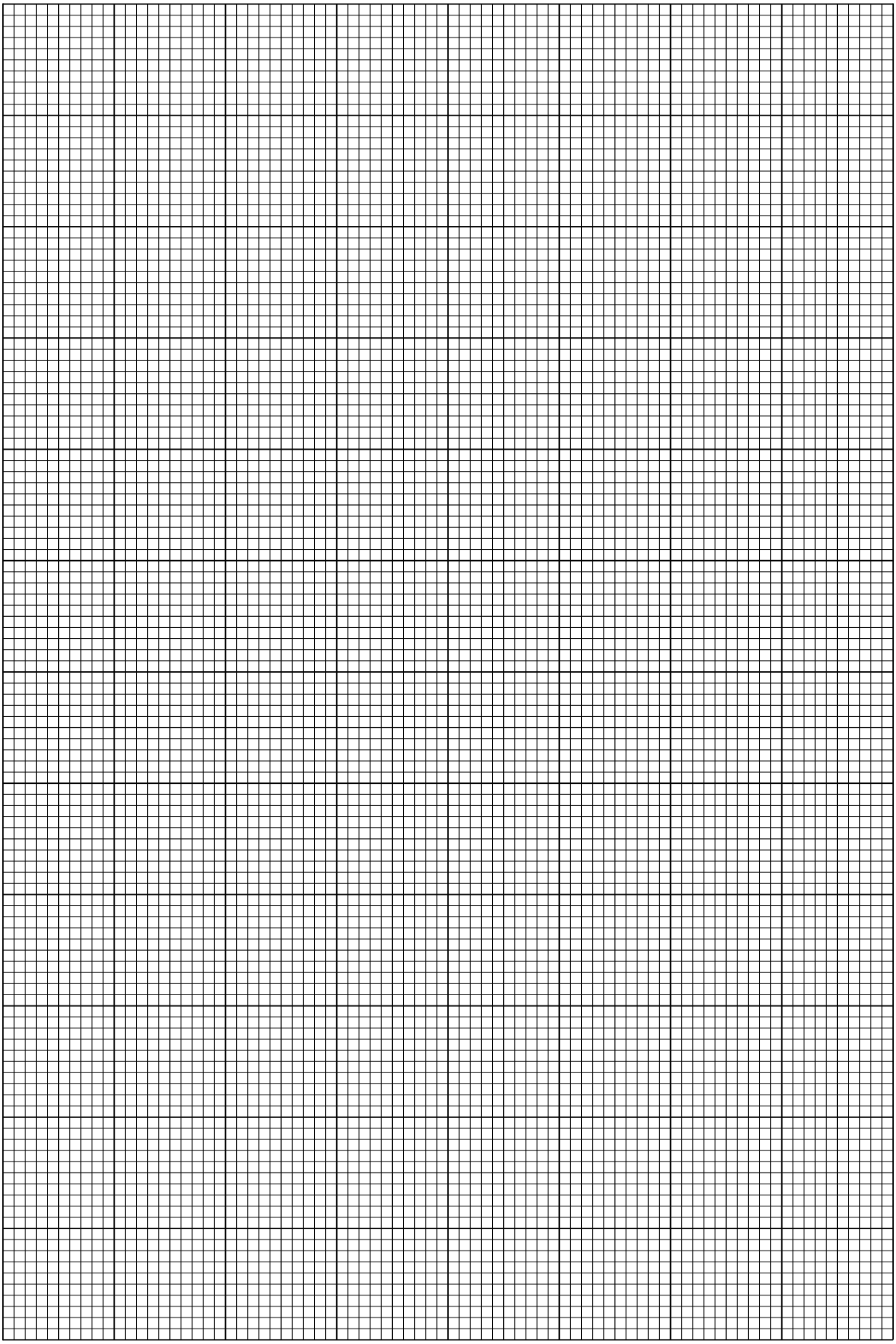
[4]

(e) Using the grid opposite, plot a graph of θ / °C against t / s. Draw a straight line of best fit through your points. [4]

(f) Determine the gradient of the line of best fit.

gradient = ... [2]

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[Total: 15]

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