UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2816502471

PHYSICS **5054/41**

Paper 4 Alternative to Practical **October/November 2011**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

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 soft 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.

You may lose marks if you do not show your working or if you do not use appropriate units.

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 **9** printed pages and **3** blank pages.

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[Turn over

1 A long pendulum is attached to the ceiling, as shown in Fig. 1.1.

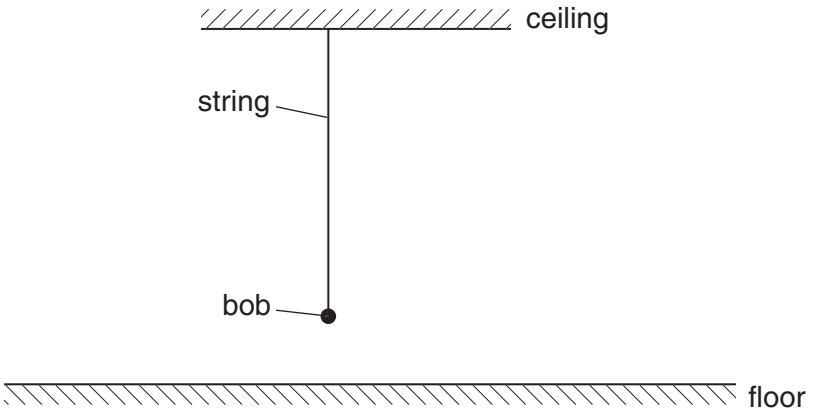


Fig. 1.1

A student performs an experiment to investigate the relationship between the time for one complete swing of the pendulum bob and its height above the floor.

(a) The vertical distance h of the bottom of the pendulum bob above the floor is measured. Mark and label on Fig. 1.1,

(i) the vertical distance h, [1]

(ii) the position of the eye of the observer when measuring h. [1]

(b) The pendulum is made to swing freely and a stopwatch is used to determine the time t_5 for 5 complete swings.

The student takes a series of readings of t_5 for different values of h.
Values of h and t_5 are recorded in Fig. 1.2.

h/cm	t_5/s	T/s	T^2/s^2
5.0	15.31		
15.0	14.96		
25.0	14.59		
35.0	14.23		
45.0	13.87		
55.0	13.49		

Fig. 1.2

Another student states that measuring the time for 50 complete swings is better.

(i) Suggest one disadvantage of timing 50 complete swings.

.....[1]

(ii) Fig. 1.2 also contains columns for the time T for one complete swing and for T^2.
Complete Fig. 1.2.
Give the values of T^2 to three significant figures. [3]

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(iii) On Fig. 1.3, plot a graph of T^2 / s^2 on the *y*-axis against *h* / cm on the *x*-axis. Start your axes from $T^2 = 7.0\ s^2$ and $h = 0$. Draw the line of best fit.

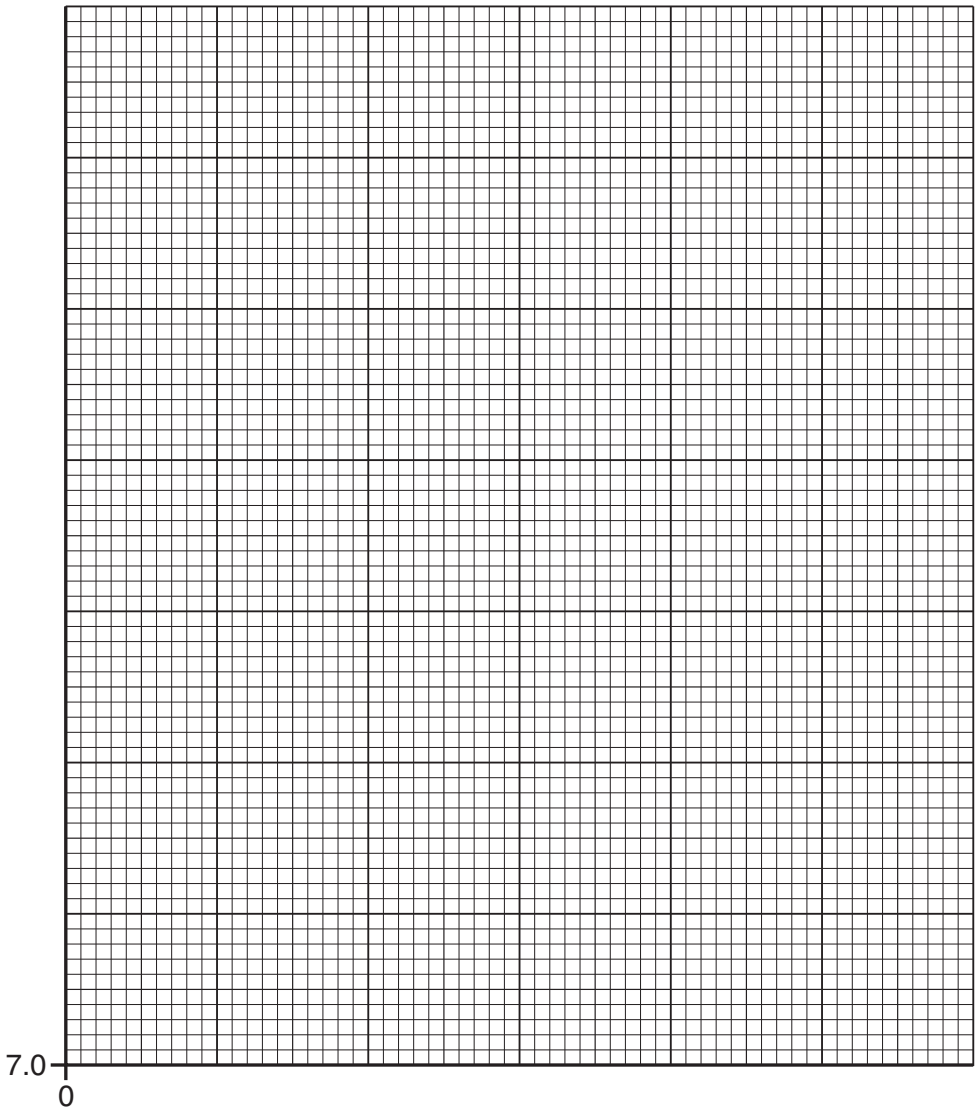


Fig. 1.3

[4]

(iv) Describe the shape of your graph.

.....

.....[1]

2 A straw balance is used to measure the mass of a length of hair.

Fig. 2.1 shows a straw balance.

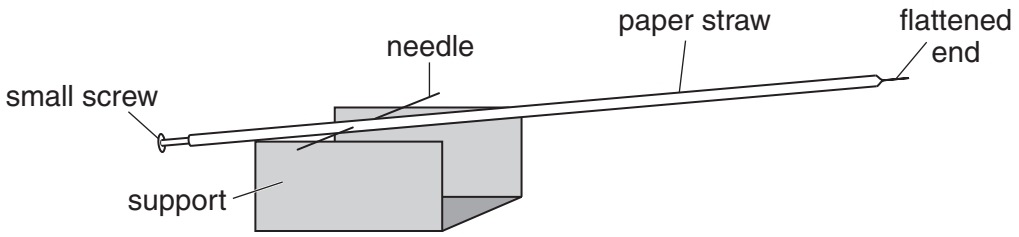


Fig. 2.1

The straw is flattened at one end and has a small screw inserted into the other end.
A needle is pushed through the straw to balance the straw on a support.

When a mass is placed on the flattened end of the straw, that end moves down.
The larger the mass, the more it moves down. The distance moved down is directly proportional to the mass.

(a) The height of the flattened end is adjusted by moving the screw into or out of the straw.
State what happens to the flattened end when the screw is moved into the straw.

.....[1]

(b) The flattened end of the straw is placed in front of a vertical scale marked in centimetres.
With nothing on the flattened end, it points to 0 on the scale, as shown in Fig. 2.2.

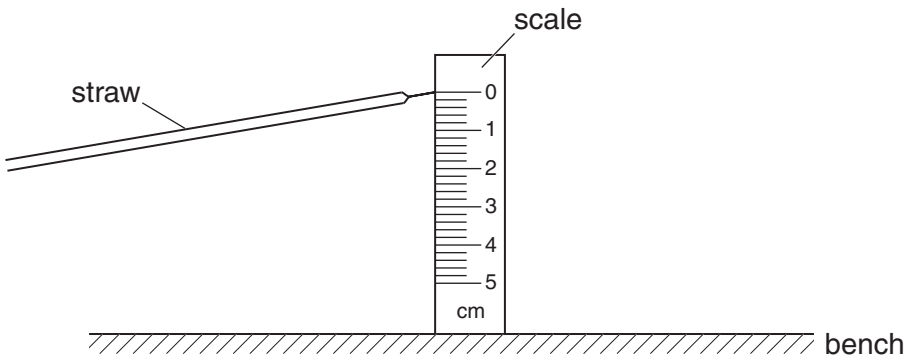


Fig. 2.2

In order to use the straw balance to measure mass, the scale can be marked in grams.
Explain how this is done.

.....

.....[1]

(c) (i) The student places a 2 mm square of graph paper on the flattened end of the straw. The end of the straw goes down, as shown in Fig. 2.3.

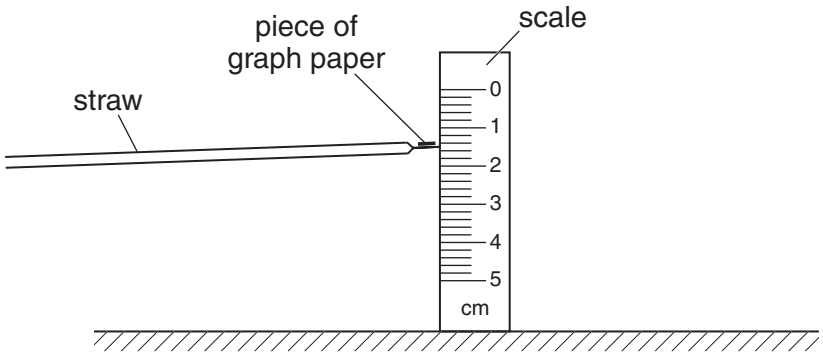


Fig. 2.3

State the reading on the scale.

reading = ... cm [1]

(ii) The graph paper is removed and a length of hair is placed on the end of the straw, as shown in Fig. 2.4.

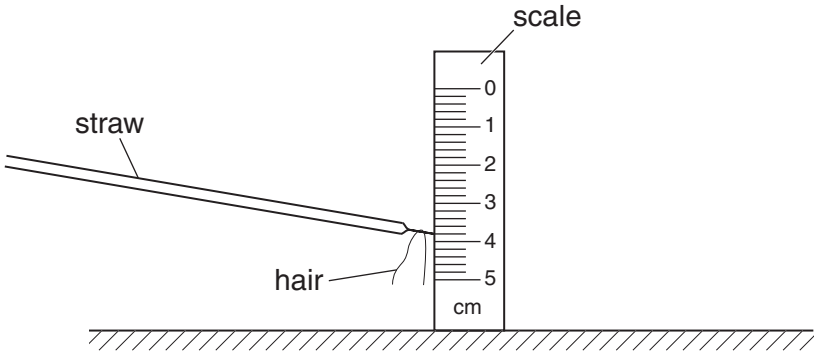


Fig. 2.4

State the new reading on the scale.

new reading = ... cm [1]

(iii) The student is told by a teacher that the piece of graph paper has a mass of 0.30 mg. Calculate the mass of the hair.

mass = ... mg [1]

(d) Suggest one advantage of a straw balance when compared with an electronic digital balance.

.....

.....[1]

3 A cathode-ray oscilloscope (c.r.o.) is used to check the voltage of a cell.
Fig. 3.1 shows the cell in a simple circuit and also the front of the c.r.o.

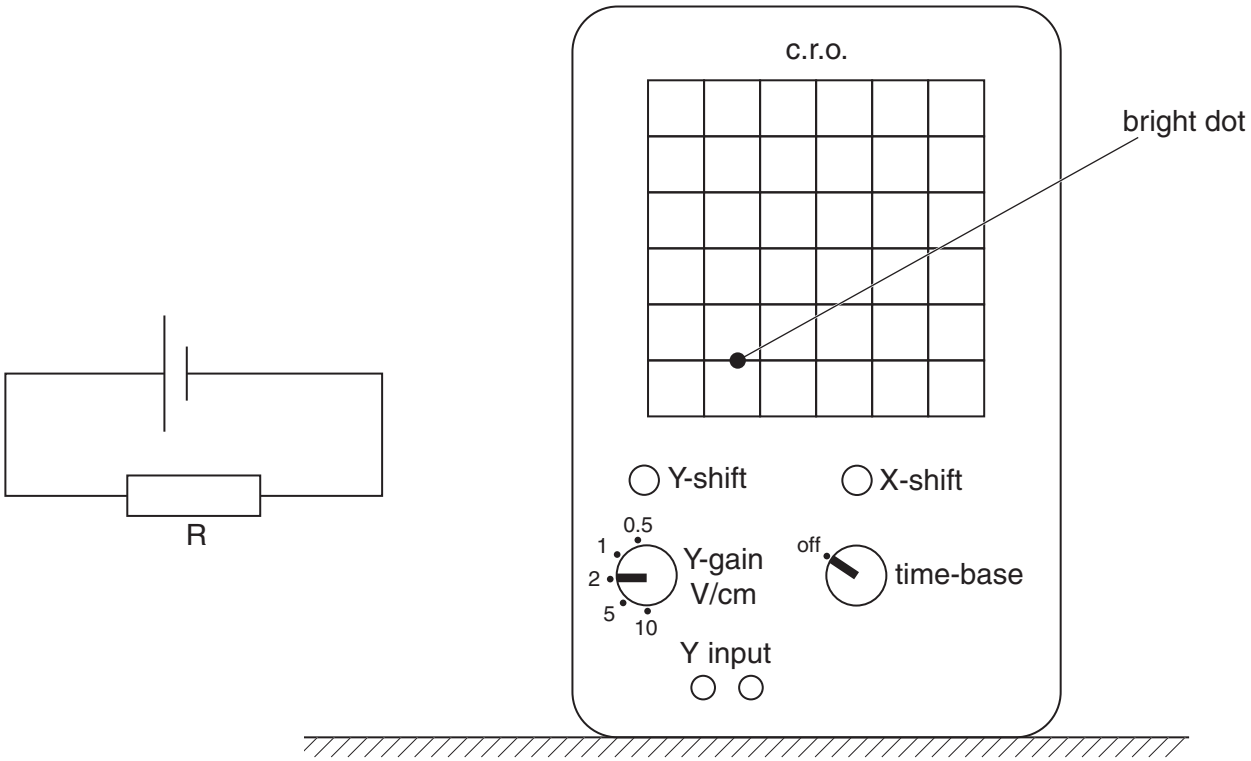


Fig. 3.1

The c.r.o. is switched on and the time-base is switched off.
A bright dot is seen on the screen, as shown in Fig. 3.1.

(a) State which controls are used to move the dot to the centre of the screen.

.....

.....[1]

(b) On Fig. 3.1, draw connections from the circuit to the c.r.o. so that the voltage of the cell can be measured. [1]

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(c) The dot is now in the centre of the screen.
Fig. 3.2 shows the dot on the screen of the c.r.o. before and after the cell is connected.

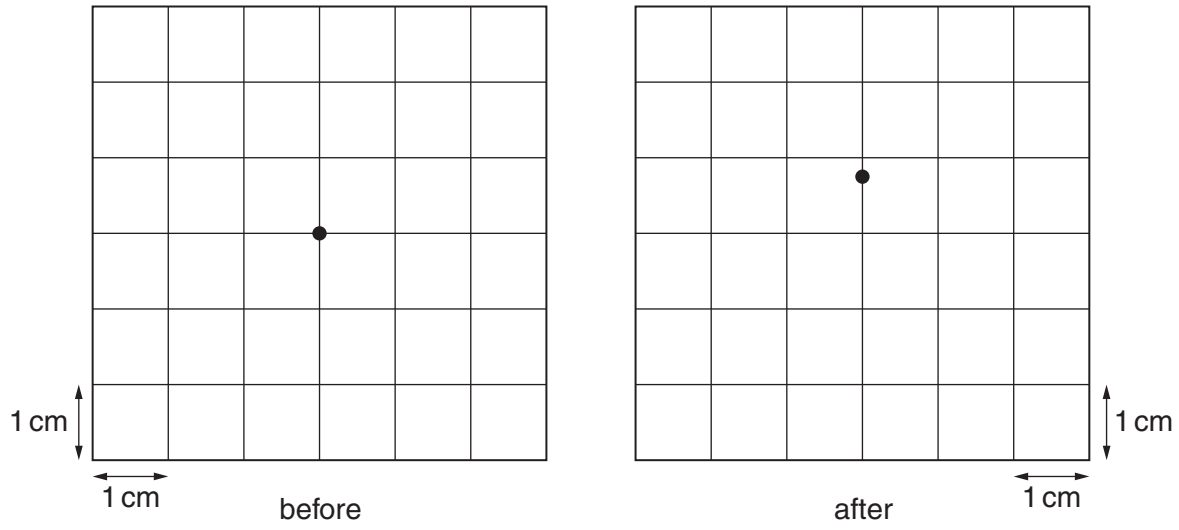


Fig. 3.2

(i) Use Fig. 3.1 to state what is represented by 1 cm on the vertical axis on the c.r.o.

.....[1]

(ii) Determine the voltage of the cell.

voltage = ...[1]

(d) Describe and explain what is observed when

(i) the connections from the circuit to the c.r.o. are reversed,

.....

.....[1]

(ii) the time-base is switched on.

.....

.....[1]

4 A student investigates the refraction of light through a parallel-sided glass block.

Fig. 4.1 shows the student's diagram. A line represents a ray of light arriving at the upper surface of the block.
The student forgets to mark the lower surface of the block.
The student draws two crosses M_1 and M_2 on the path of the emergent ray.

(a) (i) On Fig. 4.1, draw the normal through the point where the ray enters the block. [1]

(ii) Mark the angle of incidence and label it *i*. [1]

(iii) Measure the angle of incidence *i*.

i = ...[1]

(b) The distance between the upper surface and the lower surface of the block is 5.0 cm.

On Fig. 4.1,

(i) draw the lower surface of the block, [1]

(ii) complete the path of the emergent ray from the lower surface of the block through M_1 and M_2, [1]

(iii) complete the path of the ray within the block. [1]

(c) Measure the angle of refraction *r* inside the block.

r = ...[1]

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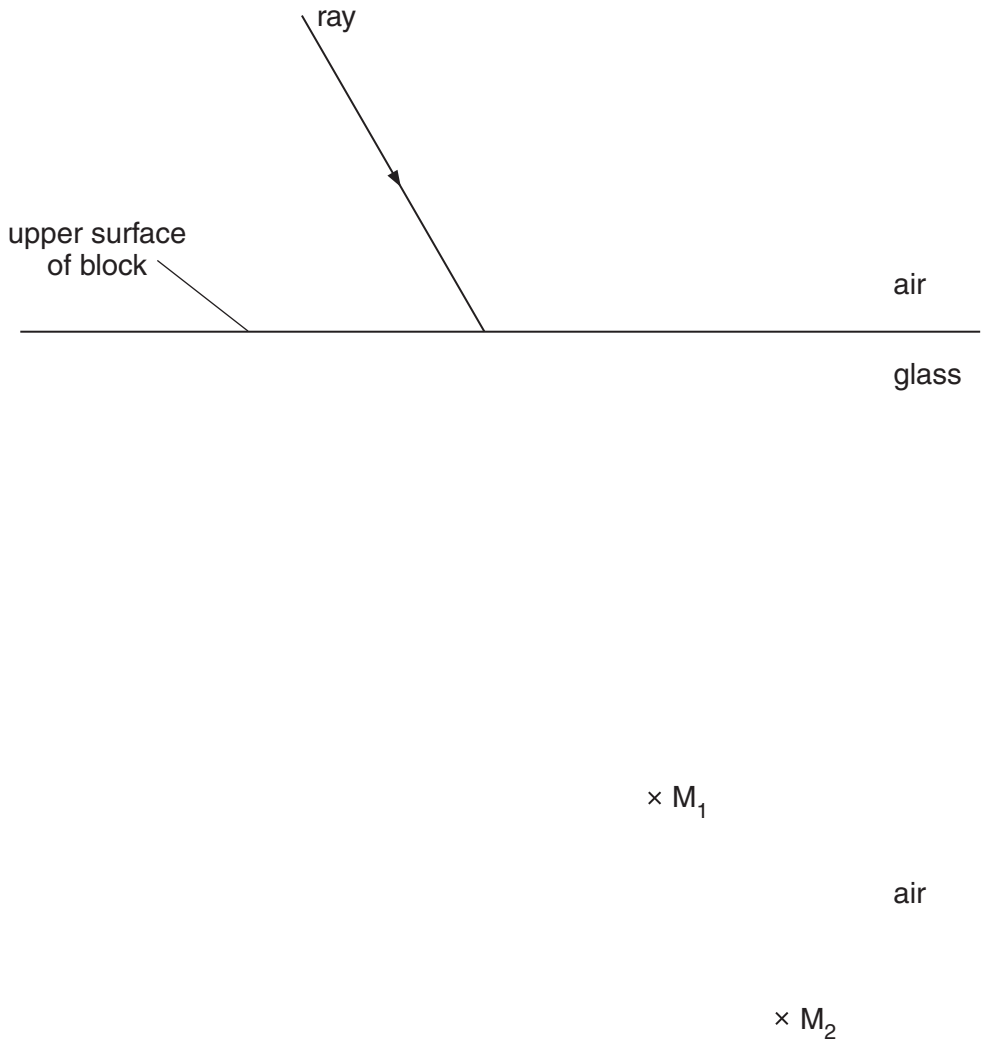


Fig. 4.1 (full size)

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