Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

PHYSICS **5054/04**

Paper 4 Alternative to Practical

October/November 2003

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 in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
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.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

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1	
2	
3	
4	
5	
Total	

This document consists of **11** printed pages and **1** blank page.

MML 4505 11/02 S53412/2

UNIVERSITY of CAMBRIDGE Local Examinations Syndicate

For Examiner's Use

1 When a ray of light is incident on a rectangular transparent block at an angle of incidence *i*, the ray of light is refracted. The emergent ray is displaced sideways by a distance *t*.

A student is investigating how *t* depends on the angle of incidence *i*. The apparatus is shown in Fig. 1.1.

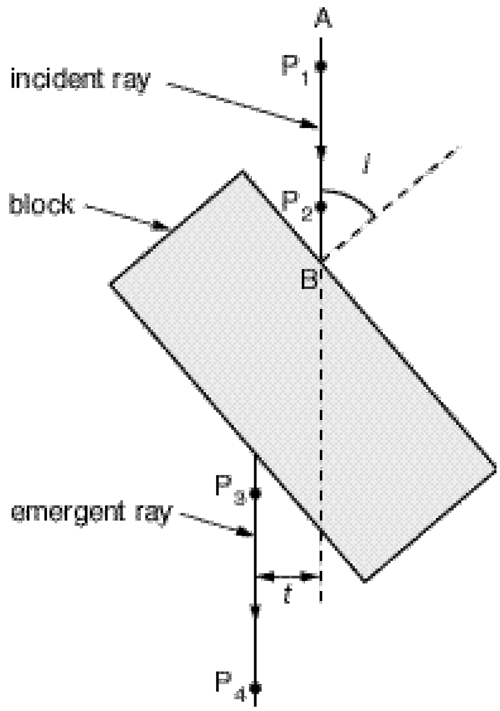

Fig. 1.1

The line AB represents the direction of an incident ray at an angle of incidence of 50°. Two pins P_1 and P_2 are inserted to show the direction of the incident ray. The direction of the emergent ray is found by aligning P_1 and P_2, as seen through the block, with two more pins P_3 and P_4.

The displacement of the ray is measured and both *i* and *t* are recorded in a tabl e. The experiment is repeated with different values for *i*.

(a) Why is it important that the pins P_1, P_2, P_3 and P_4 are standing perpendicular to the piece of the paper?

....

....

.... [2]

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(b) In the space below, draw a table in which you could record the results of the experiment. Do not write any numerical values in the table.

[1]

(c) Fig. 1.2 shows a sketch graph of the results obtained for a glass block.

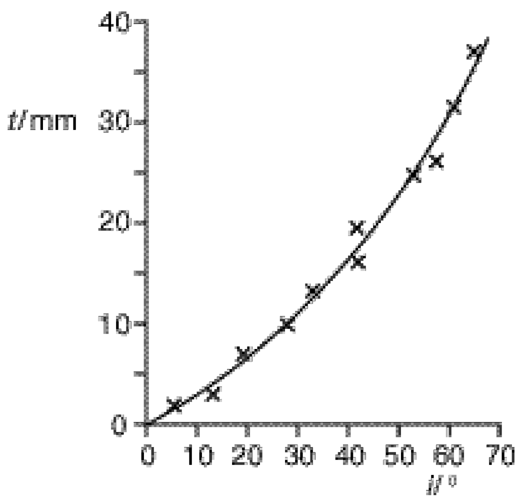

Fig. 1.2

(i) Using the graph, obtain an estimate for the value for t when i = 10°.

t = ...

(ii) Suggest two reasons why some of the points do **not** lie on the curve.

1 ....

....

....

2 ....

....

....

[3]

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2 A pendulum of length l = 250 mm is attached to a thread supported from two points A and B on a rule, as shown in Fig. 2.1.

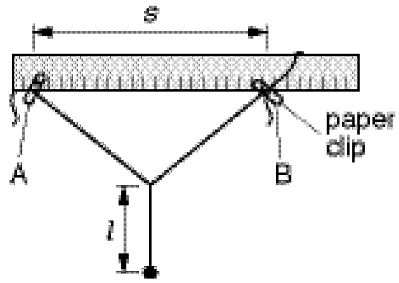

Fig. 2.1

The bob is pushed away from you so that the pendulum swings backwards and forwards.

The apparatus is used to investigate how the time T for one oscillation depends on the value of s. Different values of s are obtained by moving the paper clip so that the point B is at different places on the rule.

(a) **(i)** Describe how you would determine a precise value for the time T for one oscillation when its value is about 1 s.

....

....

....

....

(ii) State where you would place your eye when observing the pendulum and give a reason for your choice of position.

position ....

....

reason ....

....

....

[4]

For Examiner's Use

(b) To obtain different values of *s*, the thread is released from the paper clip and a new position for B is used. The clip is moved to hold the thread at the new place for B. For all the values of *s*, the length of thread between A and B is equal to 800 mm.

Suggest how you would ensure that the length of thread between A and B is always 800 mm. You may draw a diagram.

....

.... [1]

(c) A clamp and stand hold the rule shown in Fig. 2.1. How would you check that this rule is horizontal? You may draw a diagram.

....

.... [1]

[Turn over

For Examiner's Use

3 The voltmeter shown in Fig. 3.1 is used to determine the potential difference *V* across the resistor **R**.

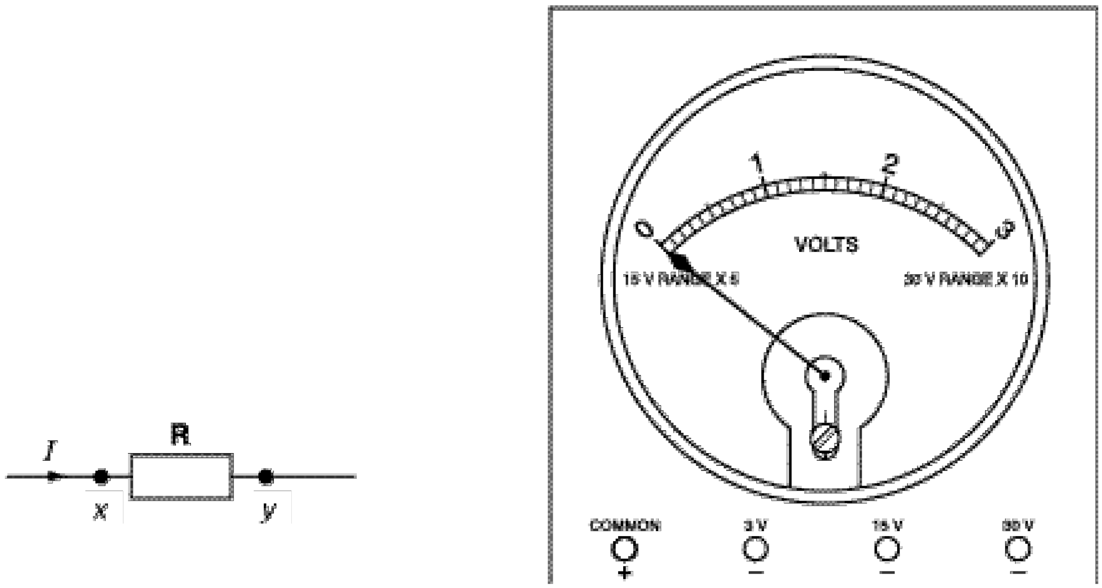

Fig. 3.1

(a) The voltmeter has three ranges, 3 V, 15 V and 30 V. There are three terminals for these ranges and one common terminal.

(i) Why is the common terminal marked with a + sign?

....

(ii) The potential difference across the resistor **R** is 10 V. On Fig. 3.1, draw lines to show the connections you would make between the voltmeter and the terminals *x* and *y* of the resistor.

(iii) Explain your connection from *x* to the voltmeter terminal.

....

....

[3]

(b) Part of the voltmeter scale is shown in Fig. 3.2. Two scale divisions are labelled p and q.

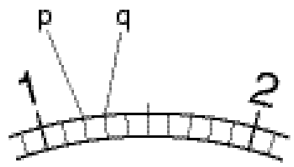

Fig. 3.2

State what change in the potential difference would make the pointer move from p to q

(i) when using the 0 V to 3 V range, ...

(ii) when using the 0 V to 30 V range. ....
[2]

(c) On the voltmeter face shown in Fig. 3.1, draw a line to represent the pointer when it indicates a potential difference of 22.5 V. [1]

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4 A large cylindrical tank of water is being emptied by filling cans. The apparatus used is shown in Fig. 4.1.

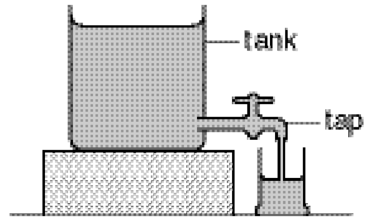

Fig. 4.1

The tap is opened at time $t = 0$. As soon as a can is filled it is replaced by another can and the time t is noted.

During the experiment a record of time and volume of water **removed** from the tank is kept in a table.

For each can filled, the volume V of water **left** in the tank is calculated. The values for V are recorded.

A graph of V/cm^3 against t/s is shown in Fig. 4.2.

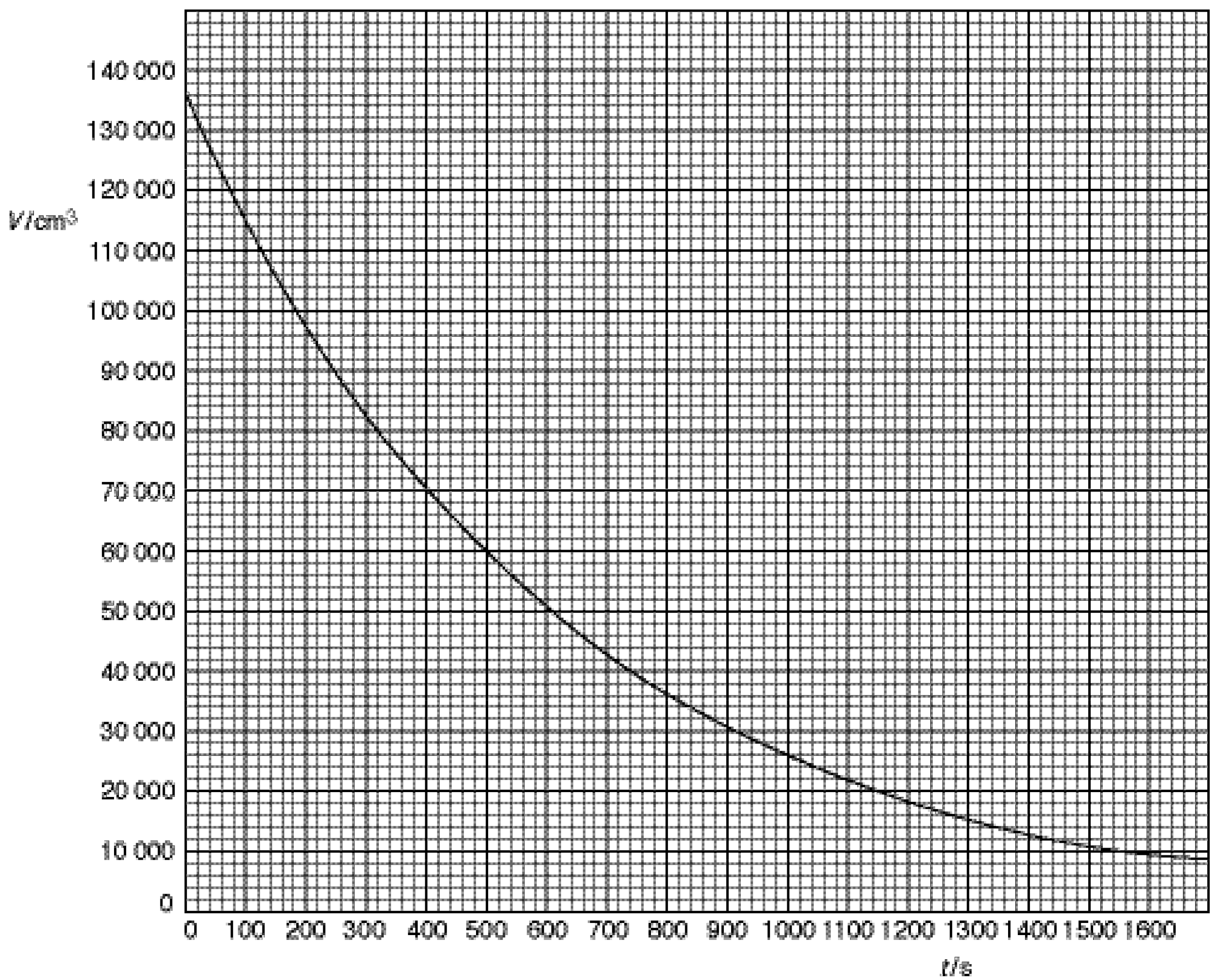

Fig. 4.2

(a) The volume V left in the tank decreases as t increases.

(i) Mark the graph to show

1. the **change** in V from $t = 0$ to $t = 200$ s,

2. the **change** in V from $t = 1300$ s to $t = 1500$ s.

(ii) Use your answer to **(i)** above to describe how the **change** of V varies with t.

....

....

.... [3]

(b) **(i)** The volume of water in the tank at the beginning of the experiment is V_0.

Use the graph to complete the table in Fig. 4.3.

t / s	V / cm^3	$\frac{V}{V_0}$
0		
420		
840		
1260		

Fig. 4.3

(ii) How long does it take for any volume of water in the tank to decay to one half of its initial value?

time = ... [3]

For Examiner's Use

5 A known mass X of brass at a temperature of 100 °C is placed into 30 cm^3 of cold water at room temperature 16.7 °C. The highest temperature Y reached by the cold water is measured and recorded. The apparatus is shown in Fig. 5.1.

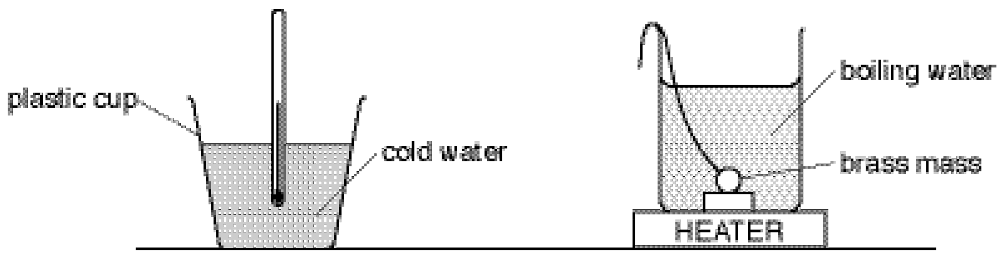

Fig. 5.1

The experiment is repeated using different masses of brass to obtain five sets of readings of Y and X. The results of the experiment are shown in Fig. 5.2.

Y / °C	21.8	25.4	27.5	31.1	34.5
X / g	20	40	50	70	90

Fig. 5.2

(a) On the graph grid on page 11, plot the graph of Y / °C (y-axis) against X / g (x-axis).

Start your y-axis at the point Y / °C = 21 and your x-axis at the point X / g = 10. The graph is slightly curved. The temperatures are given to the nearest 0.1 °C. Choose a scale that allows you to plot each point to 0.1 °C. [3]

(b) The brass is heated for at least 60 s. State why this is good experimental practice.

....

.... [1]

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(c) The thermometer shown in Fig. 5.3 is full size. Before taking a reading, the thermometer is held so that the mercury thread is just touching the temperature scale, as shown.

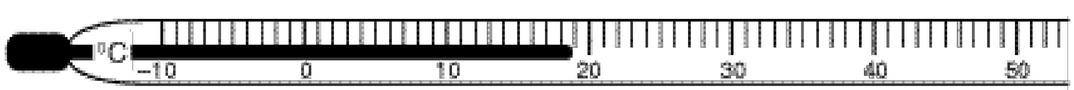

Fig. 5.3

(i) Estimate the temperature reading shown by the thermometer.

temperature = ... °C

(ii) State two things you could do to estimate the temperature as accurately as possible.

1 ....

....

2 ....

....
[2]

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