UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2486875338

PHYSICS **5054/31**

Paper 3 Practical Test **May/June 2012**

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 **11** printed pages and **1** blank page.

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Section A

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Answer **all** questions in this section.

1 *In this experiment, you will determine the mass of a piece of modelling clay.*

You have been provided with
- a piece of modelling clay,
- a metre rule,
- a knife-edge,
- a 50 g mass.

(a) Balance the metre rule on the knife-edge. The knife-edge shows the position of the centre of mass of the rule. Record the position of the knife-edge.

position of knife-edge = ...[1]

(b) Place the modelling clay at one end of the metre rule and adjust the position of the 50 g mass at the other end until the rule balances. The knife-edge must remain below the centre of mass of the rule. The arrangement is shown in Fig. 1.1.

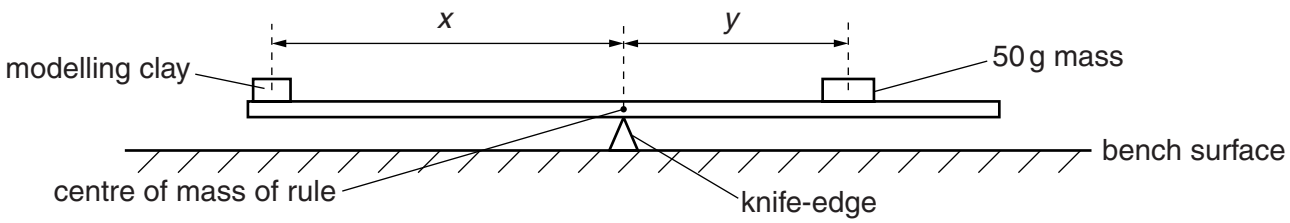


Fig. 1.1

(i) Determine the horizontal distance *x* from the centre of the modelling clay to the knife-edge and the horizontal distance *y* from the knife-edge to the centre of the 50 g mass.

x = ...

y = ...
[2]

(ii) Explain how you ensured that your measurement of *y* was taken to the centre of the 50 g mass.

.....

.....

.....

.....[1]

(iii) Calculate the mass M of the modelling clay using the relationship

$$M = \frac{50\,y}{x} \text{ gram.}$$

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M = ...[1]

[Total: 5]

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2 *In this experiment, you will investigate the motion of a mass attached to the end of a metre rule.*

You have been provided with

- a metre rule clamped horizontally at the edge of the bench, with a mass attached to the rule at its free end,
- a pin in a cork,
- a stand, boss and clamp to hold the pin,
- a stopwatch.

(a) Fig. 2.1 shows the metre rule clamped horizontally at the edge of the bench. The Supervisor has attached a mass close to the free end of the rule.

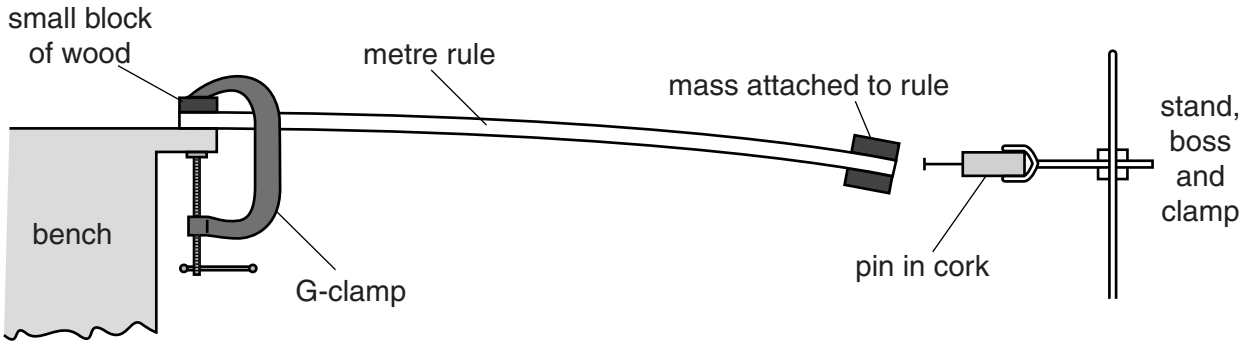


Fig. 2.1

The pin is clamped at the height of the equilibrium position of the end of the metre rule, as shown in Fig. 2.1. When the rule is pulled downwards a small distance and released, it vibrates up and down. One complete vibration is from the position of the pin, up to the highest position, down to the lowest position and back up to the position of the pin, as shown in Fig. 2.2.

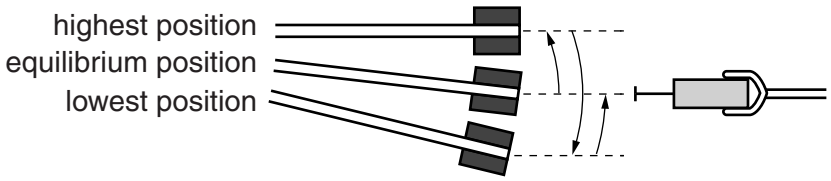


Fig. 2.2

(i) The time for 20 complete vibrations is t_1. Take measurements to determine an accurate value of t_1.

t_1 = ...[1]

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(ii) Calculate the time T_1 for one vibration.

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T_1 = ...[1]

(b) Loosen the clamp and adjust the rule so that the 15.0 cm mark on the rule is at the edge of the bench. Tighten the clamp.

(i) Determine an accurate value for the time t_2 taken for 20 complete vibrations with the rule in this new position.

t_2 = ...

(ii) Calculate the time T_2 for one vibration.

T_2 = ...
[1]

(c) Calculate the value of $\frac{T_2}{T_1}$.

$\frac{T_2}{T_1}$ = ...[2]

[Total: 5]

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3 *In this experiment, you will determine the specific heat capacity of the metal from which a mass is made.*

You have been provided with

- a 100 g mass with a length of string attached,
- a supply of hot water,
- a 250 cm^3 beaker for use with hot water, labelled H,
- a cover for this beaker,
- a stirrer,
- a supply of water at room temperature,
- a second 250 cm^3 beaker for use with cold water, labelled C,
- a 100 cm^3 measuring cylinder,
- two thermometers.

(a) Pour 100 cm^3 from the supply of water at room temperature into the measuring cylinder. Pour this volume of water into the beaker labelled C. Measure the temperature θ_1 of the water in this beaker.

θ_1 = ...[1]

(b) Place the 100 g mass into the beaker labelled H. Ensure the string hangs over the edge of the beaker. Add **hot** water to beaker H up to the level of the top of the label. Place the cover over the beaker and insert the stirrer and second thermometer as shown in Fig. 3.1.

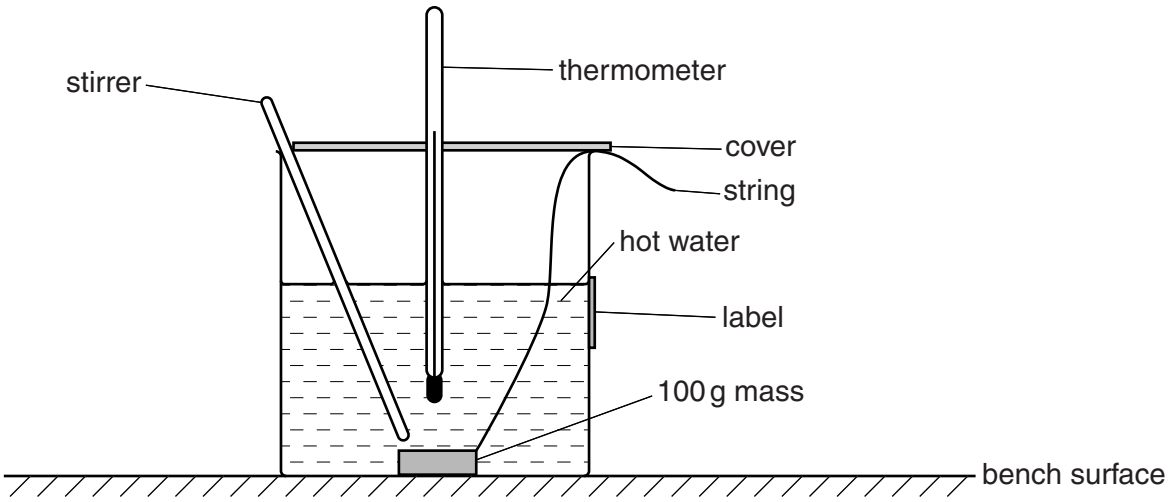


Fig. 3.1

(i) Stir the water for approximately 1 minute. Measure the temperature θ_2 of the water in beaker H and quickly transfer the mass from beaker H to beaker C. Try not to transfer any hot water.

θ_2 = ...[1]

(ii) Record the **maximum** temperature θ_3 reached by the water in beaker C.

θ_3 = ...[1]

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(c) The specific heat capacity c_M of the metal is found using the relationship

$$c_M = c_W \frac{(\theta_3 - \theta_1)}{(\theta_2 - \theta_3)}$$

where the specific heat capacity c_W of water is 4.2 J/(g °C).

Calculate c_M.

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c_M = ...[2]

[Total: 5]

Section B

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4 *In this experiment, you will investigate the relationship between resistance and length of a wire.*

You have been provided with a circuit consisting of

- a power supply,
- a length of resistance wire attached to a metre rule,
- an ammeter,
- a voltmeter,
- a jockey or sliding contact to connect one side of the voltmeter to the wire,
- a resistor,
- a switch,
- connecting wires,
- crocodile clips.

The circuit is shown in Fig. 4.1.

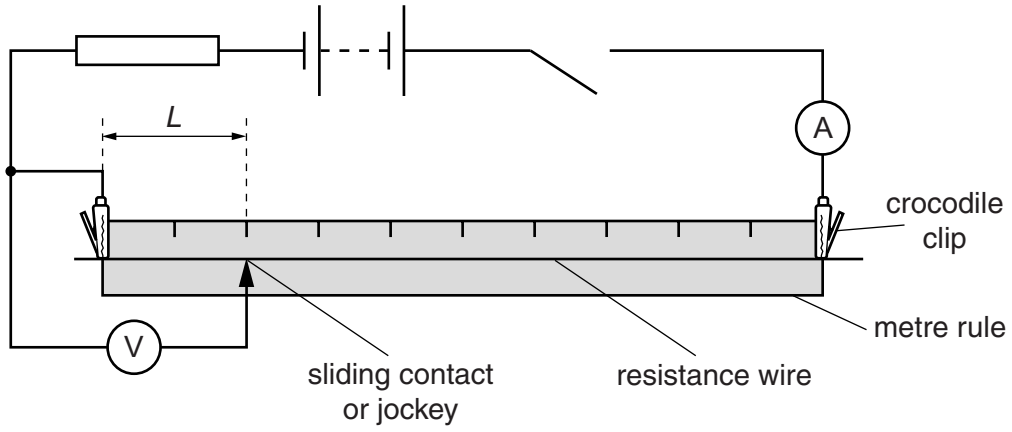


Fig. 4.1

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(a) Close the switch and place the pointed end of the sliding contact onto the wire at the 10.0 cm mark on the rule. Exert a sufficient force on the sliding contact so that a good connection is made between it and the wire.

Record

(i) the length L of wire across which the voltage is measured,

L = ...

(ii) the voltage V across the length of wire,

V = ...

(iii) the current I in the circuit.

I = ...
[2]

Open the switch.

(b) Calculate the resistance R of the length L of wire using the relationship

$$R = \frac{V}{I}.$$

R = ...[1]

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[Turn over

(c) By placing the sliding contact at different positions on the wire, repeat **(a)** and **(b)** for a wide range of values of L. Record your results for L, V, I and R in Fig. 4.2. Include the results from **(a)** and **(b)** in your table.

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Fig. 4.2

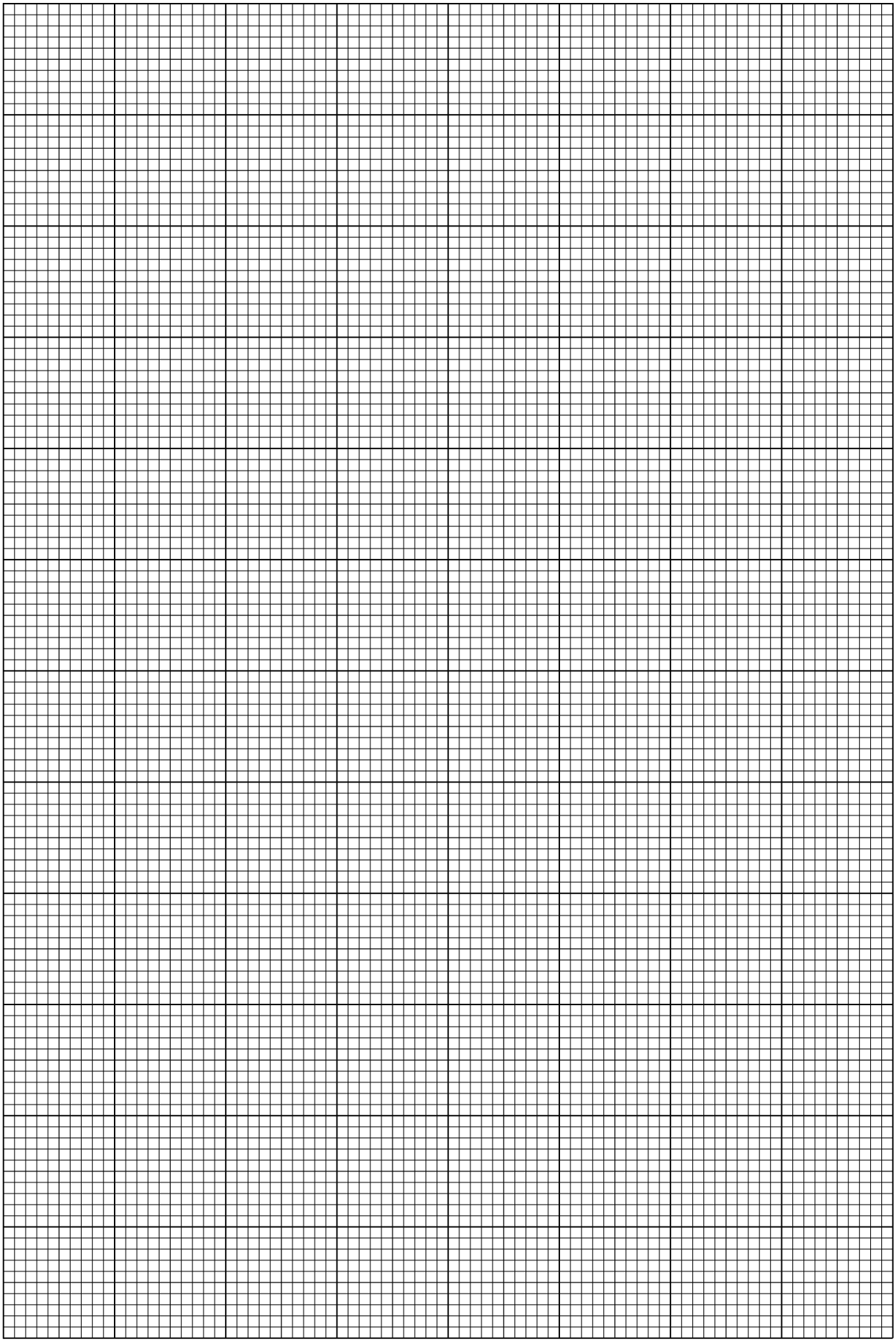
[5]

(d) Using the grid opposite, plot a graph of R / Ω against L / cm. Draw the straight line of best fit through your points. [4]

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

gradient = ...[3]

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[Total: 15]

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