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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1786328575

PHYSICS **5054/03**

Paper 3 Practical Test **May/June 2009**

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 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.
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.
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.

For Examiner's Use	
1	
2	
3	
4	
Total	

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

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International Examinations

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Section A

Answer **all** questions in this section.

1 *In this experiment, you will determine the density of the wood from which a metre rule is made.*

You have been provided with a wooden metre rule, a 100 g mass, a pivot and a 30 cm rule.

(a) Balance the rule on the pivot, in order to determine the position of the centre of mass of the rule. Measure the distance of the centre of mass from the 0.0 cm mark of the rule.

distance from 0.0 cm end of rule = ... [1]

(b) Place the 100 g mass close to the 0.0 cm end of the rule and balance the rule on the pivot, as shown in Fig. 1.1.

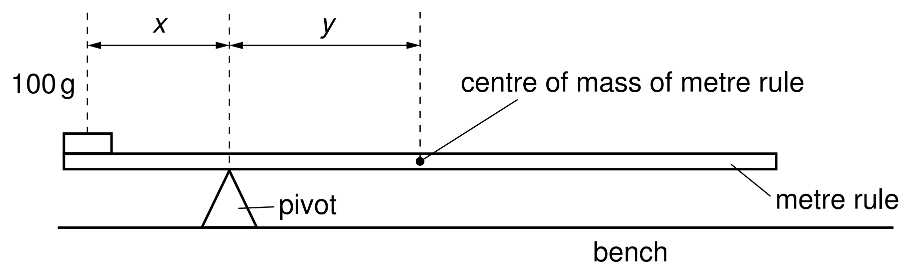

Fig. 1.1

Measure the distances x and y.

x = ...

y = ...
[1]

(c) Explain how you located accurately the centre of the 100 g mass, in order to measure x.

....

....

.... [1]

(d) Determine average values for the width w and the thickness t of the metre rule.

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w = ...

t = ... [1]

(e) **(i)** Calculate the mass M of the metre rule given that

$$M = \left(\frac{x}{y}\right) \times 100 \text{ gram.}$$

M = ... gram

(ii) Calculate the density of the material of the rule given that

$$\text{density} = \frac{M}{(l\,w\,t)}$$

where l is the length of the metre rule.

density = ... [1]

[Total: 5]

2 *In this experiment, you will investigate a light-emitting diode (LED).*

You have been provided with an electrical circuit consisting of a power supply, a switch, a light-emitting diode (LED), an ammeter, a voltmeter and a 330 Ω resistor. You also have a 10 000 Ω resistor, which you will later connect into the circuit.

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

[1]

(b) Close the switch and measure the current *I* in the circuit and the potential difference *V* across the LED.

I = ...

V = ...
[2]

(c) Open the switch and connect the 10 000 Ω resistor in series with the 330 Ω resistor in the circuit. Close the switch and measure new values for *I* and *V*.

I = ...

V = ...
[1]

(d) Using your answers to **(b)** and **(c)**, explain what happened to the resistance of the LED when the 10 000 Ω resistor was added to the circuit.

....

....

.... [1]

[Total: 5]

3 *In this experiment, you will determine the specific latent heat of fusion of ice.*

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You have been provided with a supply of crushed ice, a polystyrene or plastic cup, a supply of water at room temperature, a measuring cylinder, a 5 ml plastic spoon, a thermometer, a stirrer and some paper towels.

(a) (i) Use the measuring cylinder to take 80 cm^3 of water from the supply of water at room temperature. This corresponds to a mass m_R = 80 g of water. Pour the 80 cm^3 of water into the polystyrene or plastic cup.

Measure the temperature θ_1 of this water.

θ_1 = ...

(ii) Take a 5 ml spoonful of crushed ice, pour off excess water, and dry the ice with a paper towel. Then place the ice into the cup.

Stir the mixture and note the temperature when all the ice has melted. If this is still above 15 °C, add a second spoonful of ice. Stir the mixture and note the temperature when all the ice has melted. Continue adding spoonfuls of ice until the temperature of the water after the ice has melted is below 15 °C.

Record the final temperature θ_2 of the water.

θ_2 = ...
[1]

(b) (i) Carefully pour the water from the cup into the empty measuring cylinder and measure the final volume of water.

final volume of water = ...

(ii) Determine the volume of water that has been produced from the melted ice.

volume of water from melted ice = ...

(iii) Given that 1.0 cm^3 of water has a mass of 1.0 g, calculate the mass of ice m_I that has melted.

m_I = ...
[1]

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(c) **(i)** Calculate the thermal energy (heat) Q_1 lost by the water that was initially at room temperature, given that

$$Q_1 = m_R\, c_W\, (\theta_1 - \theta_2)$$

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

Q_1 = ... J

(ii) Calculate the thermal energy Q_2 gained by the water formed from the melted ice, given that

$$Q_2 = m_I\, c_W\, \theta_2\, .$$

Q_2 = ... J
[1]

(d) Calculate the specific latent heat of fusion L of ice, given that

$$L = \frac{(Q_1 - Q_2)}{m_I}\, .$$

L = ... [2]

[Total: 5]

Section B

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4 *In this experiment, you will investigate the bending of a beam when a mass is hung from the centre of the beam.*

You have been provided with a metre rule, two metal support rods, a 0.500 kg mass (a 100 g hanger with four 100 g masses), a loop of thread from which the mass may be suspended, a half-metre rule, a stand, boss and clamp to support the half-metre rule and a set square.

Do not adjust the height of the support rods in the experiment.

(a) Place the metre rule on the support rods, as shown in Fig. 4.1.

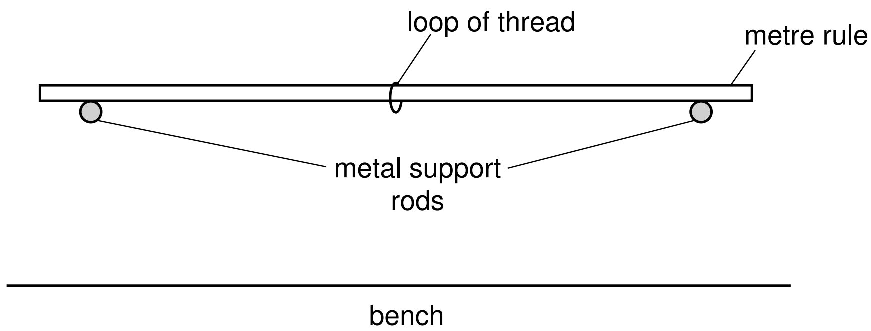

Fig. 4.1

The support rods should be placed at the 5.0 cm and 95.0 cm marks on the metre rule, and the loop of thread at the 50.0 cm mark.

(b) Clamp the half-metre rule vertically with its scale facing towards you. The zero end of the half-metre rule should be uppermost. The half-metre rule should be placed behind the centre of the metre rule.

(c) Suspend a mass M = 0.500 kg from the centre of the metre rule, as shown in Fig. 4.2.

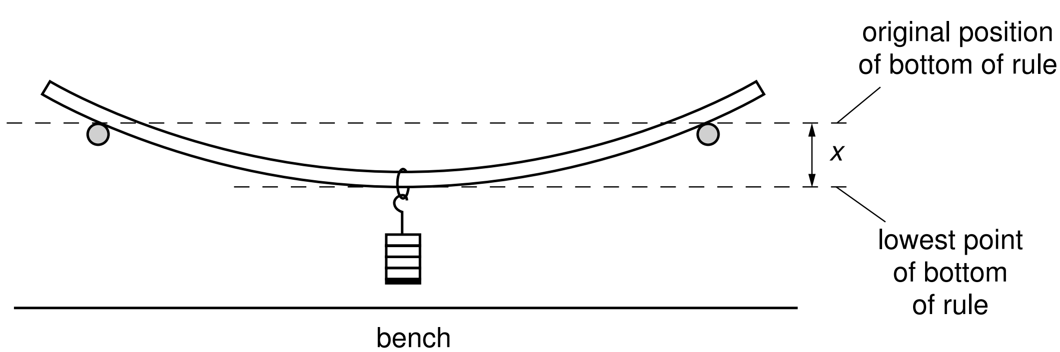

Fig. 4.2

Determine the vertical displacement x of the centre of the rule, as shown in Fig. 4.2.

Show the two readings that you took from the half-metre rule in order to determine *x*.

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x = ... [2]

(d) Explain how you ensured that *x* was determined as accurately as possible.

....

....

....

.... [2]

(e) Repeat part **(c)** for a range of values of *M*.

Do not alter the position of the support rods when these new displacements are determined.

Record your values of *x* in cm and *M* in kg in the table below. The additional columns are for you to use to record readings taken from the half-metre rule.

[4]

(f) Using the grid opposite, plot a graph of *x* / cm on the *y*-axis against *M* / kg on the *x*-axis. [4]

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(g) Draw the line of best fit. Determine the gradient of this line.

gradient = ... [2]

(h) Describe qualitatively how the vertical displacement x of the rule depends on M.

....

....

.... [1]

[Total: 15]

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