UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

8622647548

PHYSICS **5054/31**

Paper 3 Practical Test **October/November 2010**

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

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International Examinations

[Turn over

Section A

Answer **all** questions in this section.

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1 *In this experiment, you will estimate the temperature of a Bunsen flame.*

You have been provided with a Bunsen burner, a 10 g mass, tongs, a supply of water at room temperature, a stirrer, a measuring cylinder, a glass beaker, a thermometer and a stand, boss and clamp to hold the thermometer.

(a) (i) Using the measuring cylinder, transfer 50 cm^3 of water from the supply to the beaker. Clamp the thermometer so that the thermometer bulb is covered by the water in the beaker.
Record the temperature θ_1 of the water.

θ_1 = ...

(ii) Adjust the Bunsen burner so that a blue flame is produced. Holding the 10 g mass in the tongs, place the mass in the centre of the Bunsen flame. Hold in this position for approximately 1 minute.
Quickly transfer the mass to the water and record the highest temperature θ_2 reached by the water.

The 10 g mass will be very hot; it should only be held with the tongs.

θ_2 = ...
[2]

(b) The heat transferred from one object to another is given by the equation

change in thermal energy = mass × specific heat capacity × change in temperature.

A volume of 50 cm^3 of water has a mass of 50 g. The specific heat capacity of water is 4.2 J / (g °C) and the specific heat capacity of the 10 g mass is 0.42 J / (g °C).

(i) Calculate the heat gained by the water in the beaker.

heat gained = ...

(ii) Assuming that the heat gained by the water is equal to the heat lost by the 10 g mass, calculate the fall in temperature of the mass.

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fall in temperature = ...

(iii) Hence deduce the temperature θ_B of the Bunsen flame.

θ_B = ...
[2]

(c) Suggest a reason why your value for θ_B might be lower than the actual temperature of the Bunsen flame.

....

....

.... [1]

[Total: 5]

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2 *In this experiment, you will find the position of an object formed by a plane mirror.*

You have been provided with a plane mirror in a holder, three optics pins and a soft board or polystyrene tile.

(a) (i) On Fig. 2.1, draw a normal to the line XY at the point M, towards the bottom of the page. The normal should be greater than 10.0 cm long.

(ii) Place Fig. 2.1 on top of the soft board or polystyrene tile. Place the front surface of the mirror along the line XY with the reflective surface facing the bottom of the page.
Place a pin at a distance of 10.0 cm from M along the normal. This is the object pin.

(iii) Mark the position of this pin on the page with the letter O.

[1]

(b) You are to determine the position of two reflected rays and the position of the image as accurately as possible.

(i) Look at the image of the object pin from the bottom right-hand corner of the page. Without moving your head, place another pin in line with the image. This pin is a sighting pin.
Place a second sighting pin in line with the image and the first sighting pin.
Label the positions of the sighting pins on the page with the letters P1 and P2. Remove the sighting pins.

(ii) Look at the image from a different point on the page. Repeat **(i)** and label the positions of the sighting pins P_3 and P_4. Remove the sighting pins and mirror.

(iii) Draw a line connecting points P_1 and P_2 and extend the line so that it passes behind the position of the mirror. Also draw a line connecting points P_3 and P_4 and extend this line so that it intersects the line connecting points P_1 and P_2. Label the point of intersection I.

(iv) Measure and record the perpendicular distance y from I to the line XY.

y = ...

[4]

[Total: 5]

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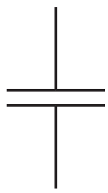
Fig. 2.1

3 *In this experiment, you will investigate a capacitor charging through a resistor.*

You have been provided with a circuit consisting of a power supply, a resistor, a capacitor, a switch and a voltmeter. You have also been provided with a stopwatch.

(a) In the space below, draw a circuit diagram of the circuit. The symbol for the capacitor has been drawn for you.



[1]

(b) **(i)** Close the switch to ensure that the capacitor has been discharged and that the voltmeter reads zero.

(ii) Open the switch and observe that the reading on the voltmeter rises as the capacitor charges.

(iii) Close the switch again to discharge the capacitor. Open the switch and start the stopwatch. Stop the stopwatch when the reading on the voltmeter is 2.0V.

Determine the **average** time t_2 taken for the capacitor to charge to 2.0V.

t_2 = ... [1]

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(c) Repeat the procedure of **(b)(iii)**. This time, stop the stopwatch when the reading on the voltmeter is 1.0V.

Determine the **average** time t_1 taken for the capacitor to charge to 1.0V.

t_1 = ... [2]

(d) Calculate $\frac{t_2}{t_1}$.

$\frac{t_2}{t_1}$ = ... [1]

[Total: 5]

Section B

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4 *In this experiment, you will investigate the bending of a wooden metre rule when masses are added to the end of the rule.*

You have been provided with a wooden metre rule that has been clamped horizontally at the edge of the bench, a 100 g mass hanger and four 100 g masses, a set square, a second metre rule and a stand, boss and clamp to support the second metre rule.

Do not adjust the position of the wooden metre rule that is clamped at the edge of the bench.

(a) Clamp the second metre rule vertically with the zero end of the rule uppermost. Position the vertical rule close to the free end of the horizontal metre rule, with its scale facing towards you, as shown in Fig. 4.1.

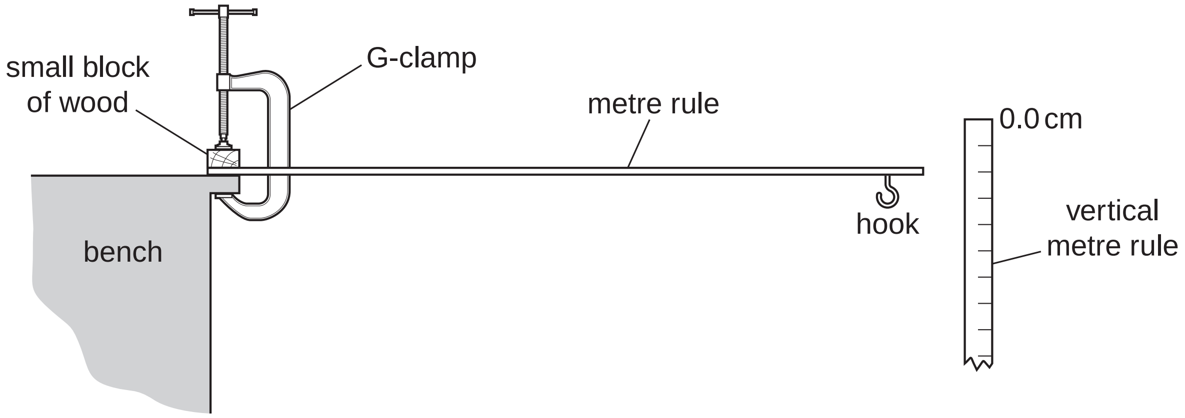

Fig. 4.1

Explain, with the aid of a diagram, how you ensured that the metre rule was vertical.

....

....

.... [1]

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(b) **(i)** Suspend the 100 g mass hanger from the small hook at the end of the horizontal rule, as shown in Fig. 4.2.

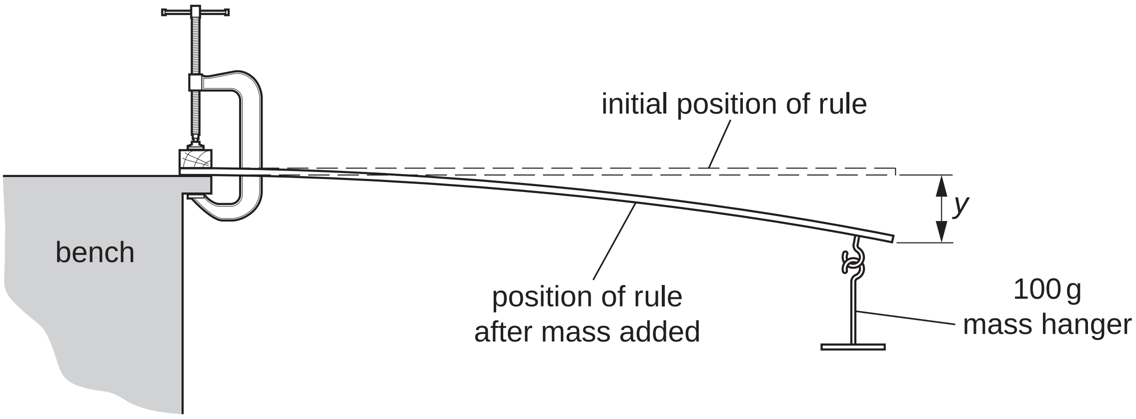

Fig. 4.2

(ii) Determine the vertical displacement *y* of the end of the horizontal rule, as shown in Fig. 4.2. Show the two readings that you took from the vertical rule in order to determine *y*.

y = ... [2]

(c) Add a further 100 g to the mass hanger and measure the total vertical displacement of the end of the horizontal rule from its starting position when no load was applied.
Record the total mass *M* suspended from the rule and the new value of *y*. Show the readings that you took in order to determine the total vertical displacement.

M = ...

y = ...
[2]

(d) Repeat **(c)** for a further three values of *M*. Record your results in a table, including your results from **(b)(ii)** and **(c)**.

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[4]

(e) Using the grid opposite, plot a graph of y/cm against M/g. Draw a straight line of best fit. [4]

(f) Determine the gradient of your graph.

gradient = ... [2]

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[Total: 15]

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