UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

9941567008

PHYSICS **5054/31**

Paper 3 Practical Test **October/November 2013**

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.

Electronic calculators may be used.
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.

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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

For Examiner's Use

Answer **all** the questions in this section.

1 *In this experiment, you will determine the density of the rubber from which a stopper (bung) is made.*

You have been provided with

- a rubber stopper,
- a 30 cm ruler.

You also have access to a top-pan balance.

Fig. 1.1 shows the stopper.

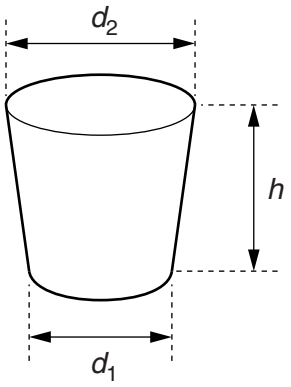


Fig. 1.1

(a) Determine, for the stopper, average values for

(i) the smallest diameter d_1,

d_1 = ...

(ii) the largest diameter d_2,

d_2 = ...

(iii) the height h.

h = ...
[2]

(b) State and explain a precaution that you took to ensure that your values of d_1 and d_2 were as accurate as possible.

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.....

.....

.....[1]

(c) **(i)** Use the top-pan balance to measure the mass m of the stopper.

m = ...

(ii) Calculate z, where $z = \frac{d_1 + d_2}{4}$.

z = ...

(iii) Calculate an approximate value of the density ρ of the rubber using

$$\rho = \frac{m}{\pi z^2 h}.$$

ρ = ...
[2]

[Total: 5]

2 *In this experiment, you will investigate the thermal power from a candle flame.*

For Examiner's Use

You have been provided with

- a beaker,
- a thermometer held in a clamp,
- a supply of water at room temperature,
- a measuring cylinder,
- a candle,
- a means of lighting the candle,
- a plastic stirrer,
- a stopwatch or stop-clock,
- a stand with a clamp and two bosses.

The thermometer should stay in the clamp throughout the experiment.

(a) (i) Hold the thermometer and clamp in the beaker so that the thermometer is vertical and does not touch the sides or base of the beaker. Pour sufficient water into the beaker to **just** cover the bulb of the thermometer.

(ii) Remove the thermometer from the beaker. Measure the volume V of the water in the beaker using the measuring cylinder. Pour all the water back into the beaker.

V = ...

(iii) A volume of 1.0 cm^3 of water has a mass of 1.0 g. Write down the mass m of water in the beaker.

m = ... g
[1]

(b) (i) Light the candle.

(ii) Set up the apparatus as shown in Fig. 2.1 with the candle away from the beaker. The base of the beaker should be level with the top of the candle flame.

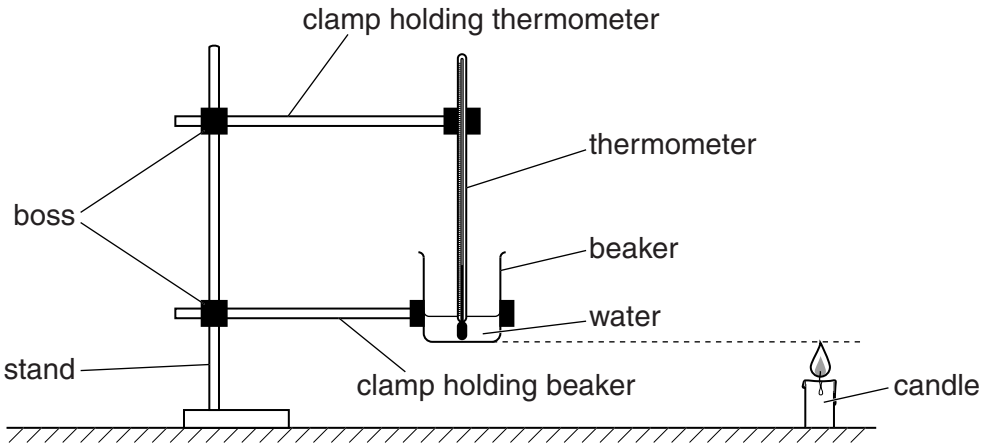


Fig. 2.1

(iii) Record the temperature θ_R of the water in the beaker.

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θ_R = ...[1]

(c) Carefully place the lit candle under the beaker and start the stopwatch or stop-clock. After a time $t = 120\,s$, remove the candle from under the beaker and record the highest temperature θ_H reached by the water. Extinguish the candle.

θ_H = ...[1]

(d) Calculate the power P used to heat the water using the equation

$$P = \frac{mc\,(\theta_H - \theta_R)}{t},$$

where the specific heat capacity c of water is $4.2\,J/(g\,°C)$.

P = ...[1]

(e) Explain why P is less than the thermal power provided by the candle flame.

.....

.....

.....[1]

[Total: 5]

3 *In this experiment, you will investigate resistors connected in series.*

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You have been provided with a circuit containing

- a 3V power supply,
- a switch,
- a resistor labelled X,
- a resistor labelled Y,
- an ammeter.

You also have been provided with

- a voltmeter with two connecting leads,
- a flying lead connected to one point in the circuit.

The circuit is shown in Fig. 3.1.

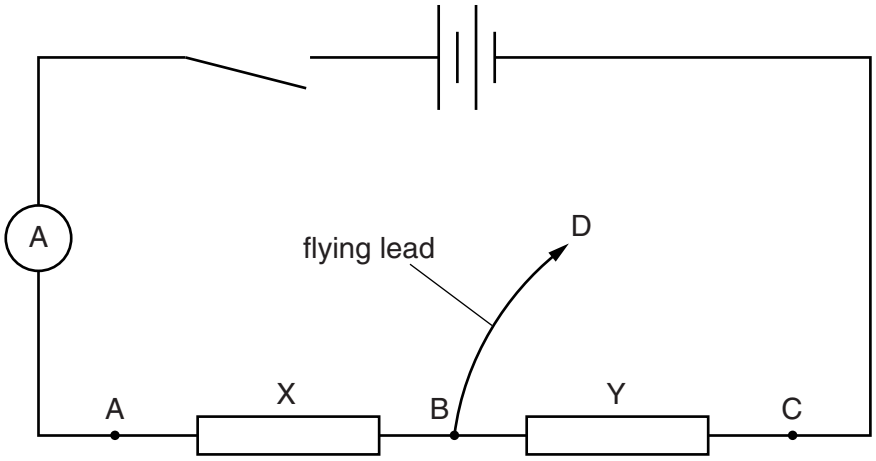


Fig. 3.1

(a) Connect the voltmeter between points A and C. Close the switch and record the voltmeter reading V and the current I in the circuit.

V = ...

I = ...
[2]

(b) Open the switch. Calculate the total resistance R of the resistors using the equation

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

R = ...[1]

(c) Connect the loose end D of the flying lead to point A. Close the switch and record the new voltage V_Y between points A and C and the new current I_Y in the circuit.

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V_Y = ...

I_Y = ...
[1]

(d) **(i)** Open the switch. Calculate the resistance R_Y of resistor Y using the equation

$$R_Y = \frac{V_Y}{I_Y}.$$

R_Y = ...

(ii) Determine the resistance R_X of resistor X.

R_X = ...
[1]

[Total: 5]

Section B

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4 *In this experiment, you will investigate the frictional force opposing the motion of a wooden block.*

You have been provided with

- a wooden block with a small hook at one end,
- a length of string with a loop at each end,
- a pulley arrangement at the edge of the bench,
- a 10 g mass hanger with nine 10 g slotted masses,
- eight 100 g slotted masses.

(a) (i) Place the loop at one end of the string over the small hook on the block. Pass the string over the pulley and suspend the 10 g mass hanger from the loop at the other end of the string. A diagram of the apparatus is shown in Fig. 4.1. Face A of the block should be uppermost.

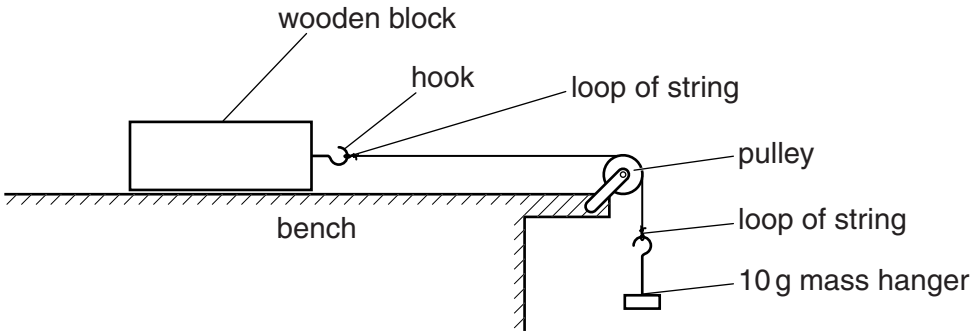


Fig. 4.1

(ii) Give the wooden block a push for a short distance towards the pulley. The block will stop. Add 10 g masses to the mass hanger until the block moves at approximately constant velocity after it is given a short push towards the pulley. If the bench surface exerts a large frictional force, you may need to use one or more of the 100 g slotted masses in addition to the 10 g slotted masses.

Record, in kg, the total mass *M* suspended from the string.

M = ... kg

(iii) Repeat the experiment and obtain an average value for *M.*

average value of *M* = ...

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(iv) Calculate the weight W of the mass using the relationship $W = Mg$, where $g = 10\,\text{N/kg}$.

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W = ...

(v) The weight W can be taken as the frictional force opposing the motion of the block. Explain how the experiment could be improved to obtain a more accurate value of the frictional force.

.....

.....

.....

[4]

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(b) When a mass P is placed on top of the block it changes the frictional force opposing the motion of the block.
Use some of the 100 g masses to change the value of P.
For each value of P, find the corresponding value of M required to move the block at constant speed.
You will need to use some of the 100 g masses to increase P and others, with the 10 g slotted masses, to increase M.

Record your results in a table. Include in your table columns for P, M and W. Also include your result from **(a)**.

[4]

(c) Using the grid opposite, plot a graph of W/N against P/g. Draw a straight line of best fit through your points. [4]

(d) Determine

(i) the gradient of your graph,

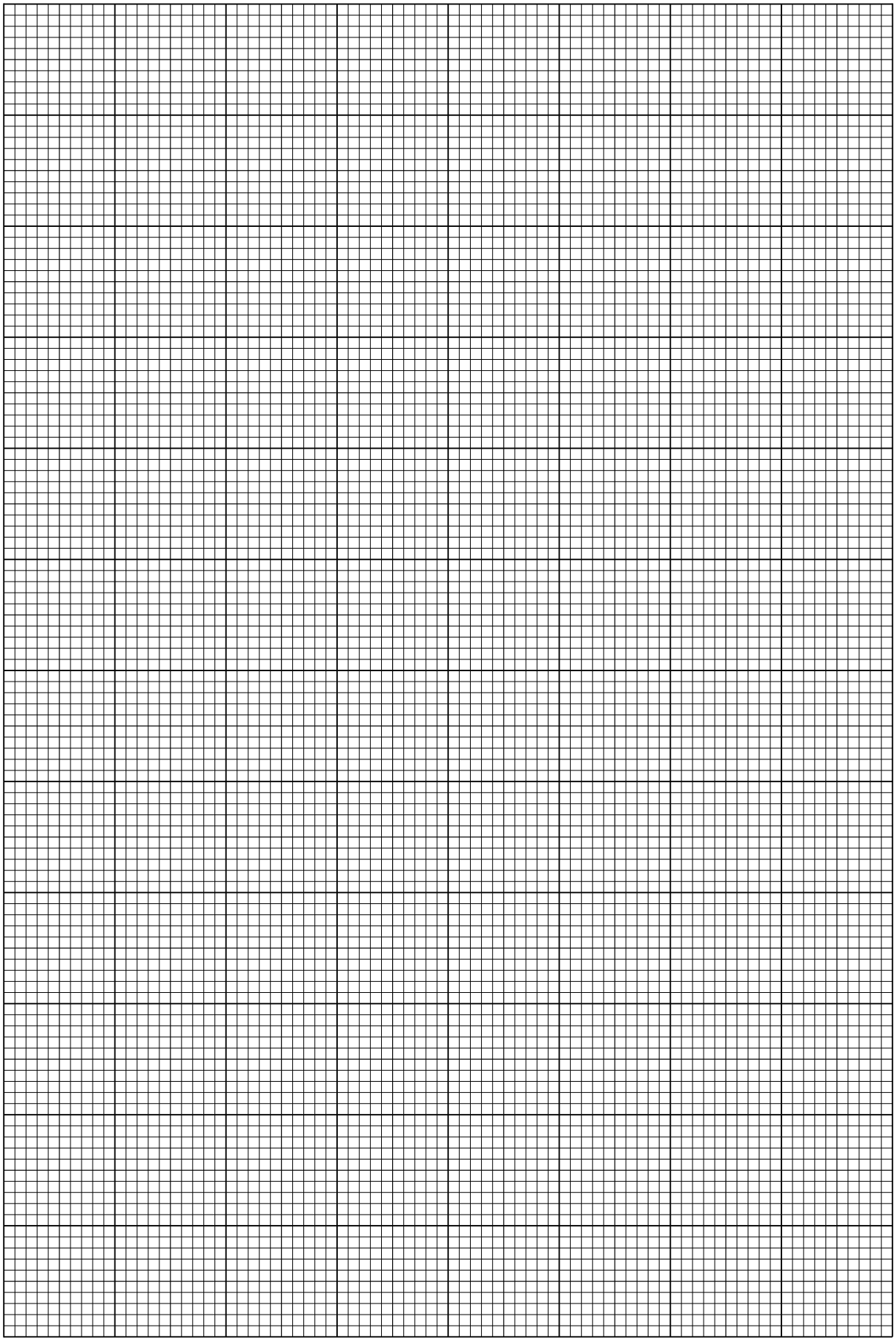
gradient = ...

(ii) the intercept on the W axis.

intercept = ...
[3]

[Total: 15]

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