Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7280780236

PHYSICS **5054/31**

Paper 3 Practical Test **May/June 2014**

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 an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, 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.

For Examiner's Use	
1	
2	
3	
4	
Total	

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

© UCLES 2014

CAMBRIDGE International Examinations

[Turn over

Section A

Answer **all** questions in this section.

1 *In this experiment, you will determine the mass of a half-metre rule.*

You are provided with

- a half-metre rule with holes near both ends,
- a length of string attached to the rule at the 49.0 cm mark,
- a pivot in the form of a thin rod or nail,
- a 50 g mass labelled P,
- a pulley supported above the bench,
- a stand and boss to support the pivot,
- a metre rule,
- a set square.

(a) The Supervisor has set up the apparatus as shown in Fig. 1.1.

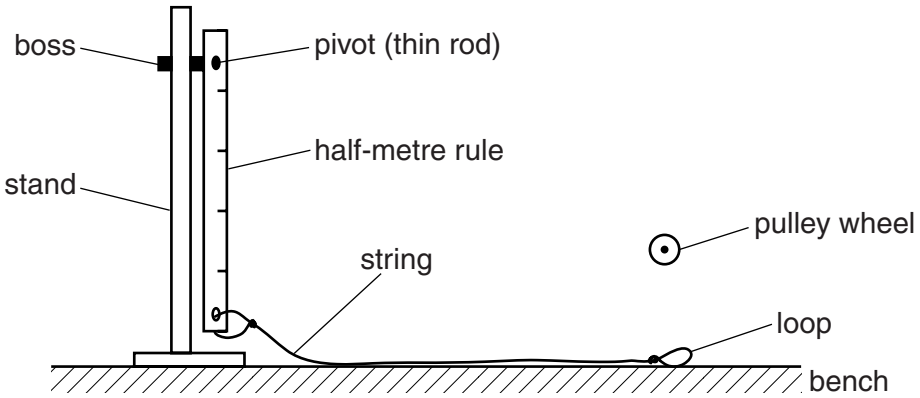


Fig. 1.1

Set up the apparatus as shown in Fig. 1.2. Adjust the height of the pulley and/or the position of the stands to make the section of the string labelled AB horizontal.

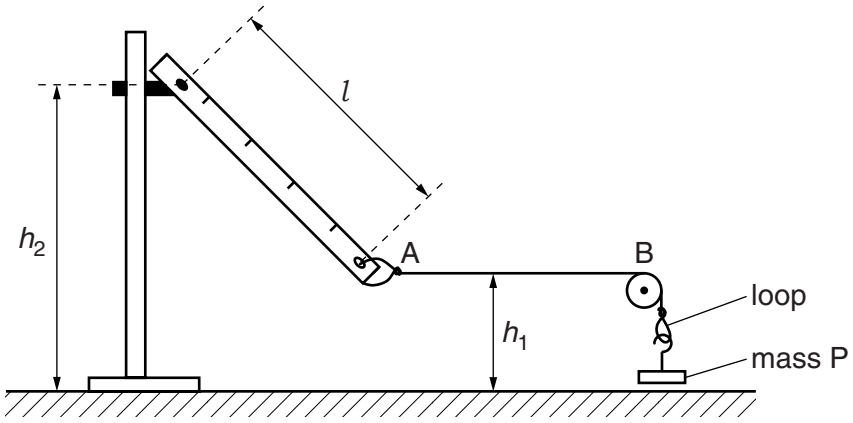


Fig. 1.2

Explain how you made sure that AB was horizontal. You may draw on Fig. 1.2 if you wish.

.....

.....

.....[1]

(b) Measure and record

(i) the height h_1 of AB above the bench,

h_1 = ...

(ii) the height h_2 of the centre of the pivot above the bench,

h_2 = ...

(iii) the distance l between the centres of the two holes in the rule.

l = ...
[2]

(c) Calculate

(i) the distance h using $h = h_2 - h_1$,

h = ...

(ii) the distance x using $x = \sqrt{(l^2 - h^2)}$

x = ...

(iii) the mass M of the half-metre rule using

$$M = \frac{2mh}{x}$$

where the mass m of P is 50 g.

M = ...
[2]

[Total: 5]

© UCLES 2014

2 *In this experiment, you will determine the focal length of a lens.*

You are provided with

- a converging lens in a holder,
- an object consisting of a transparent ruler fixed to a card,
- a light source to illuminate the object,
- a screen,
- a metre rule,
- a set square,
- a 30 cm ruler.

(a) Set up the apparatus as shown in Fig. 2.1. The side of the object labelled F should face the lens. The object is at the 0.0 cm mark on the metre rule and the screen is at the 100.0 cm mark.

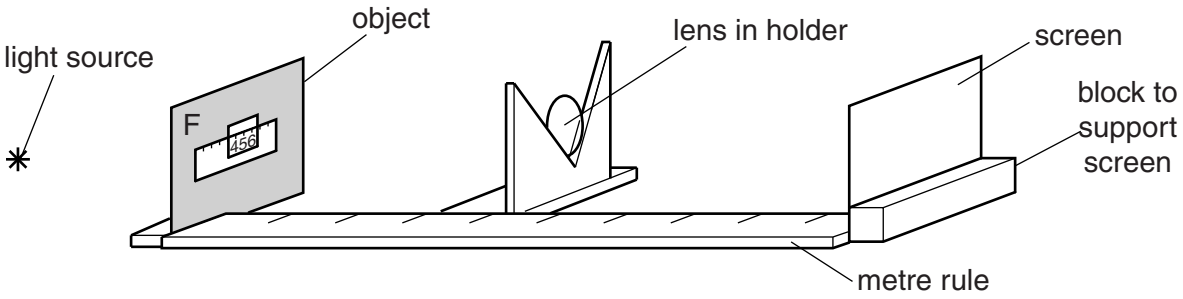


Fig. 2.1

Move the lens until a sharply focused magnified image of the object is formed on the screen. The image may be larger than the screen.

(i) In the space below, draw a diagram of the part of the image that is on the screen.

(ii) The image is magnified. State two other properties of the image.

1. .....

2. .....

[2]

(b) (i) The distance s is the spacing between the images, seen on the screen, of 1 cm divisions on the object. Using the 30 cm ruler determine, as accurately as possible, an average value for s.

$s =$ .....

(ii) Using your answer to **(b)(i)**, state the value of the magnification m produced by the lens.

$m =$ .....

(iii) Measure the distance v between the centre of the lens and the screen.

$v =$ .....

(iv) Calculate the focal length f of the lens using $f = \frac{v}{m + 1}$.

$f =$ .....
[3]

[Total: 5]

3 *In this experiment, you will determine the power dissipated in an arrangement of resistors.*

You have been provided with a circuit consisting of
- a cell,
- a switch,
- a resistor labelled R_1,
- an ammeter.
- connecting leads.

The Supervisor has set up the circuit shown in Fig. 3.1.

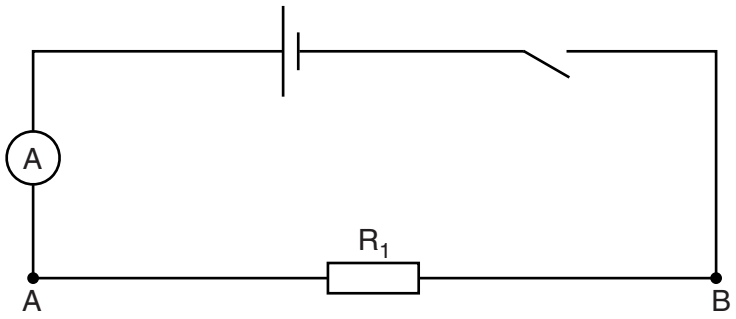


Fig. 3.1

You are also provided with
- a voltmeter,
- a resistor labelled R_2,
- four connecting leads.

(a) Using two of the connecting leads, connect the voltmeter between points A and B in the circuit. Close the switch and measure

(i) the potential difference V_1 across resistor R_1,

V_1 = ...[1]

(ii) the current I_1 in the circuit.

I_1 = ...[1]

Open the switch.

(b) Calculate the power P_1 dissipated in R_1, using $P_1 = I_1 V_1$.

P_1 = ...[1]

© UCLES 2014

(c) Using two more connecting leads, connect R_2 between A and B so that it is in parallel with R_1. Close the switch and measure

(i) the potential difference V_2 across the resistor combination,

V_2 = ...

(ii) the current I_2 in the circuit.

I_2 = ...
[1]

Open the switch.

(d) **(i)** Calculate the power P_2 dissipated in the resistor combination.

P_2 = ...

(ii) The resistances of R_1 and R_2 are similar. Explain why P_2 is greater than P_1.

.....

.....

.....
[1]

[Total: 5]

BLANK PAGE

© UCLES 2014

Section B

4 *In this experiment, you will determine a value for the power loss from a beaker of water at a particular time.*

You are provided with

- a 100 cm^3 beaker with a label,
- a supply of hot water,
- a thermometer,
- a stand, boss and clamp to support the thermometer,
- a stirrer,
- a stopwatch,
- a measuring cylinder.

(a) Set up the apparatus as shown in Fig. 4.1, with the bulb of the thermometer just above the base of the beaker.

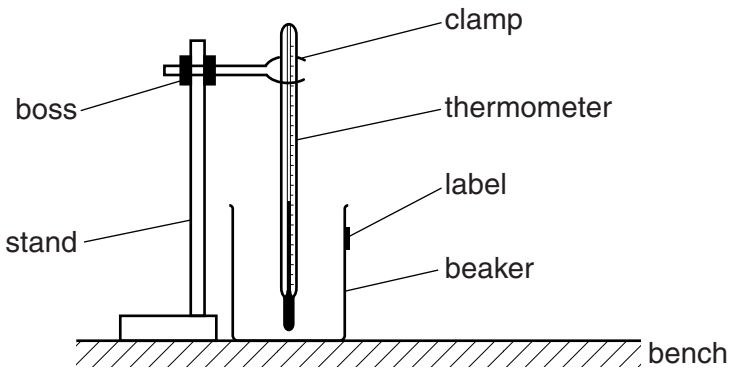


Fig. 4.1

(b) You will use the table of Fig. 4.2, which is on page 10, to record your readings of time and temperature. The experiment will last for six minutes. Write headings and units on Fig. 4.2.

[1]

(c) **(i)** The mass *m* of the beaker is written on the label. Record *m*.

m = ...

(ii) Using water from the hot water supply, pour hot water into the beaker until the water is level with the top of the label. Observe the thermometer and you will see that the temperature rises initially. As soon as the temperature starts to fall, start the stopwatch. Record the temperature and time in the table of Fig. 4.2. Continue to record the temperature at suitable intervals of time for a period of six minutes.

[3]

© UCLES 2014

[Turn over

Fig. 4.2

(d) Using the grid opposite, plot a graph of temperature on the *y*-axis against time on the *x*-axis. Draw the smooth curve of best fit through your points. [4]

(e) Draw a tangent to the curve at a time of 180 s (3.0 min) and determine the gradient *G* of the tangent at this point.

G = ...[3]

(f) Carefully remove the thermometer from the beaker without removing any water.

(i) Measure accurately the volume *V* of water used in your experiment.

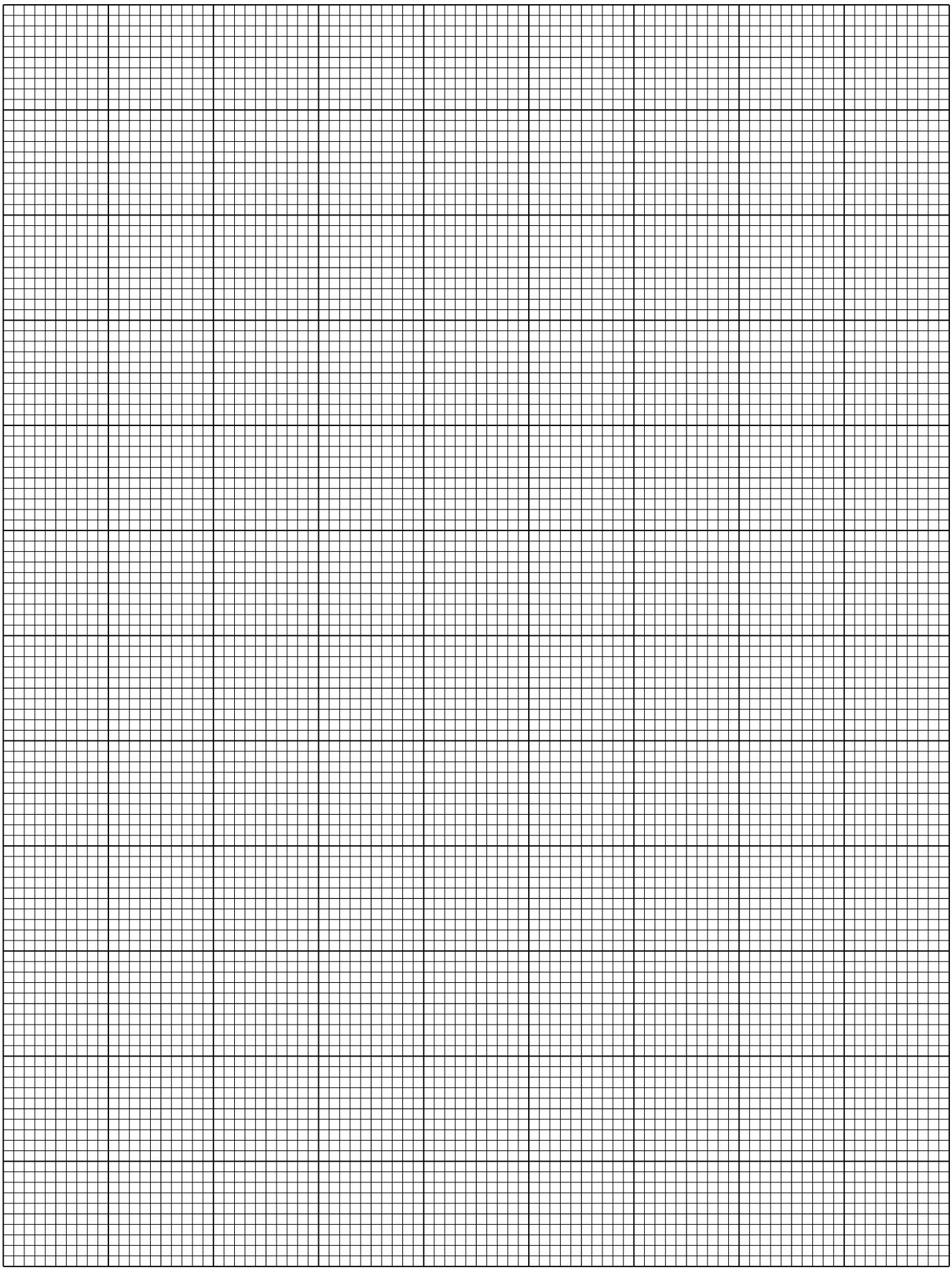
V = ...

(ii) The mass of 1.0 cm^3 of water is 1.0 g. State the mass *M* of water used.

M = ...
[1]

Question 4 continues on page 12.

© UCLES 2014



© UCLES 2014

(g) The rate of fall of temperature R at time 180 s is numerically equal to the gradient G with an appropriate unit. Calculate the power loss P from the beaker and water, at time 180 s, using

$$P = (Mc_w + mc_g)R,$$

where the specific heat capacity c_w of water is 4.2 J/(g °C)
and the specific heat capacity c_g of glass is 0.67 J/(g °C).

$P =$ .....[2]

(h) State one precaution that you took in this experiment to ensure that your results were accurate.

.....

.....[1]

[Total: 15]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.