Cambridge International AS & A Level

**Cambridge International Examinations**
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*6326997405*

**PHYSICS** **9702/36**

Paper 3 Advanced Practical Skills 2 **October/November 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 **both** questions.
You will be allowed to work with the apparatus for a maximum of one hour for each question.
You are expected to record all your observations as soon as these observations are made, and to plan the presentation of the records so that it is not necessary to make a fair copy of them.
You are reminded of the need for good English and clear presentation in your answers.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

Additional answer paper and graph paper should be used only if it becomes necessary to do so.

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 | |
| Total | |

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


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CAMBRIDGE International Examinations

**[Turn over**

**You may not need to use all of the materials provided.**

**1** In this experiment, you will investigate a network of resistors.

**(a) (i)** Assemble the circuit of Fig. 1.1.

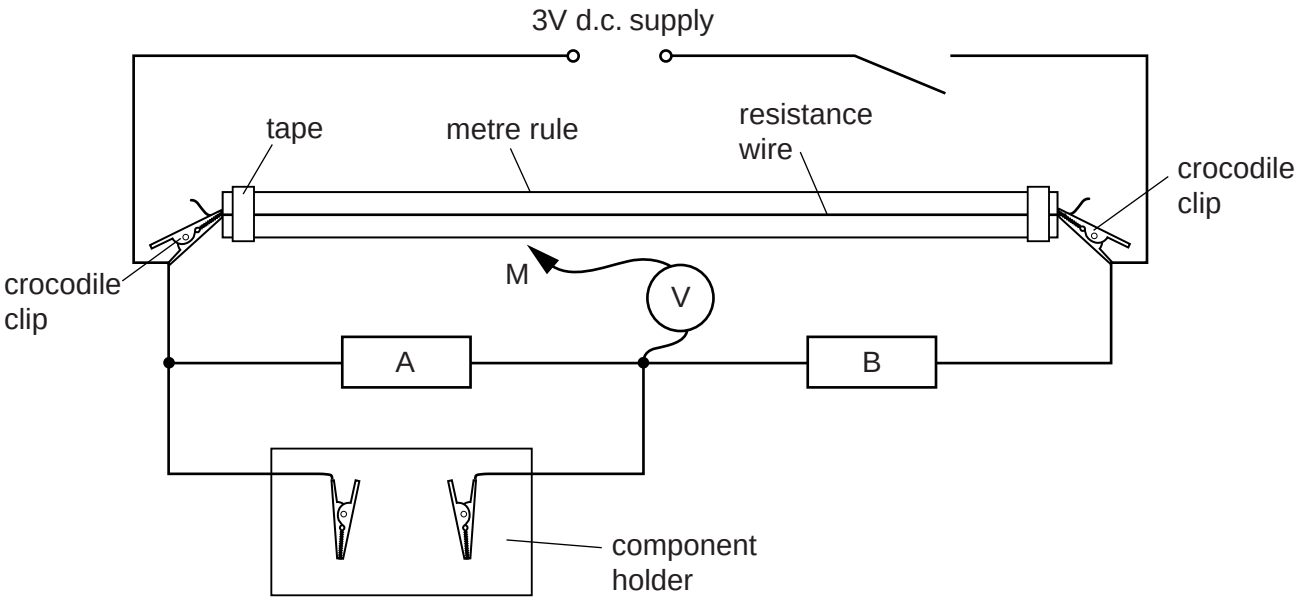



**Fig. 1.1**

**(ii)** To check that your circuit is correct, close the switch and place the movable contact M on the resistance wire at the 50 cm mark.
Record the voltmeter reading, which should be between 0.3 V and 0.7 V.

voltmeter reading = ..... [1]

**(iii)** Open the switch.

**(b) (i)** Select one of the resistors labelled with a numerical value and connect it between the crocodile clips of the component holder. Record the resistance *R* of your selected resistor.

*R* = ..... kΩ

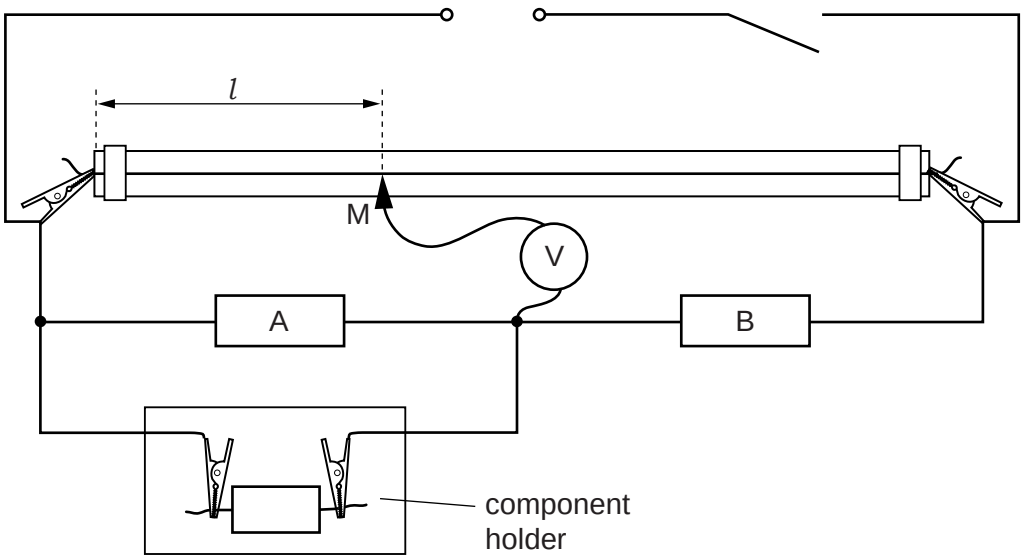



**Fig. 1.2**

**(ii)** Close the switch. Adjust the position of M on the resistance wire until the voltmeter reads zero. Measure and record the length *l* as shown in Fig. 1.2.

*l* = ..... [1]

**(iii)** Open the switch.

**(c)** Repeat **(b)** using different labelled resistors in the component holder until you have six sets of values of $R$ and $l$. Include values of $\frac{1}{R}$ and $\frac{1}{l}$ in your table.

[10]

**(d)** **(i)** Plot a graph of $\frac{1}{l}$ on the $y$-axis against $\frac{1}{R}$ on the $x$-axis. [3]

**(ii)** Draw the straight line of best fit. [1]

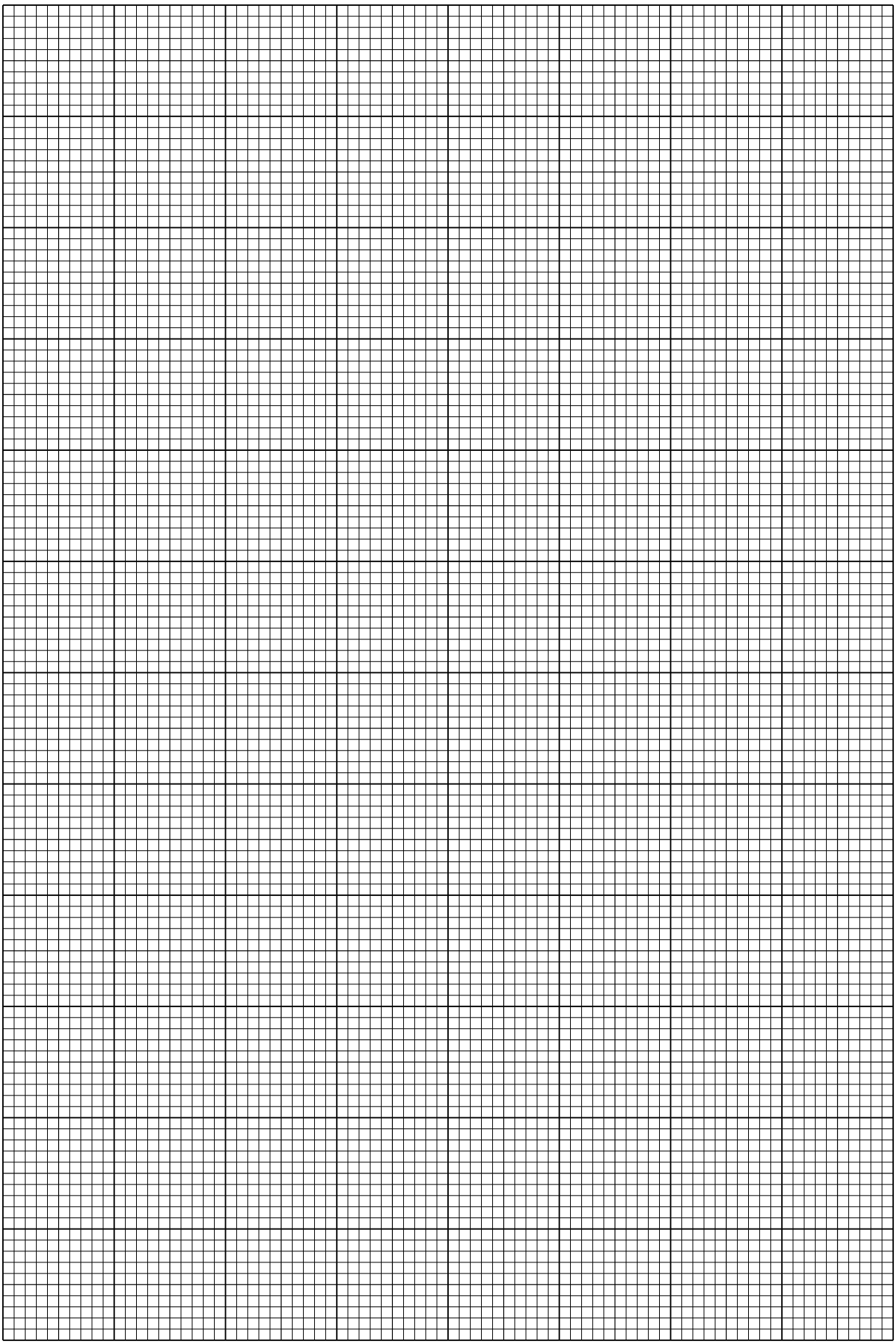
**(iii)** Determine the gradient and $y$-intercept of this line.

gradient = .....

$y$-intercept = .....

[2]

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**(e)** The quantities $l$ and $R$ are related by the equation

$$\frac{1}{l} = \frac{a}{R} + b$$

where $a$ and $b$ are constants.

Use your answers in **(d)(iii)** to determine the values of $a$ and $b$.
Give appropriate units.

$a$ = .....

$b$ = .....

[2]

**You may not need to use all of the materials provided.**

**2** In this experiment, you will investigate the motion of a partially-filled bottle.

**(a) (i)** Place the stand in the tray and suspend the empty bottle from the nail, as shown in Fig. 2.1.
Check that the bottle swings freely.

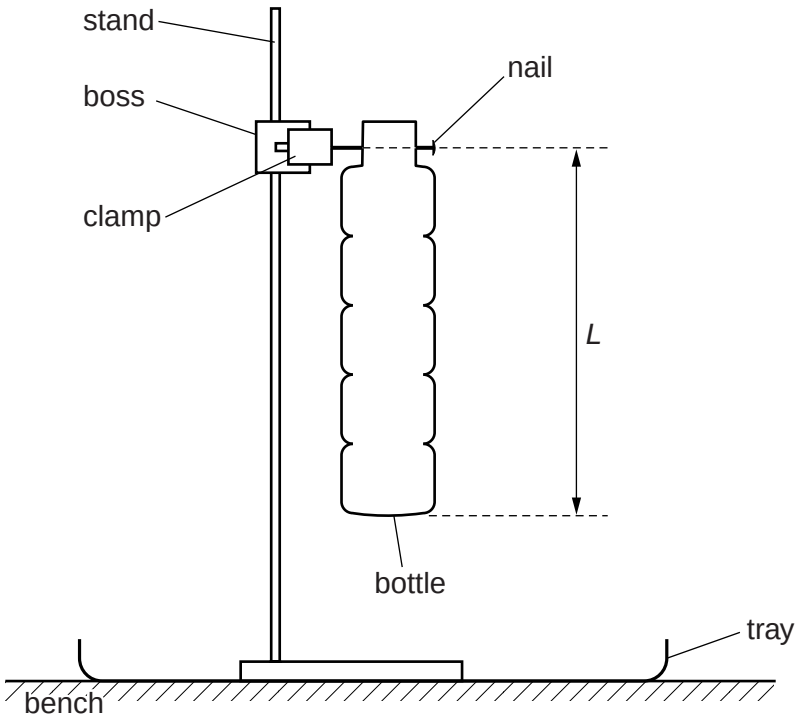



**Fig. 2.1**

**(ii)** Measure and record the distance *L* from the base of the bottle to the nail, as shown in Fig. 2.1.

*L* = .....mm [1]

**(b) (i)** Pour water into the bottle until it is approximately half full, as shown in Fig. 2.2.

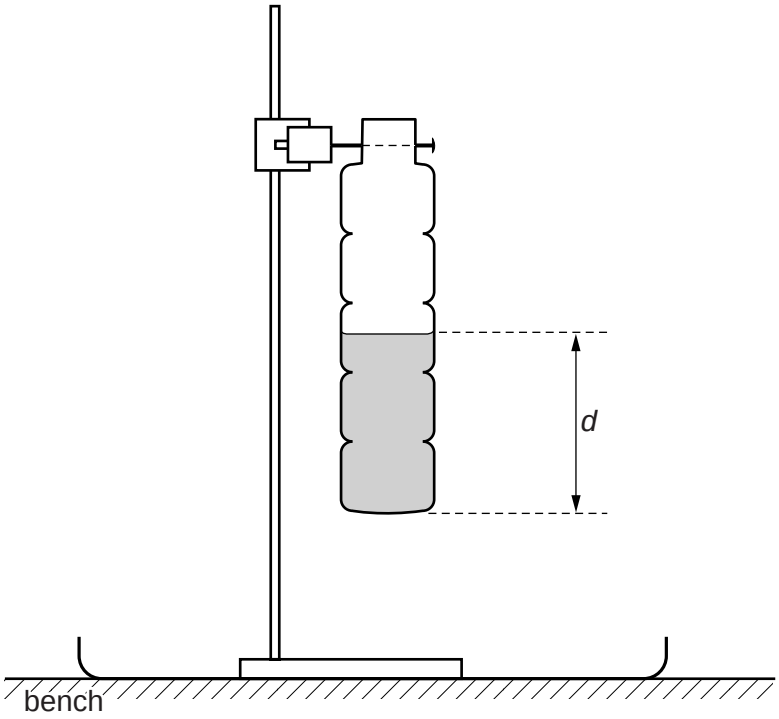



**Fig. 2.2**

**(ii)** With the bottle hanging vertically, measure and record the distance *d* from the base of the bottle to the water surface, as shown in Fig. 2.2.

*d* = ..... mm [1]

**(iii)** Calculate the ratio *c* using the relationship $c = \frac{d}{L}$ .

*c* = .....

**(iv)** Justify the number of significant figures that you have given for your value of *c*.

.....

.....

.....

..... [1]

**(c)** Calculate the value of $q$ using the relationship

$$q = \frac{\frac{c^2}{3} - c + 1}{1 - \frac{c}{2}}.$$

$q =$ ..... [1]

**(d) (i)** Push the base of the bottle approximately 4 cm to one side and then release it so that it swings, as shown in Fig. 2.3.

Ensure that the stand does not fall over when the bottle is swinging.

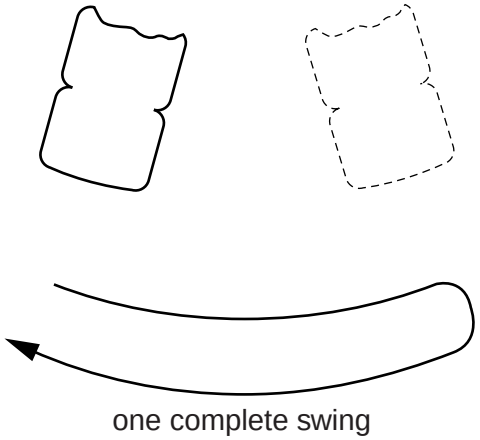



**Fig. 2.3**

**(ii)** Measure and record the total time $t$ for 10 complete swings.

$t =$ ..... [2]

**(iii)** Estimate the percentage uncertainty in your value of $t$.

percentage uncertainty = ..... [1]

**(e)** **(i)** Pour more water into the bottle until it is approximately ¾ full.

**(ii)** Repeat **(b)(ii)**, **(b)(iii)**, **(c)**, **(d)(i)** and **(d)(ii)**.

$d$ = .....mm

$c$ = .....

$q$ = .....

$t$ = .....

[3]

**(f)** It is suggested that the relationship between $t$ and $q$ is

$$t^2 = kq$$

where $k$ is a constant.

**(i)** Using your data, calculate two values of $k$.

first value of $k$ = .....

second value of $k$ = .....

[1]

**(ii)** Explain whether your results support the suggested relationship.

.....

.....

.....

..... [1]

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**(g) (i)** Describe four sources of uncertainty or limitations of the procedure for this experiment.

1. .....

.....

2. .....

.....

3. .....

.....

4. .....

.....

[4]

**(ii)** Describe four improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

1. .....

.....

2. .....

.....

3. .....

.....

4. .....

.....

[4]

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