Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9645711887

PHYSICS **9702/34**

Paper 3 Advanced Practical Skills 2 **May/June 2018**

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

1 In this experiment, you will investigate an electrical circuit.

You are provided with groups of components connected in parallel. The circuit symbol for each of these components is shown in Fig. 1.1.

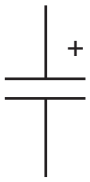


Fig. 1.1

(a) • Assemble the circuit shown in Fig. 1.2.

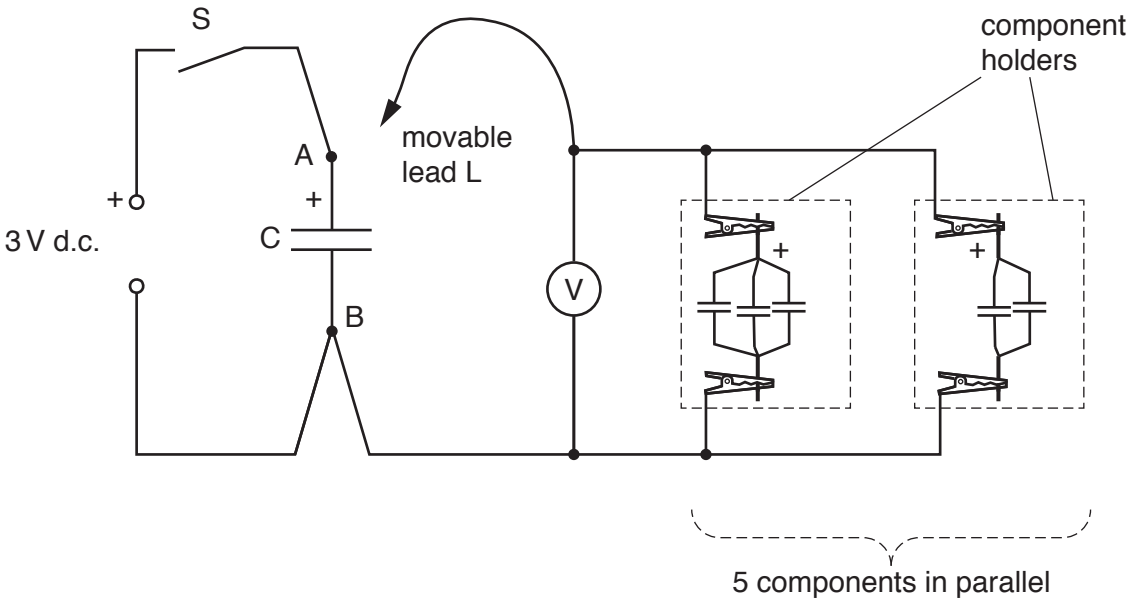


Fig. 1.2

- Check that the positive terminals of the power supply, component C and the groups of components are connected as shown in Fig. 1.2.
- Connect the movable lead L to terminal A.
- Close the switch S.
- Record the voltage V_S shown on the voltmeter.

V_S = ...

- Open switch S.

[1]

(b) • Record the total number n of components in parallel in the component holders.

n = ...

- Move the movable lead L and connect it to terminal B.
- Close switch S.
- Open switch S after approximately 5 s.
- Move the movable lead L and connect it to terminal A. **Immediately** record the voltage V shown on the voltmeter.

V = ...[2]

(c) Change n and repeat **(b)** until you have six sets of values of n and V. One of the component holders may be left empty if required.

Record your results in a table. Include your values from **(b)**. Also include values of $\frac{1}{V}$ in your table.

[9]

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

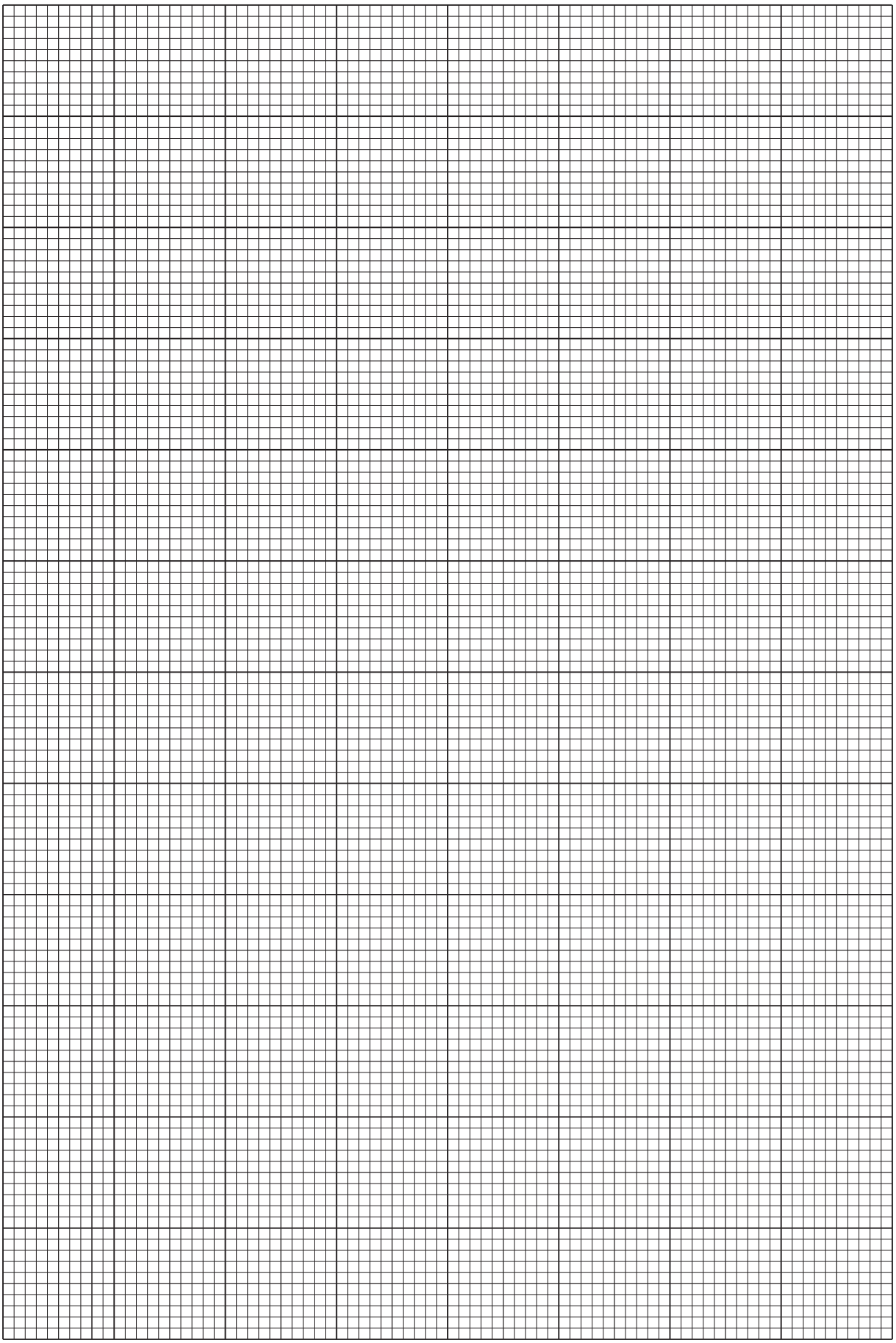
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...
[2]

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(e) It is suggested that the quantities V and n are related by the equation

$$\frac{1}{V} = an + b$$

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]

[Total: 20]

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[Turn over

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

2 In this experiment, you will investigate the motion of a plastic bottle floating in water.

(a)
- Pour 500 cm^3 of water from the jug into the beaker (1 ml = 1 cm^3).
- Pour this water into the bottle.
- Place the 100 g mass hanger with two 100 g slotted masses in the bottle, as shown in Fig. 2.1.

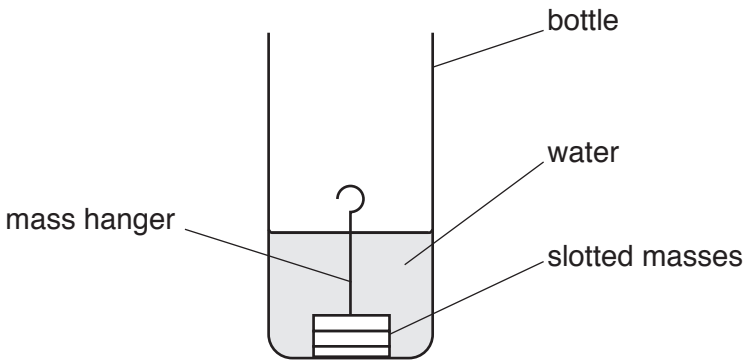


Fig. 2.1

- Assume that the density of the added water is 1.0 g cm^{-3} (1.0 cm^3 of water has a mass of 1.0 g).

  Calculate the total mass *M* of the mass hanger, slotted masses and water in the bottle.

M = ... kg [1]

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(b) (i)

- Carefully place the bottle in the bucket of water so that the bottle floats vertically in the water.
- Carefully push the bottle down, ensuring that its top remains above the level of the water in the bucket.
- Release the bottle so that it oscillates **vertically**, as indicated in Fig. 2.2.

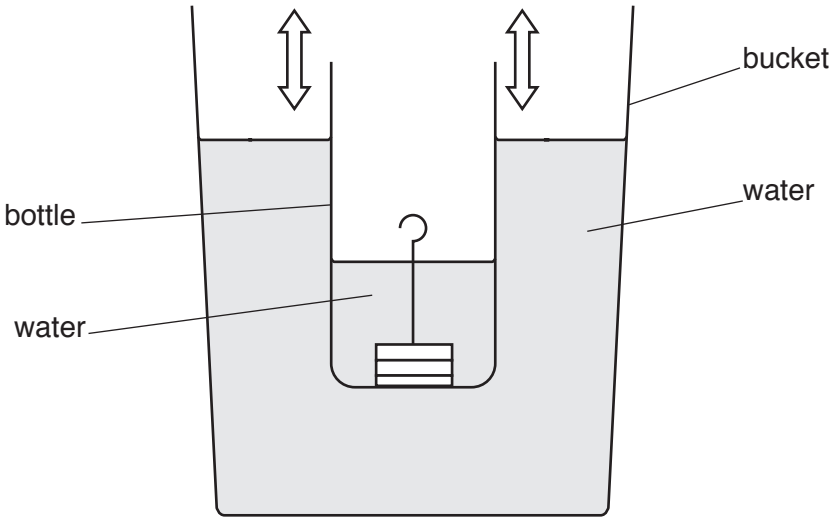


Fig. 2.2

- Take measurements to find the period T of the oscillations.

T = ...[2]

(ii) Estimate the percentage uncertainty in your value of T.

percentage uncertainty = ...[1]

(c) **(i)**
- Remove the bottle from the bucket and place it in the tray.
- Add three more 100 g slotted masses to the mass hanger in the bottle.
- Calculate the new total mass M.

$M =$ ..... kg [1]

(ii) Repeat **(b)(i)**.

$T =$ .....[2]

(d) It is suggested that the relationship between M and T is

$$M = kT^2$$

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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(e) (i) Measure and record the diameter D of the bottle.

D = ...m [1]

(ii) Calculate the cross-sectional area A of the bottle using

$$A = \frac{\pi D^2}{4}.$$

A = ... m^2 [1]

(iii) The density ρ of the water in the bucket is given by

$$\rho = \frac{4\pi^2 k}{Ag}$$

where $g = 9.81\,m\,s^{-2}$.

Using your second value of k, calculate ρ.

ρ = ...$kg\,m^{-3}$ [1]

(f) (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]

[Total: 20]

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