Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6669258492

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **October/November 2016**

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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[Turn over

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

1 In this experiment, you will investigate the motion of a bottle in water.

(a) You have been provided with a bottle with a mass attached, a measuring cylinder, a jug of water and a large cylindrical container of water.

(i) Use water from the jug and the measuring cylinder to determine the maximum volume V_F of water held by the bottle.

Record V_F.

(1 ml = 1 cm^3)

V_F = ... cm^3 [1]

(ii) Return any water to the jug.
Do **not** change the volume of water in the large cylindrical cylinder.

(b) (i) Add volume V of water to the bottle where V is approximately 100 cm^3.

(ii) Record V.

V = ... cm^3

(iii) Screw the cap on the bottle so that no water leaks out of the bottle when the bottle is inverted.

(c) (i) Place both rubber bands around the top of the large cylindrical container.

(ii) Gently push the bottle into the water in the large cylindrical container until the top is just on the water surface as shown in Fig. 1.1.

Keep the bottle in this position using one hand.

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(iii) Use your other hand to slide one of the rubber bands down so that it is level with the bottom of the mass.

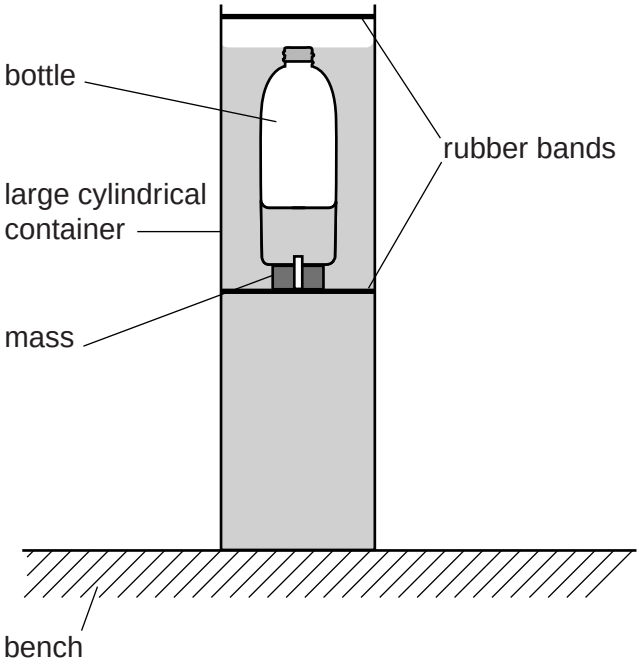


Fig. 1.1

(iv) Release the bottle. The bottle will move upwards and then move downwards.

Place the other rubber band so that it is level with the highest position of the bottom of the mass as shown in Fig. 1.2. You should repeat this several times before you decide on the position of this rubber band.

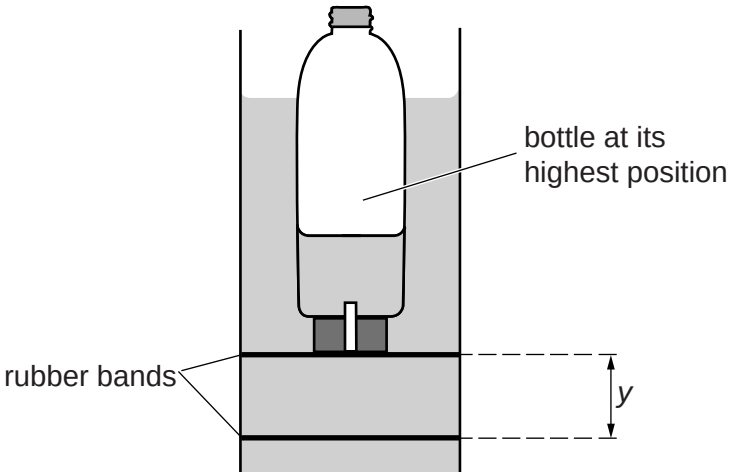


Fig. 1.2

The maximum distance moved upwards by the bottle is *y* as shown in Fig. 1.2.

(v) Measure and record *y*.

y = ... cm [1]

(d) (i) Calculate $\frac{2V_F}{3}$.

$\frac{2V_F}{3}$ = ... cm^3

(ii) Increase V and repeat **(b)(ii)**, **(b)(iii)**, **(c)(ii)**, **(c)(iv)** and **(c)(v)** until you have six sets of values of V and y.

Do **not** use a value of V greater than $\frac{2V_F}{3}$.

[8]

(e) (i) Plot a graph of y on the y-axis against V on the x-axis. [3]

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

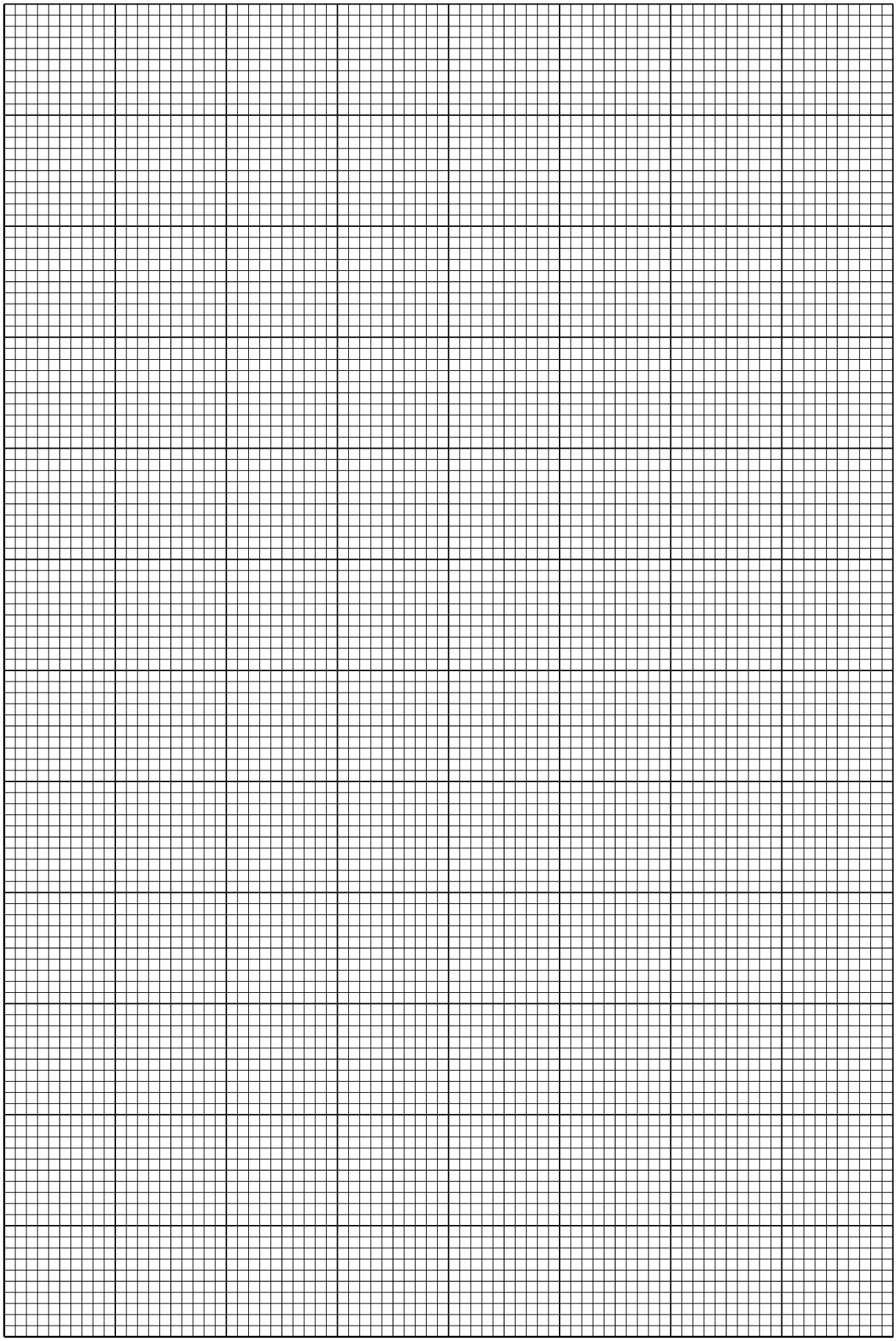
(iii) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...

[2]

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(f) The quantities y and V are related by the equation

$$y = PV + Q$$

where P and Q are constants.

Using your answers in **(e)(iii)**, determine the values of P and Q.
Give appropriate units.

P = ...

Q = ...
[2]

(g) **(i)** Use your values from **(f)** to calculate the value of V when $y = 0$.

V = ... cm^3 [1]

(ii) Explain why it is impossible to repeat the experiment using the value of V calculated in **(g)(i)**.

.....

.....

.....

.....[1]

[Total: 20]

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

2 In this experiment, you will investigate the deflection of a loaded wooden strip.

(a) (i) Clamp the wooden strip as shown in Fig. 2.1.

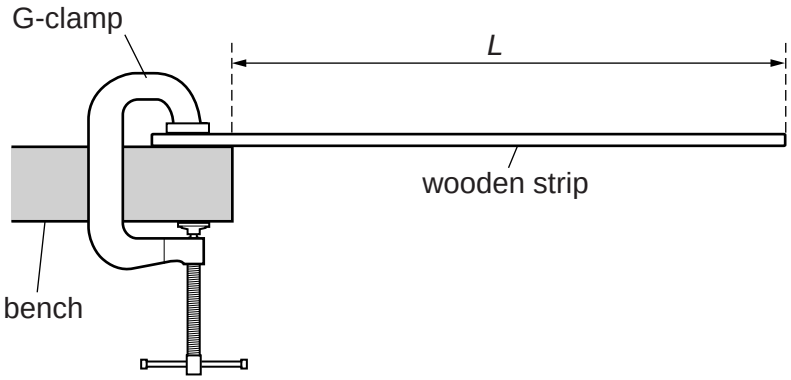


Fig. 2.1 (not to scale)

The distance *L* that the wooden strip extends beyond the edge of the bench should be approximately 80 cm.

(ii) Measure and record *L*.

L = ... [1]

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

percentage uncertainty = ... [1]

(b) (i) Place the 100g mass on the end of the wooden strip as shown in Fig. 2.2.

The vertical distance between the floor and the bottom of the end of the wooden strip is d_1.

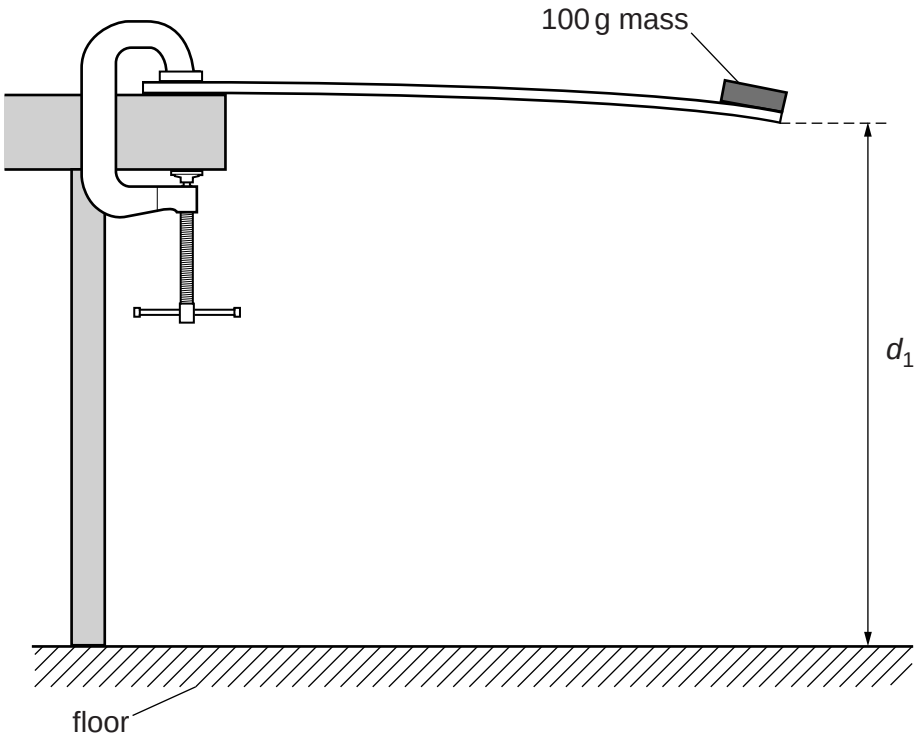


Fig. 2.2 (not to scale)

(ii) Measure and record d_1.

d_1 = ...[1]

(iii) Remove the 100g mass from the wooden strip.

(c) **(i)** Use ten 10g masses to evenly distribute a total mass of 100g along the length of the wooden strip.

(ii) The distance between the floor and the bottom of the end of the wooden strip is d_2.

Measure and record d_2.

d_2 = ...[1]

(iii) Calculate $(d_2 - d_1)$.

$(d_2 - d_1)$ = ...[1]

(iv) The mass per unit length M added to the wooden strip is given by

$$M = \frac{m}{L}$$

where the total added mass m is 0.100kg.

Calculate M.

M = ...[1]

(d) Justify the number of significant figures that you have given for your value of M.

.....

.....

.....[1]

(e) Repeat **(b)** using the 50 g mass and repeat **(c)** using five 10 g masses to evenly distribute 50 g along the length of the wooden strip.

For this mass the value of m is 0.050 kg.

d_1 = ...

d_2 = ...

$(d_2 - d_1)$ = ...

M = ...

[3]

(f) It is suggested that the relationship between $(d_2 - d_1)$ and M is

$$(d_2 - d_1) = kM$$

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]

[Total: 20]

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