Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7337664815

PHYSICS **9702/34**

Paper 3 Advanced Practical Skills 2 **May/June 2017**

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	

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

1 In this experiment, you will investigate the oscillation of a mass-spring system.

(a) Assemble the apparatus as shown in Fig. 1.1, with the rods of both clamps at an equal height of approximately 50 cm above the bench.

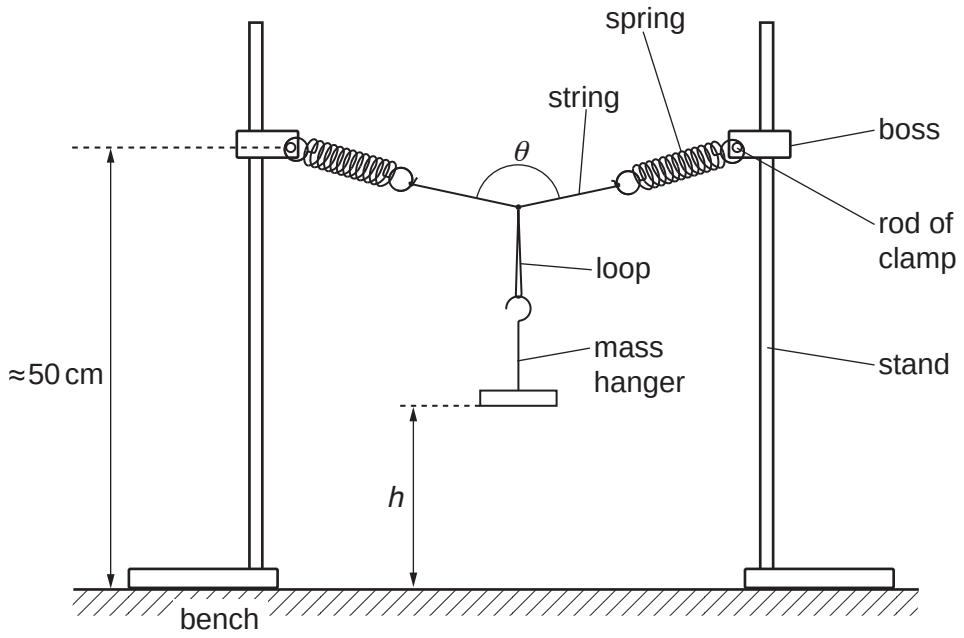


Fig. 1.1

(i) The angle between the two lengths of string is θ, as shown in Fig. 1.1. Adjust the positions of the stands so that θ is approximately 165°.

Use the two G-clamps to secure the stands to the bench.
The stands should remain in these positions for the rest of the experiment.

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(ii) Add 200 g to the mass hanger.

(iii) Record the total mass M of the mass hanger and added mass.

M = ...

(iv) Measure and record the height h of the bottom of the mass hanger above the bench.

h = ... cm

(v) Pull down the mass hanger through a distance of approximately 2 cm. Release the mass hanger so that it oscillates vertically.

Determine the period T of the vertical oscillations.

T = ... s [2]

(b) Change M and repeat **(a)(iii)**, **(a)(iv)** and **(a)(v)** until you have six sets of values of M, h and T.
Record your results in a table.
Include values of T^3 in your table.

[10]

(c) **(i)** Plot a graph of T^3 on the y-axis against h on the x-axis. [3]

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

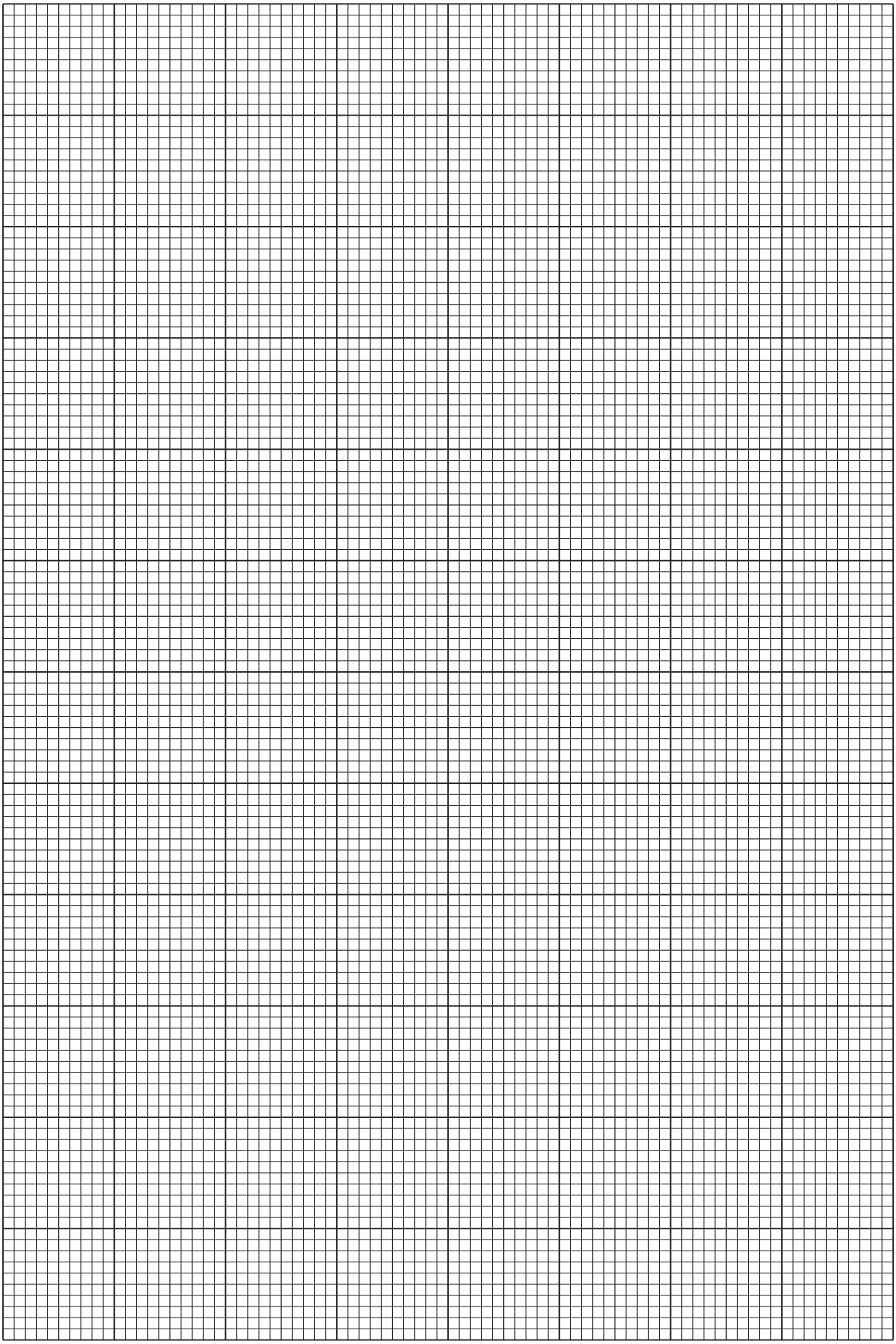
(iii) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...

[2]

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(d) It is suggested that the quantities T and h are related by the equation

$$T^3 = ah + b$$

where a and b are constants.

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

a = ...

b = ...

[2]

[Total: 20]

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

2 In this experiment, you will investigate the equilibrium position of a pivoted wooden strip and determine the density of water.

(a) Assemble the apparatus as shown in Fig. 2.1. The nail should pass through the hole in the wooden strip and be held in the boss. The bottom of the plastic pipe should be approximately 2 cm above the bottom of the container.

Position the string loop with paper clips so that the wooden strip is parallel to the bench.

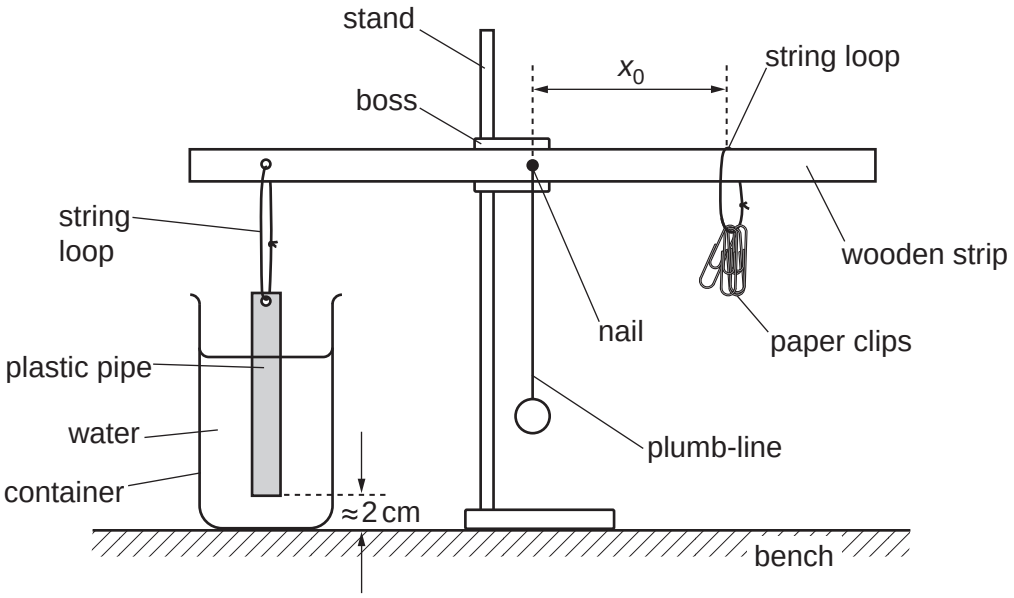


Fig. 2.1 (not to scale)

The distance from the nail to the string loop holding the paper clips is x_0, as shown in Fig. 2.1.

Measure and record x_0.

x_0 = ... cm [1]

(b) (i) Move the string loop holding the paper clips approximately 4 cm further from the nail. Let the wooden strip settle at an angle, as shown in Fig. 2.2.

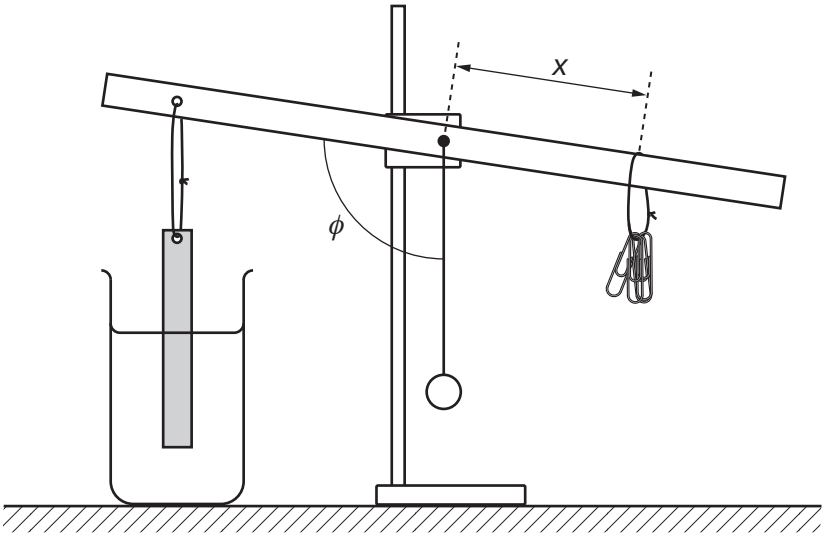


Fig. 2.2 (not to scale)

(ii) Measure and record the new distance x from the nail to the string loop holding the paper clips, as shown in Fig. 2.2.

x = ... cm [1]

(iii) Measure and record the larger angle ϕ between the wooden strip and the plumb-line, as shown in Fig. 2.2.

ϕ = ... ° [1]

(iv) Calculate (ϕ – 90°).

(ϕ – 90°) = ... °

(v) Estimate the percentage uncertainty in your value of (ϕ – 90°).

percentage uncertainty = ...[1]

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(c) (i) Move the string loop holding the paper clips approximately 3 cm further from the nail. Let the wooden strip settle at a new angle.

(ii) Repeat **(b)(ii)**, **(b)(iii)** and **(b)(iv)**.

x = ... cm

ϕ = ... °

(ϕ – 90°) = ... °

[3]

Question 2 continues on page 10.

(d) It is suggested that the relationship between ϕ, x_0 and x is

$$\sin(\phi - 90°) = k(x - x_0)$$

where k is a constant.

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

first value of k = ...

second value of k = ... [1]

(ii) Justify the number of significant figures you have given for your values of k.

.....

.....

..... [1]

(iii) Explain whether your results in **(d)(i)** support the suggested relationship.

.....

.....

.....

..... [1]

(e) (i) Remove the plastic pipe from the water.

(ii) Measure and record the outside diameter D and the inside diameter d of the pipe, as shown in Fig. 2.3.

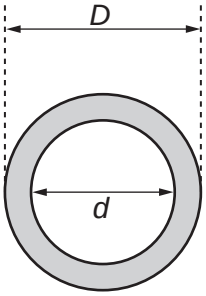


Fig. 2.3

D = ... cm

d = ... cm
[1]

(iii) The mass m of the paper clips and string loop is written on the card. Record m.

m = ... g

(iv) Using your second value of k, calculate the density ρ of the water using the relationship

$$\rho = \frac{m}{Ck(D^2 - d^2)}$$

where $C = 201\,\text{cm}^2$.

ρ = ... g cm^{-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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