Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8629017065

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **October/November 2019**

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 **12** printed pages.

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

1 In this experiment, you will investigate the motion of a pendulum consisting of a chain of paper clips and a sphere of modelling clay.

(a) • Set up the apparatus as shown in Fig. 1.1.

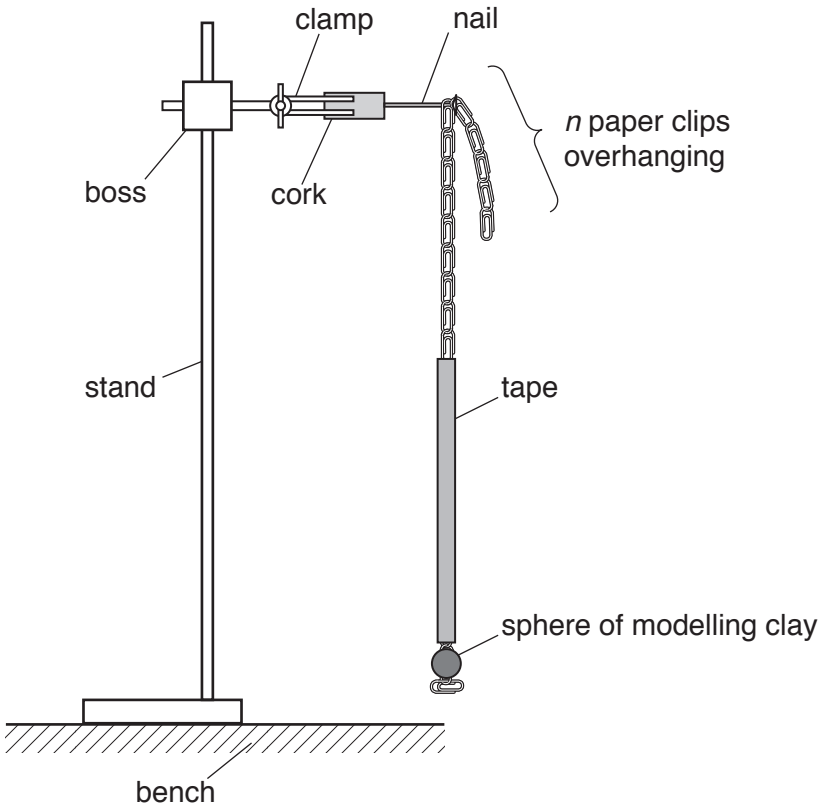


Fig. 1.1

- Suspend the chain of paper clips from the nail by one of the clips with *n* clips overhanging.
- Count and record *n*.

n = ...

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- Pull the sphere to the side through a short distance, as shown in Fig. 1.2.

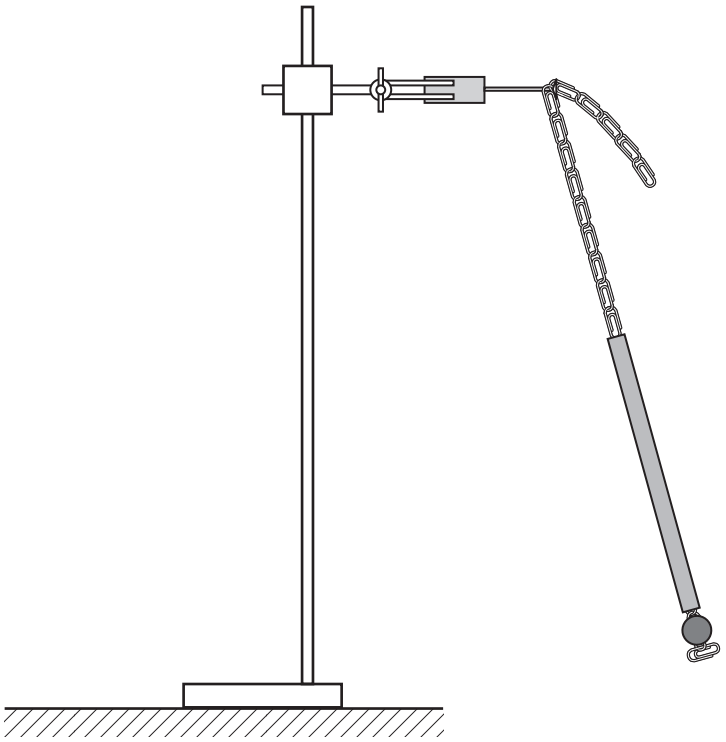


Fig. 1.2

- Release the sphere. The sphere will oscillate.
- Determine the period T of these oscillations.

T = ... [1]

(b) Vary n by placing the nail through different clips in the chain. Measure and record n and T. Repeat until you have six sets of values.

Record your results in a table. Include values of T^2 in your table.

[10]

(c) **(i)** Plot a graph of T^2 on the y-axis against n on the x-axis. [3]

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

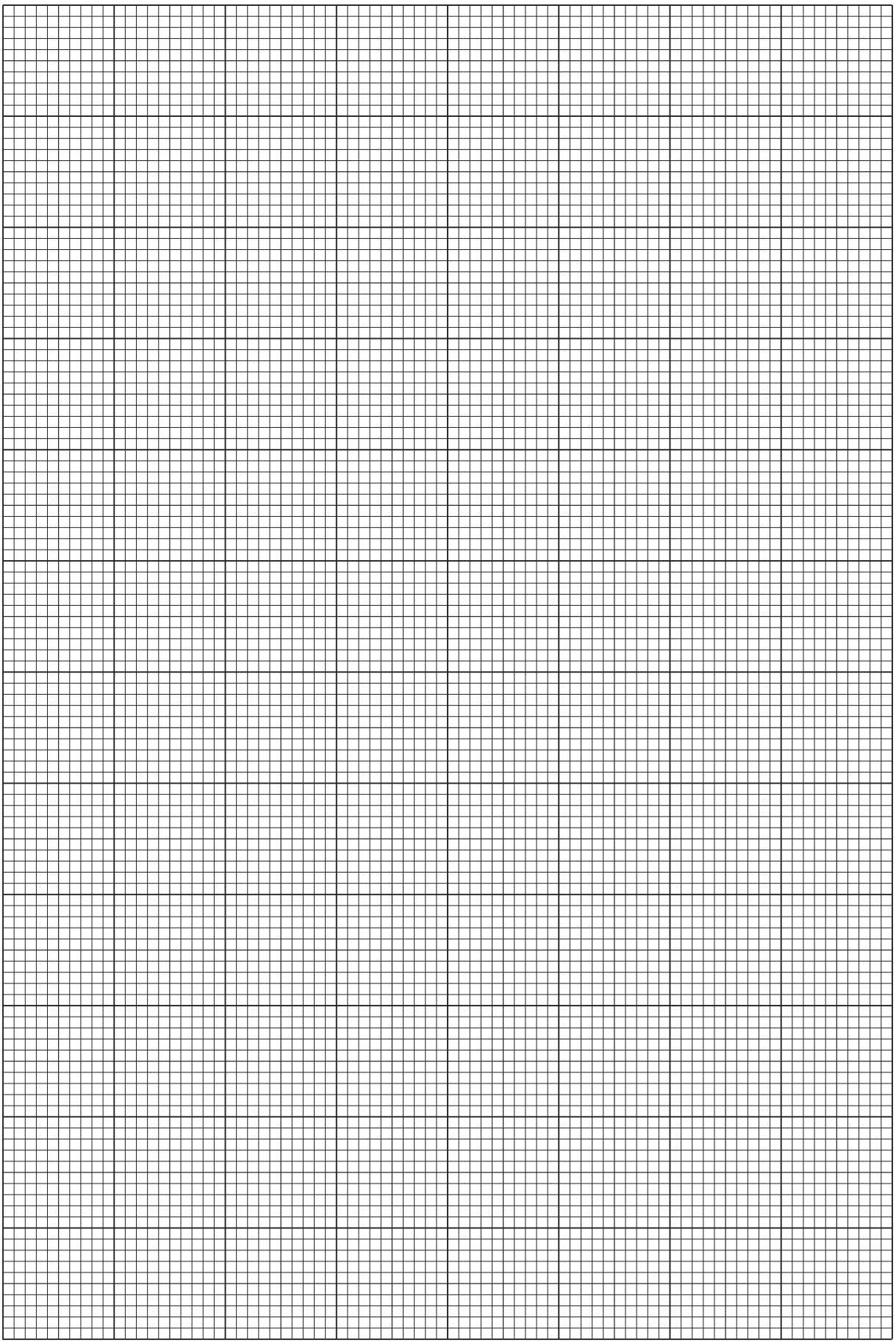
(iii) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...

[2]

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[Turn over

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

$$T^2 = Pn + Q$$

where P and Q are constants.

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

P = ...

Q = ...
[2]

(e) Theory suggests that P is proportional to the length of a paper clip and that Q is proportional to the total length of the chain.

The experiment is repeated using a chain consisting of 30 paper clips of the same length as those used in your experiment.

For this experiment, draw a second line on the graph to show the expected results.
Label this line W. [1]

[Total: 20]

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

2 In this experiment, you will investigate how the force of attraction between two bar magnets depends on their separation.

(a) (i) • Place magnet A on the wooden board as shown in Fig. 2.1.

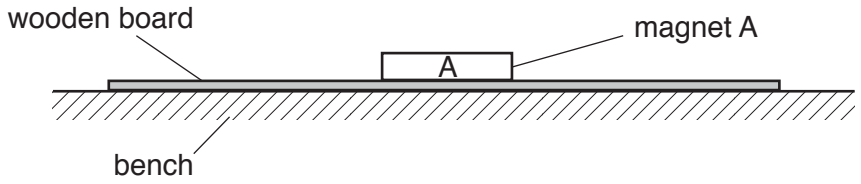


Fig. 2.1

• Raise the end of the board until the magnet just starts to move down the board, as shown in Fig. 2.2.

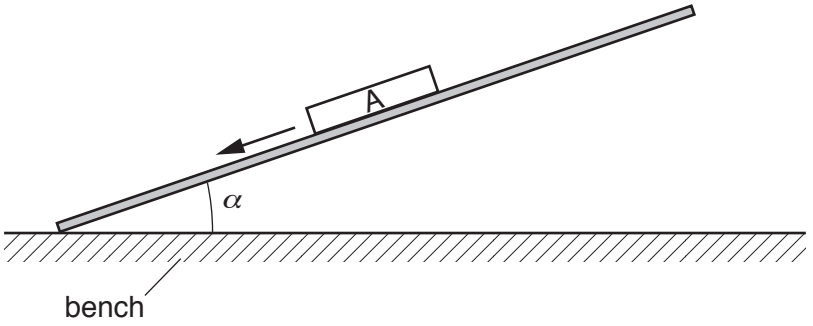


Fig. 2.2

• The angle between the bench and the board when the magnet just starts to move is α.

Measure and record α.

α = ...° [2]

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

percentage uncertainty = ... [1]

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(b) You have been provided with a small block of wood as shown in Fig. 2.3.

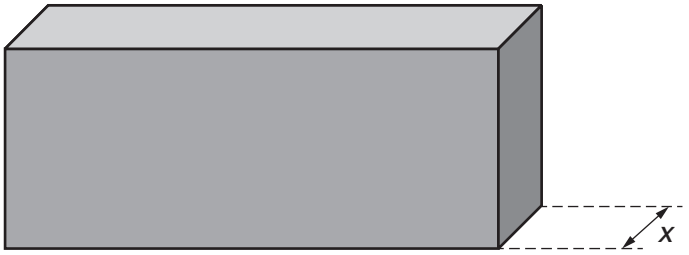


Fig. 2.3

The smallest dimension of the block is *x*.

Measure and record *x*.

x = ... [1]

(c)
- Use some of the adhesive putty to secure the block to the board on the line as shown in Fig. 2.4.
- Use some of the adhesive putty to secure magnet B to the board at a distance *y* from the block, where *y* is approximately 5 mm.
- Place magnet A on the board as shown in Fig. 2.4 so that the magnets are attracting each other.

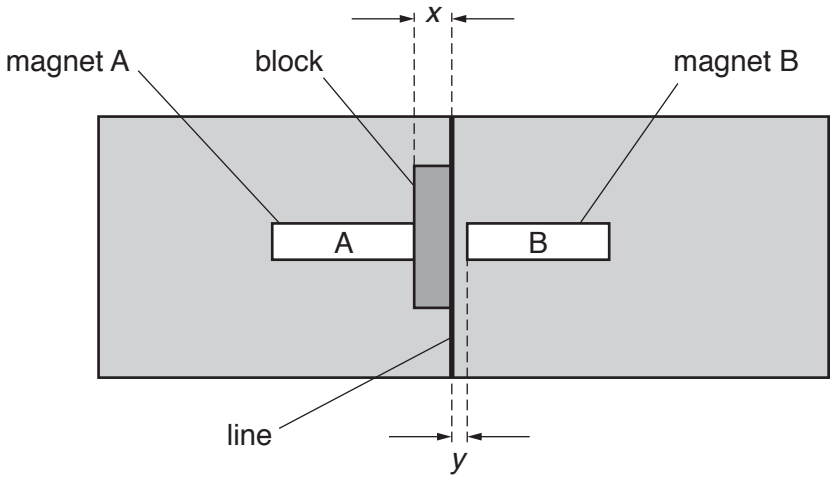


Fig. 2.4

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- Raise the end of the board until magnet A starts to move down the board.
- The angle at which A just starts to move is β, as shown in Fig. 2.5. If A does not move down the board for any angle of the board, gradually increase y until it does move.

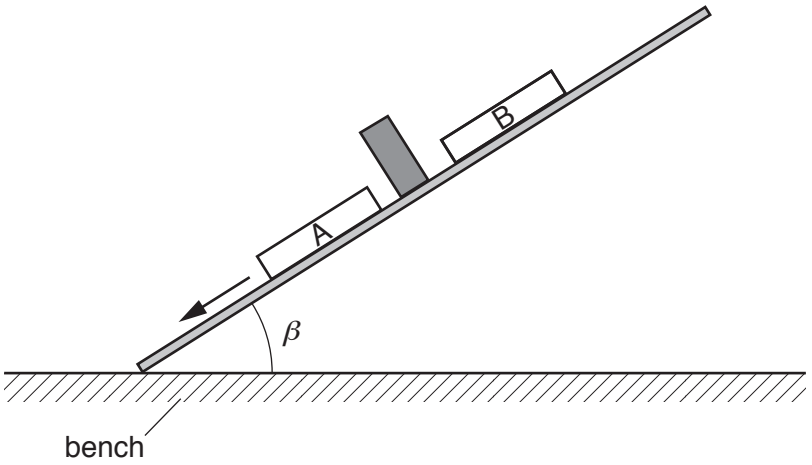


Fig. 2.5

- Measure and record β.

β = ...° [1]

(d) (i) • Measure and record y.

y = ...

- Calculate $(x + y)^2$.

$(x + y)^2$ = ...
[1]

(ii) Justify the number of significant figures that you have given for your value of $(x + y)^2$.

.....

.....

..... [1]

(e) • Remove the block from the board.

• Measure and record the dimension of the block shown in Fig. 2.6.



Fig. 2.6

x = ...

• Calculate $(x + y)^2$ using your value of y in **(d)(i)**.

$(x + y)^2$ = ...

• Place and secure the block on the board as shown in Fig. 2.7.
Do not move B.

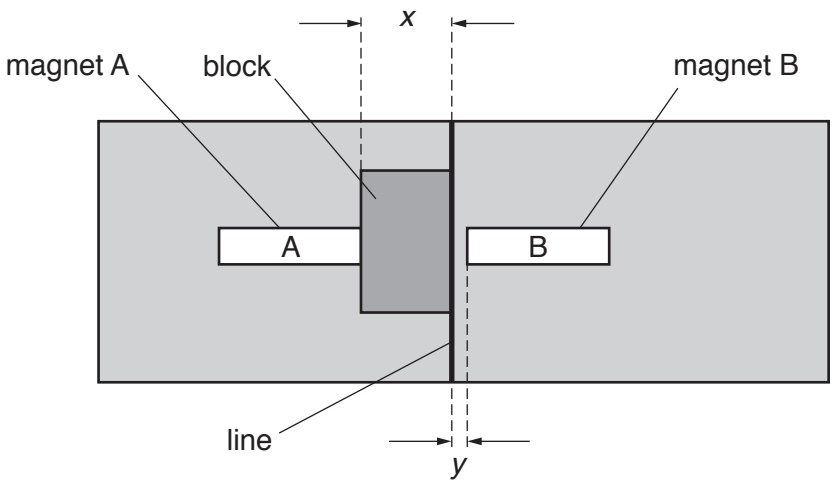


Fig. 2.7

• Determine β.

β = ... °
[3]

(f) It is suggested that the relationship between β, α, x and y is

$$(\sin \beta - \sin \alpha) = \frac{k}{(x + y)^2}$$

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]

(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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