



Cambridge International AS & A Level

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PHYSICS

9702/03

Paper 3 Advanced Practical Skills 1

For examination from 2022

SPECIMEN PAPER

2 hours

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You will be allowed to work with the apparatus for a maximum of 1 hour for each question.
- You should record all your observations in the spaces provided in the question paper as soon as these observations are made.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [].

| For Examiner's Use | |
|--------------------|--|
| 1 | |
| 2 | |
| Total | |

This document has **12** pages. Blank pages are indicated.

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

- 1** In this experiment, you will investigate the motion of a chain of paper clips.

You have been provided with a chain of fifteen paper clips with a sphere of modelling clay attached to one end of the chain.

- (a)** Measure and record the length L of one paper clip as shown in Fig. 1.1.

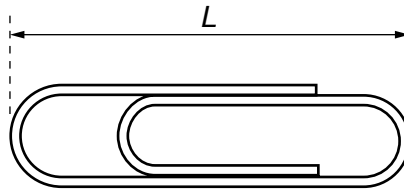


Fig. 1.1

$L = \dots\dots\dots$ [1]

- (b) • Set up the apparatus as shown in Fig. 1.2.

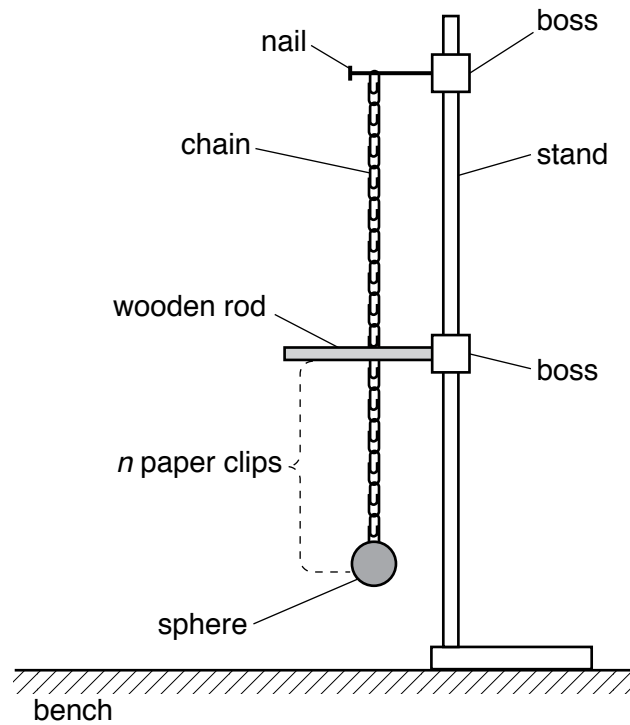


Fig. 1.2

- Suspend the chain from the nail.
- Position the wooden rod so that the chain, when hanging vertically, just touches the rod. The number n of paper clips below the rod should be equal to 6.
- Move the sphere towards you through a distance of approximately 10 cm. Release the sphere. The chain will oscillate and hit the rod during these oscillations.
- Determine the period T of the oscillations.

$T = \dots\dots\dots$ [2]

- (c) Change n by moving the wooden rod vertically and determine T . Repeat until you have six sets of values of n and T .

Record your results in a table. Include values of \sqrt{n} to three significant figures in your table.

[8]

- (d) (i) Plot a graph of T on the y -axis against \sqrt{n} on the x -axis.

[3]

- (ii) Draw the straight line of best fit.

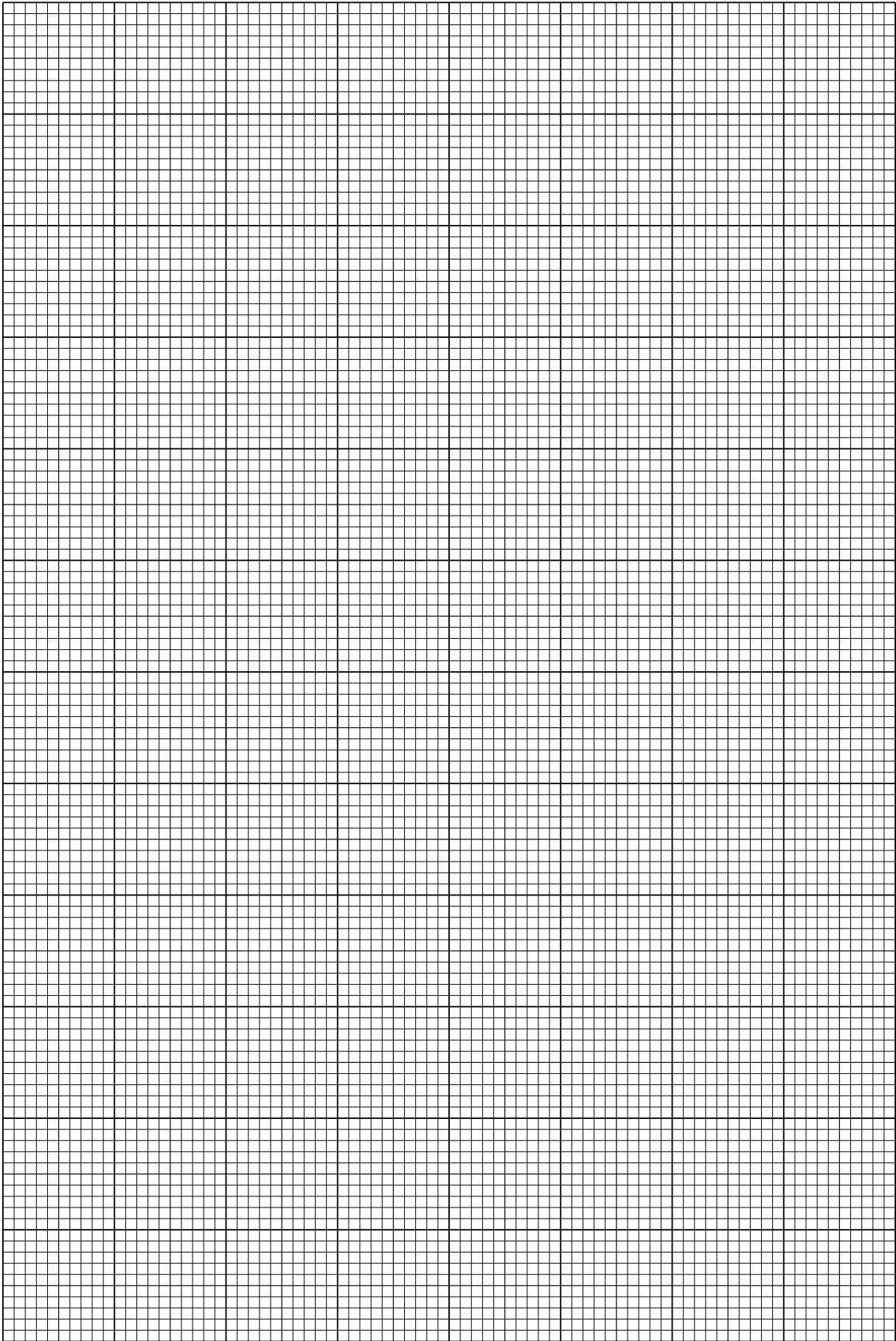
[1]

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

gradient =

y -intercept =

[2]



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

$$T = P\sqrt{n} + Q$$

where P and Q are constants.

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

$$P = \dots\dots\dots$$

$$Q = \dots\dots\dots$$

[2]

- (f) Theory suggests that

$$P = \pi\sqrt{\frac{L}{g}}$$

where g is the acceleration of free fall.

Use your values in (a) and (e) to determine a value for g .
Give an appropriate unit.

$$g = \dots\dots\dots [1]$$

[Total: 20]

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

2 In this experiment, you will investigate the potential difference across a current-carrying wire.

You have been provided with a wooden strip with wires attached.

(a) The wire attached between A and B has a diameter D .

(i) Without detaching the wire from the board, measure and record D .

$D = \dots\dots\dots$ [1]

(ii) Estimate the percentage uncertainty in your value of D . Show your working.

percentage uncertainty = $\dots\dots\dots$ % [1]

- (b) • Set up the circuit shown in Fig. 2.1.

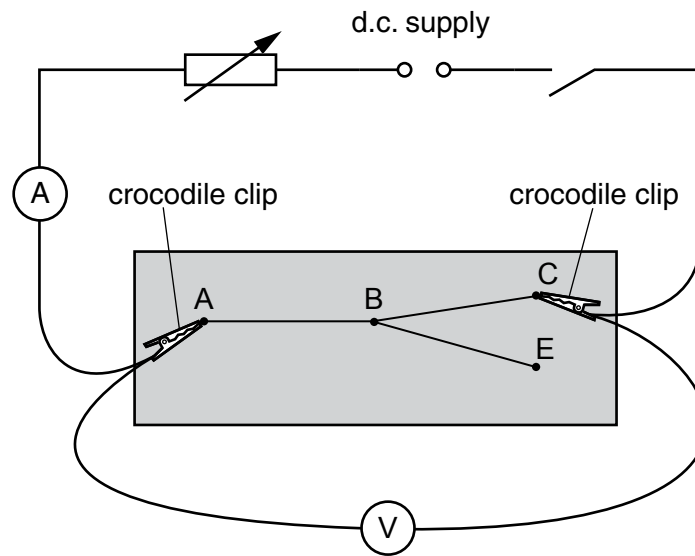


Fig. 2.1

- Connect the crocodile clips to A and C.
- Adjust the rheostat to approximately the middle of its range.
- Close the switch.
- Record the ammeter reading.

ammeter reading =

- Record the voltmeter reading V .

$V =$

- Open the switch.

[2]

- (c) (i) The wire attached between B and C has a diameter d .

Measure and record d .

$d = \dots\dots\dots$ [1]

- (ii) Calculate G where

$$G = \frac{D^2 + d^2}{D^2 d^2}.$$

$G = \dots\dots\dots$ [1]

- (iii) Justify the number of significant figures that you have given for your value of G .

.....

 [1]

- (d)
- Disconnect the crocodile clip from C and connect it to E.
 - Close the switch.
 - Adjust the rheostat so that the ammeter reading is as close as possible to the reading in (b).
 - Record the voltmeter reading V .

$V =$

- Open the switch.

[2]

- (e) The wire attached between B and E has diameter d .

- Measure and record d .

$d =$

- Calculate G .

$G =$

[1]

- (f) It is suggested that the relationship between V and G is

$$V = kG$$

where k is a constant.

Using your data, calculate two values of k .

first value of $k =$

second value of $k =$

[1]

- (g) It is suggested that the percentage uncertainty in the values of k is 5%.

Using this uncertainty, explain whether your results support the relationship in (f).

.....
.....
.....
..... [1]

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

For any uncertainties in measurement that you describe, you should state the quantity being measured and a reason for the uncertainty.

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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