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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

0074675534

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **May/June 2022**

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	

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

1 In this experiment, you will investigate the oscillations of a wooden strip.

You have been provided with a wooden strip with two string loops attached.

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

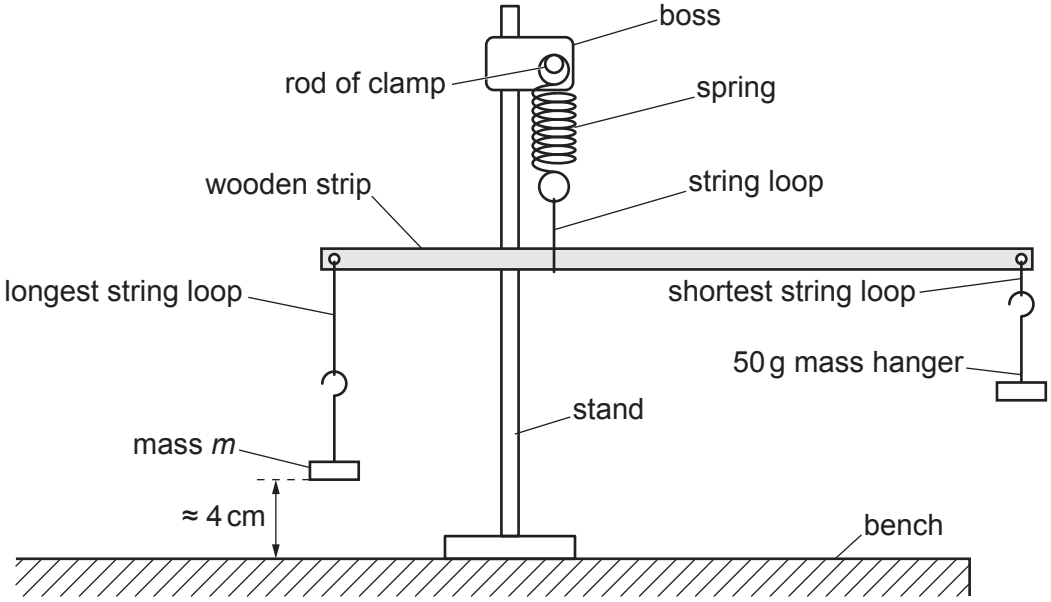


Fig. 1.1

- Add a 100 g mass to the 100 g mass hanger to make a total mass *m* of 200 g.
- Suspend mass *m* from the longest string loop.
- Record *m*.

m = ... g

- Suspend the 50 g mass hanger from the shortest string loop.
- Adjust the position of the wooden strip in the string loop attached to the spring until the strip balances. Use some of the adhesive putty to fix this string loop to the strip.
- Pull mass *m* down to the bench and secure it to the bench using adhesive putty.
- With mass *m* stuck to the bench, adjust the height of the boss until the wooden strip is parallel to the bench, as shown in Fig. 1.2.

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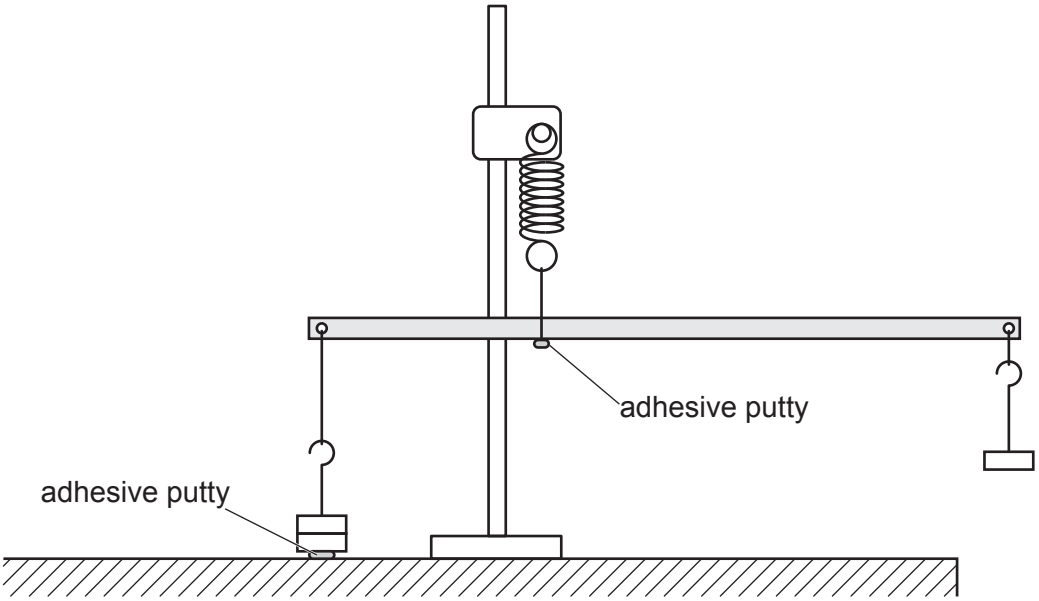


Fig. 1.2

- Pull the 50 g mass hanger down through a short distance.
- Release the 50 g mass hanger. The hanger will oscillate.
- Determine the period T of these oscillations.

T = ...

- Carefully remove all the adhesive putty from mass m and the strip.

[2]

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(b) Vary m and repeat **(a)** with different values of m until you have six sets of readings of m and T.

Record your results in a table. Include values of $\frac{T}{m}$ and $\frac{1}{m}$ in your table.

[10]

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

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

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

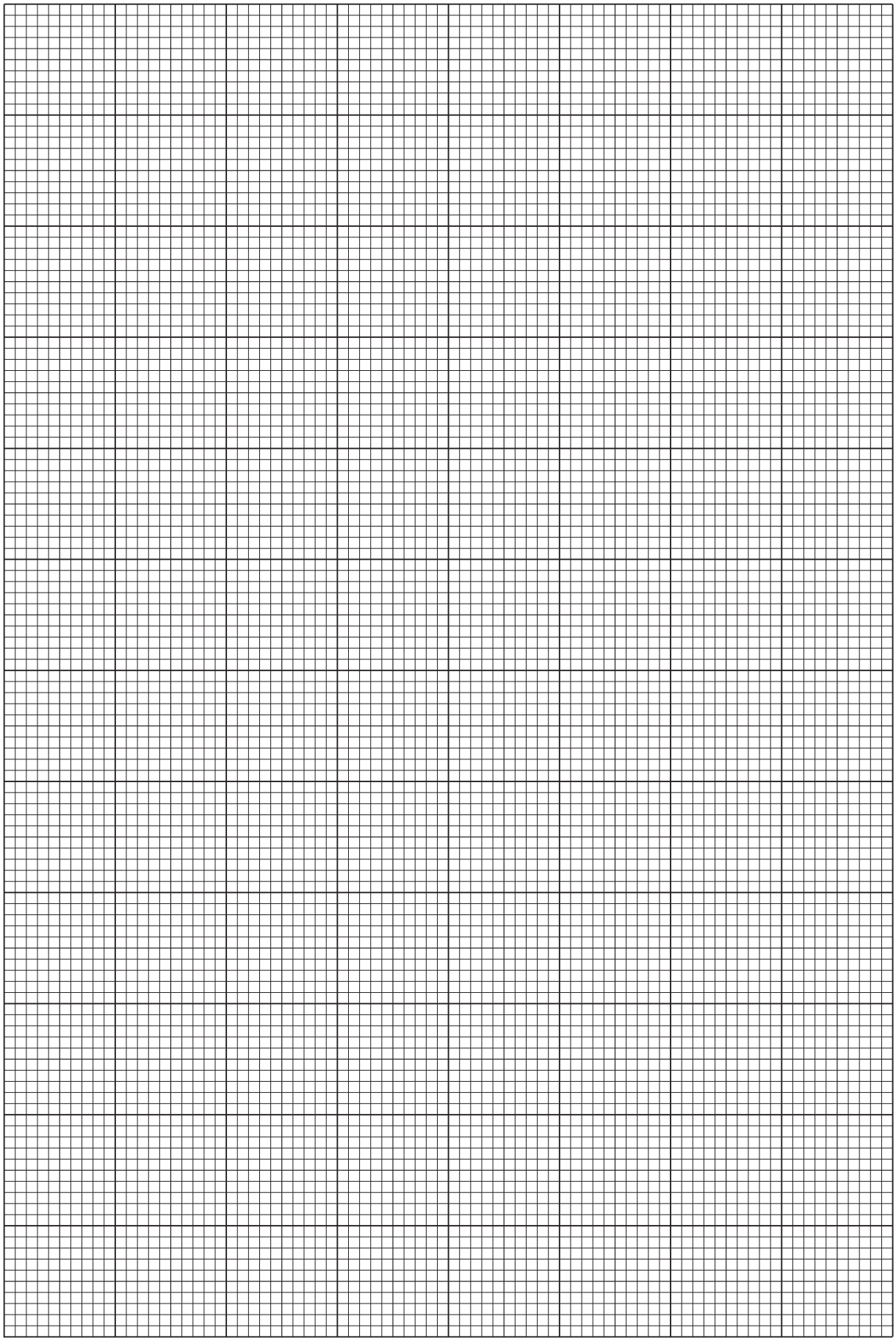
gradient = ...

y-intercept = ...

[2]

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

$$\frac{T}{m} = \frac{P}{m} + Q$$

where P and Q are constants.

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

P = ...

Q = ...
[2]

[Total: 20]

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

2 In this experiment, you will investigate the effect of temperature on an electric circuit.

You have been provided with two copper wires of the same length. You have also been provided with two constantan wires of different lengths.

(a) (i) Measure and record the diameter *d* of the **longer** constantan wire.

d = ... [1]

(ii) ● Using the two copper wires and the longer constantan wire, twist the ends together to form junctions as shown in Fig. 2.1.

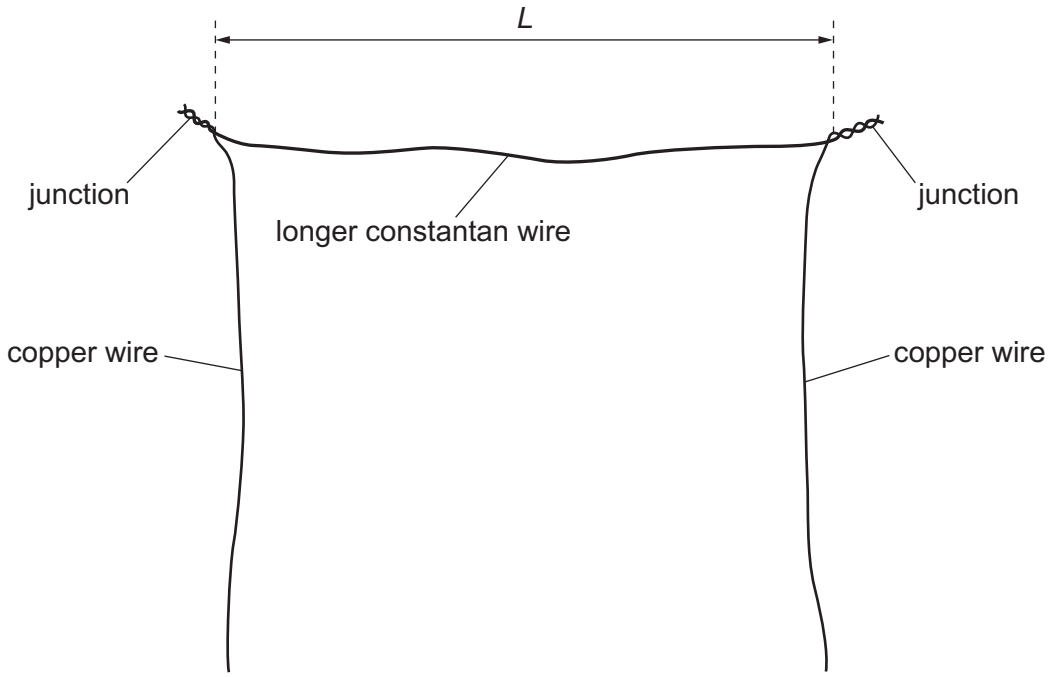


Fig. 2.1

- Ensure the junctions are tight so that the wires cannot be separated by pulling.
- The distance between the junctions along the constantan wire is *L*, as shown in Fig. 2.1.

  Measure and record *L*.

L = ... cm [1]

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

percentage uncertainty = ... % [1]

(iv) Calculate C where

$$C = \frac{d^2}{L}.$$

C = ... [1]

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

.....

.....

..... [1]

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(b) ● Measure and record the temperature θ_R of the room.

θ_R = ... °C

● Connect the copper wires to the ammeter as shown in Fig. 2.2.

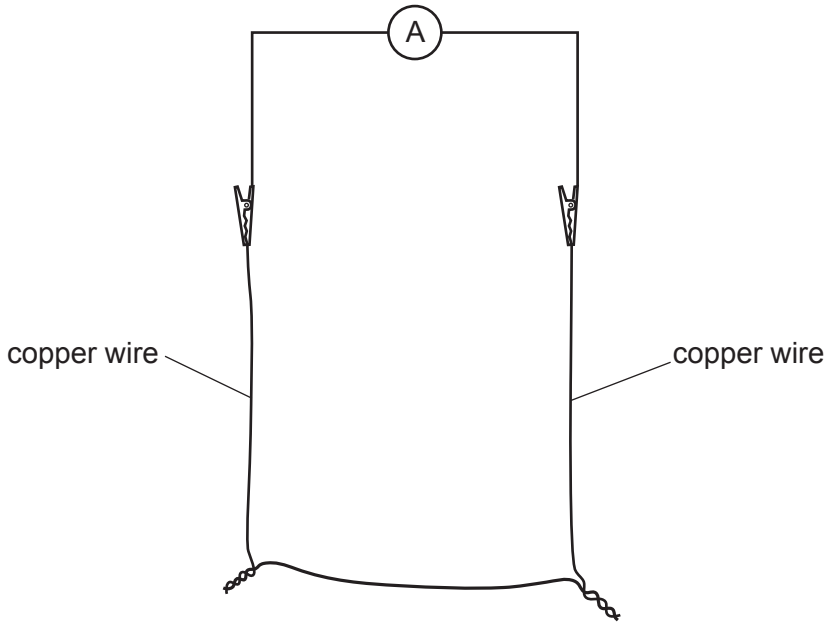


Fig. 2.2

● Pour boiling water into the beaker so that the beaker is half-full.

● Place **one** of the junctions deep in the water. The other junction should be at room temperature.

● Record the ammeter reading I when the temperature θ of the water passes 75 °C.

I = ...

● Record θ.

θ = ... °C

● Calculate $\Delta\theta$ where

$$\Delta\theta = (\theta - \theta_R).$$

$\Delta\theta$ = ... °C

● Pour the hot water into the sink.

[2]

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(c) (i) ● Untwist the wires at the junctions.

● Using the **shorter** constantan wire and the two copper wires, repeat **(a)(i)**, **(a)(ii)** and **(a)(iv)**.

d = ...

L = ... cm

C = ...
[2]

(ii) ● Connect the copper wires to the ammeter as shown in Fig. 2.2.

● Pour boiling water into the beaker so that the beaker is half-full.

● Place **one** of the junctions deep in the water. The other junction should be at room temperature.

● Record the ammeter reading I when the temperature θ of the water passes 65 °C.

I = ...

● Record θ.

θ = ... °C

● Calculate $\Delta\theta$ where

$$\Delta\theta = (\theta - \theta_R).$$

$\Delta\theta$ = ... °C

● Pour the hot water into the sink.
[1]

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(d) It is suggested that the relationship between I, C and $\Delta\theta$ is

$$I = kC\Delta\theta$$

where k is a constant.

Using your data, calculate two values of k.

first value of k = ...

second value of k = ...

[1]

(e) It is suggested that the percentage uncertainty in the values of k is 30%.

Using this uncertainty, explain whether your results support the suggested relationship in **(d)**.

.....

.....

.....

..... [1]

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(f) (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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