Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **May/June 2021**

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.

[Turn over

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

1 In this experiment, you will investigate the motion of a pendulum bob.

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

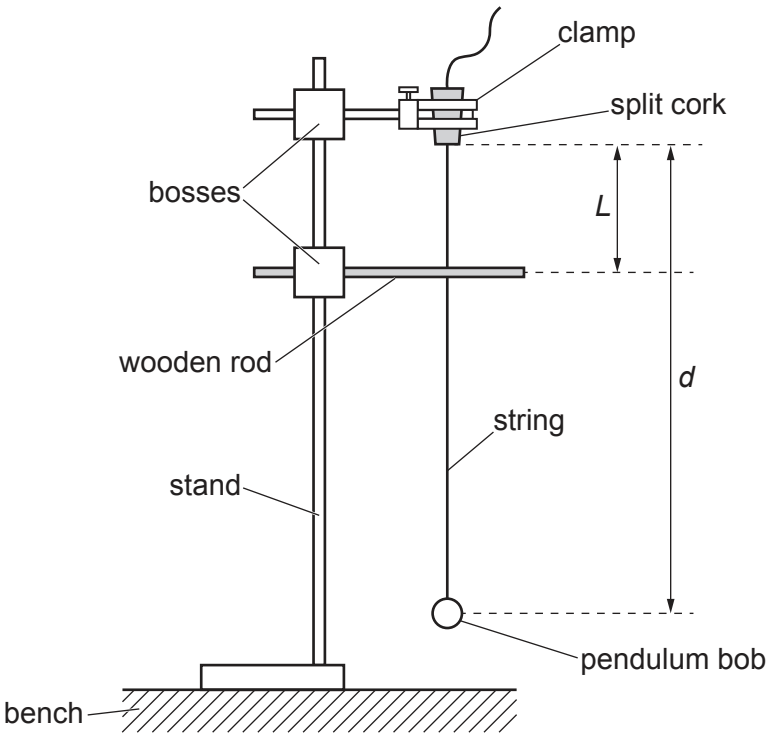


Fig. 1.1

● The distance between the bottom of the cork and the centre of the bob is *d*.

The distance between the bottom of the cork and the centre of the wooden rod is *L*.

Adjust the height of the rod until the value of *L* is approximately 10 cm. Ensure the rod is horizontal and the string is just touching the rod.

● Measure and record *L*.

L = ... [1]

(b)

- Adjust the string in the cork until the value of d is approximately 30 cm.
- Measure and record d.

d = ...

- Pull the bob towards you through a short distance at right angles to the rod.
- Release the bob. The bob will oscillate.
- Determine the period T of these oscillations.

T = ... s
[1]

(c) ● Write down your value of L from **(a)**.

L = ...

● Keeping L **constant**, repeat **(b)** with different values of d until you have five sets of values of d and T.

Record your results in a table. Include values of $\frac{T}{\sqrt{d}}$ and $\sqrt{\frac{(d-L)}{d}}$ in your table.

[10]

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

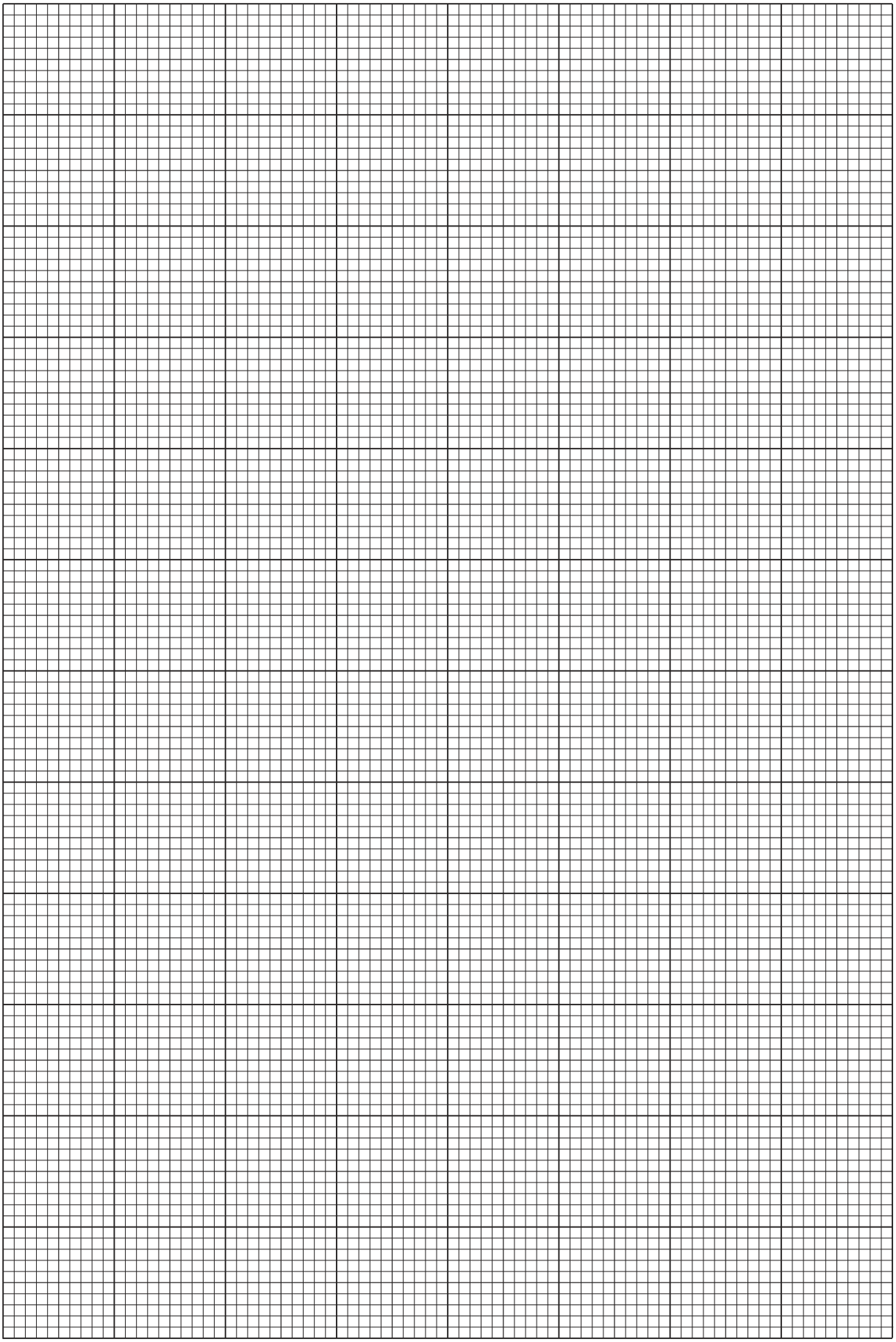
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...

[2]



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

$$\frac{T}{\sqrt{d}} = P\sqrt{\frac{(d-L)}{d}} + Q$$

where P and Q are constants.

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

P = ...

Q = ...
[2]

[Total: 20]

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

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

(a) You have been provided with a wooden strip. There are three holes in the strip and string is attached to two of the holes.

- Press the modelling clay onto the end of the strip as shown in Fig. 2.1.

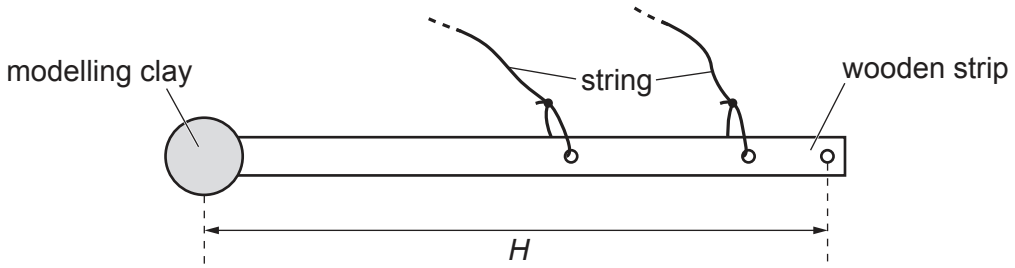


Fig. 2.1

- The distance between the centre of the modelling clay and the centre of the hole at the other end of the strip is *H*.

  Using the ruler, take measurements to determine *H*.

H = ... cm [1]

(b) (i) ● Set up the apparatus as shown in Fig. 2.2.

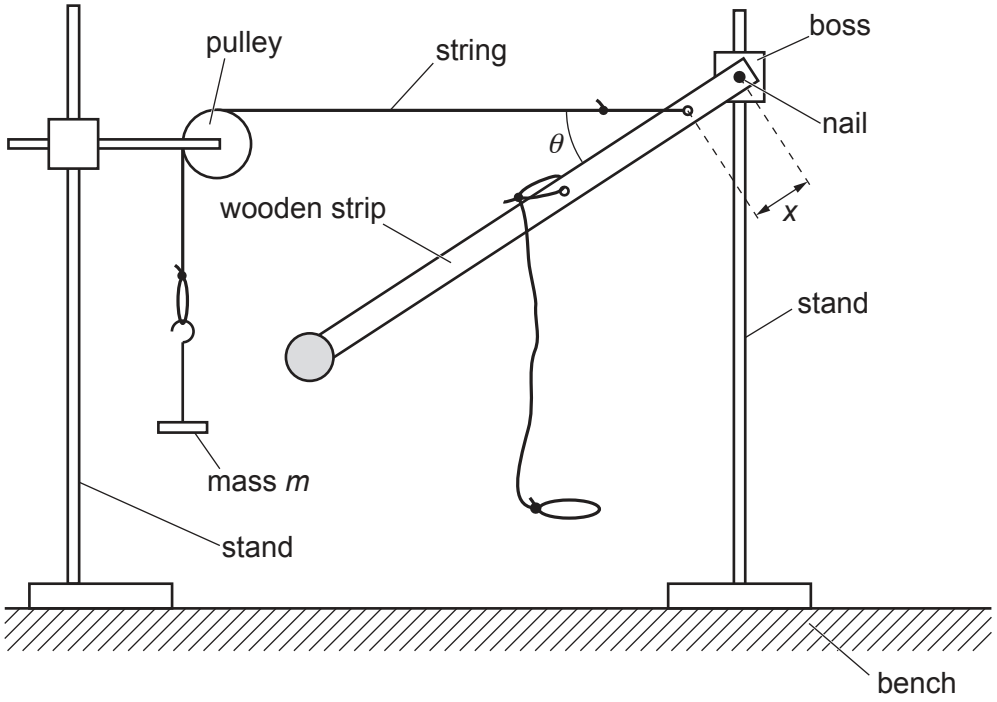


Fig. 2.2 (not to scale)

- Hang a mass m of 100 g from the string.
- Adjust the heights of the boss and pulley until the string between the strip and the pulley is horizontal.
- The distance between the nail and the hole through which the string is attached is x.

  The angle between the strip and the horizontal string is θ.

  Measure and record x and θ.

x = ... cm

θ = ... °

[2]

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

percentage uncertainty = ... [1]

(iii) Calculate $x \tan \theta$.

$x \tan \theta =$ ..... cm [1]

(iv) Justify the number of significant figures that you have given for your value of $x \tan \theta$.

.....

.....

..... [1]

(c) ● Remove the mass and the string from the pulley.

● Set up the apparatus as shown in Fig. 2.3 using the other string.

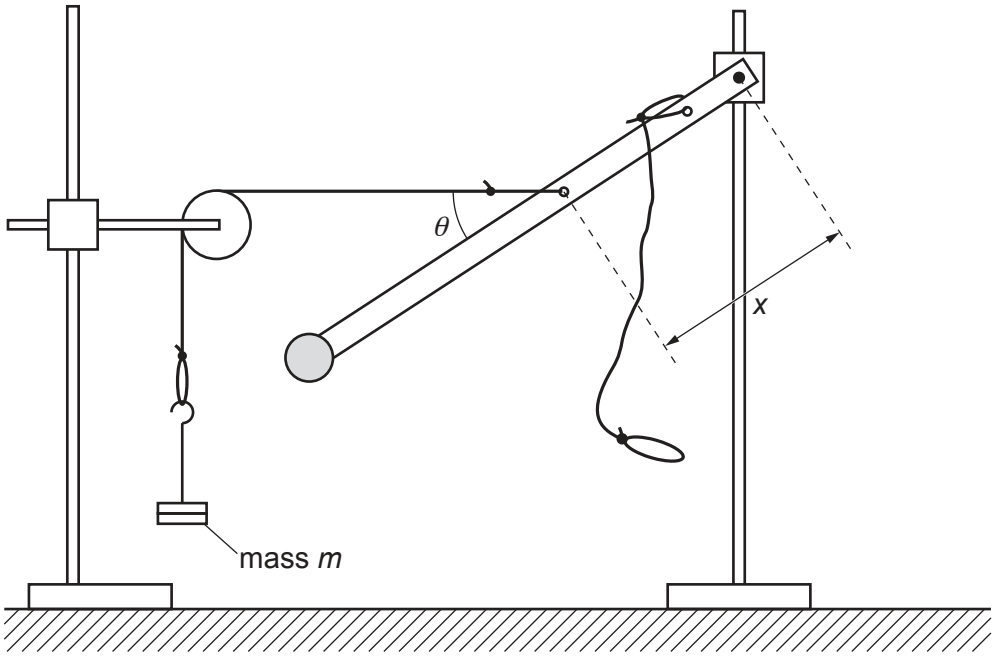


Fig. 2.3 (not to scale)

● Hang a mass m of 200 g from the string.

● Adjust the heights of the boss and pulley until the string between the strip and the pulley is horizontal.

● The distance between the nail and the hole through which the string is attached is x.

The angle between the strip and the horizontal string is θ.

Measure and record x and θ.

x = ... cm

θ = ... °

● Calculate $x \tan \theta$.

$x \tan \theta$ = ... cm
[3]

(d) It is suggested that the relationship between x, θ and m is

$$x \tan\theta = \frac{k}{m}$$

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]

(e) Theory suggests that

$$k = \frac{5HM}{6}$$

where M is the mass of the wooden strip.

Use your second value of k to calculate a value for M.
Give an appropriate unit.

M = ... [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]