Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

6076125870

PHYSICS **9702/36**

Paper 3 Advanced Practical Skills 2 **October/November 2018**

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 **10** printed pages and **2** blank pages.

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

1 In this experiment, you will investigate a system in equilibrium.

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

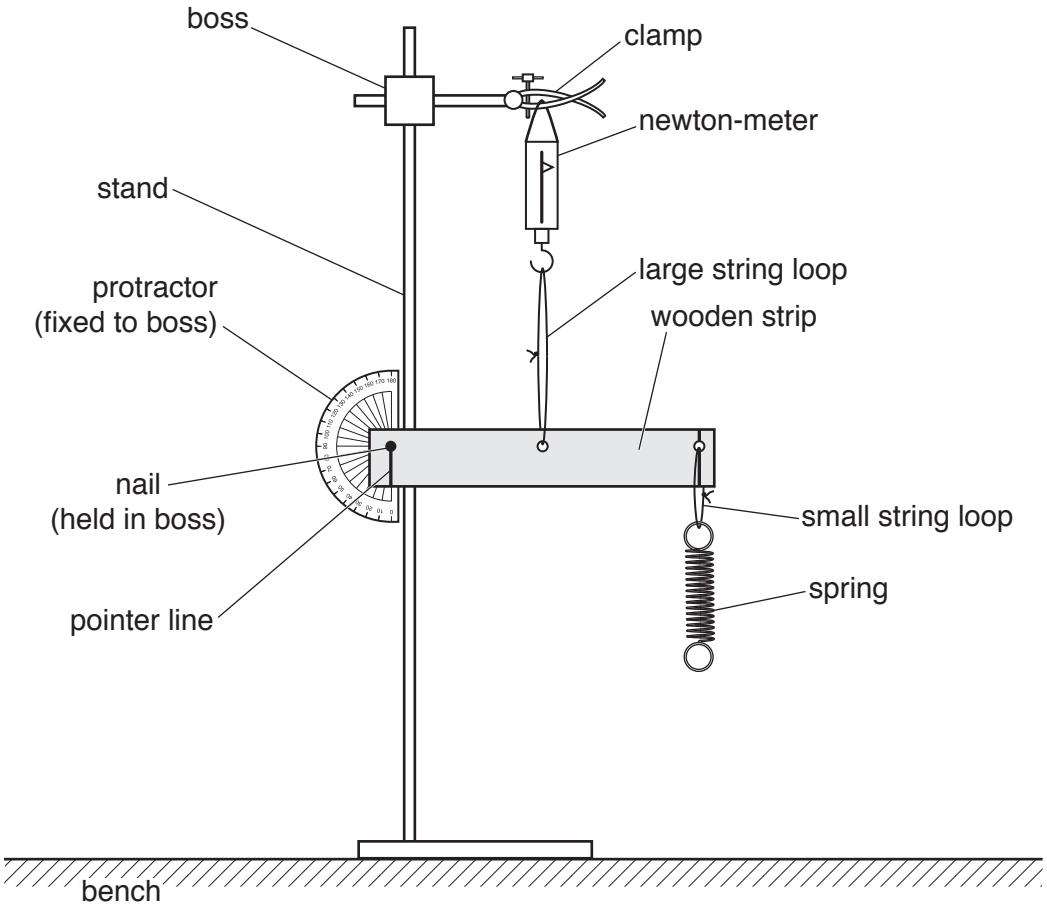


Fig. 1.1

- Adjust the apparatus so that the wooden strip is horizontal, the large string loop and newton-meter are vertical, and the pointer line is aligned with the zero line on the protractor.

- Measure and record the length L_0 of the coiled part of the spring, as shown in Fig. 1.2.

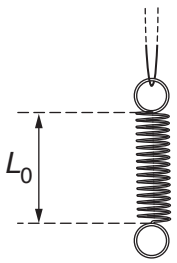


Fig. 1.2

L_0 = ... [1]

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(b) • Pull the spring down a short distance, keeping the small string loop aligned with the line on the wooden strip, as shown in Fig. 1.3.

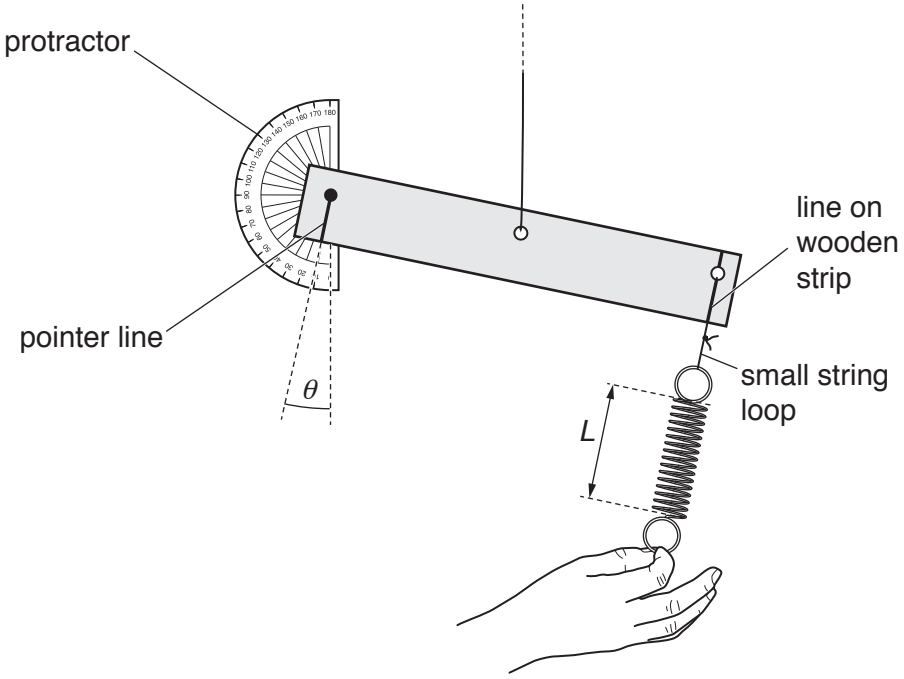


Fig. 1.3

• Measure and record the length L of the coiled section of the spring, as shown in Fig. 1.3.

L = ...

• Read and record the angle θ of the pointer line from the vertical, as shown in Fig. 1.3.

θ = ...
[1]

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(c) Repeat **(b)** using different values of θ less than 45° until you have six sets of values of θ and L.

Record your results in a table. Include values of $(L-L_0)$ and values of $(\sin\theta)(\cos\theta)$ in your table.

[10]

(d) **(i)** Plot a graph of $(L-L_0)$ on the y-axis against $(\sin\theta)(\cos\theta)$ on the x-axis. [3]

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

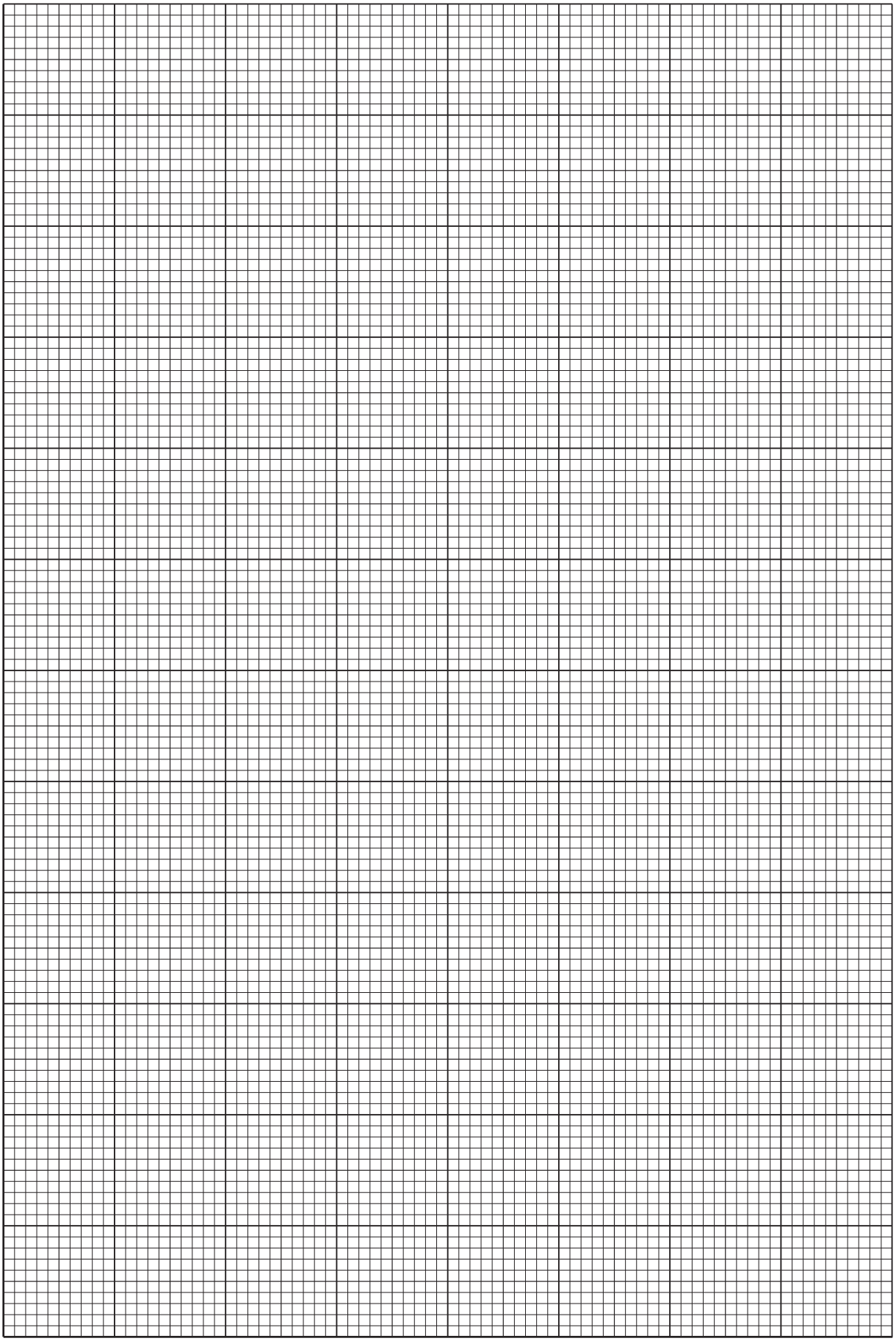
(iii) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...

[2]

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[Turn over

(e) It is suggested that the quantities L and θ are related by the equation

$$(L - L_0) = a\,(\sin\theta)(\cos\theta) + b$$

where a and b are constants.

Use your answers in **(d)(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 motion of a hacksaw blade.

(a) • Assemble the apparatus as shown in Fig. 2.1.

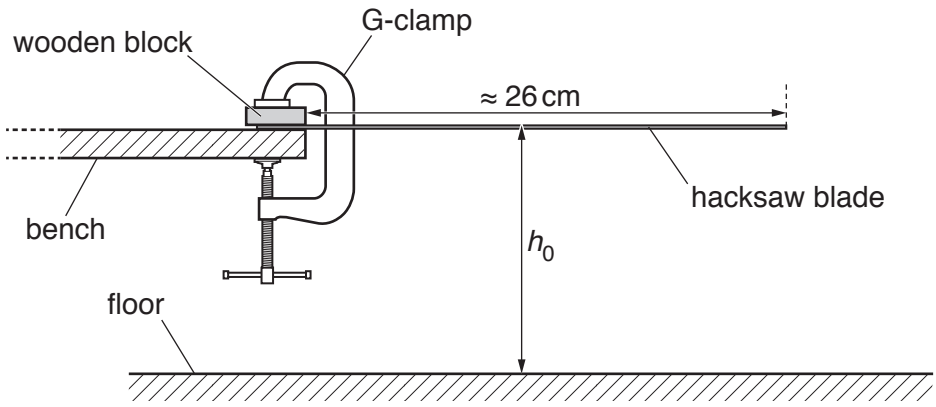


Fig. 2.1 (not to scale)

• The vertical distance from the floor to the top surface of the hacksaw blade is h_0, as shown in Fig. 2.1.

Measure and record h_0.

h_0 = ... [1]

(b) (i) • Place the 100 g mass on the blade with its centre approximately 19 cm from the bench and tape it in position.

When released, the hacksaw blade will bend down, as shown in Fig. 2.2.

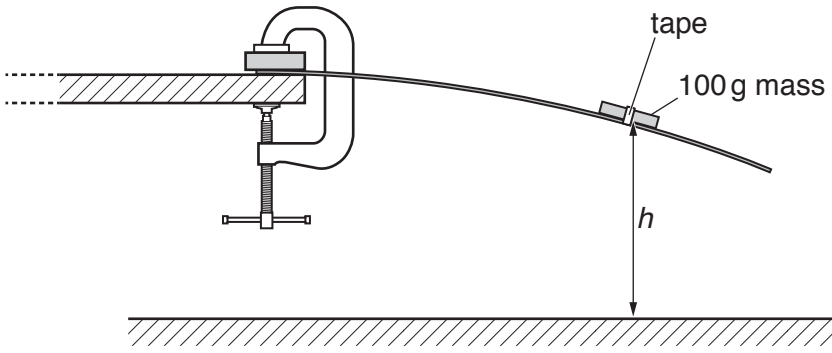


Fig. 2.2 (not to scale)

• The vertical distance from the floor to the top surface of the hacksaw blade at the centre of the mass is h.

Measure and record h.

h = ... [1]

(ii) Calculate y, where $y = h_0 - h$.

$y =$ ..... [1]

(c) Estimate the percentage uncertainty in your value of y.

percentage uncertainty = ... [1]

(d) Push the end of the hacksaw blade down a small distance and then release it. The blade will oscillate.

Determine the period T of the oscillations.

$T =$ ..... [2]

(e)
- Move the slotted mass approximately 3 cm further from the bench and fix it with tape.
- Measure and record h.

$h =$ .....

- Repeat **(b)(ii)** and **(d)**.

$y =$ .....

$T =$ .....
[3]

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(f) It is suggested that the relationship between T and y is

$$T = c\sqrt{y}$$

where c is a constant.

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

first value of c = ...

second value of c = ...
[1]

(ii) Explain whether your results support the suggested relationship.

.....

.....

..... [1]

(g) Theory suggests that an approximate value of the acceleration of free fall g is given by

$$g = \frac{4\pi^2}{c^2}.$$

Using your second value of c, calculate g.
Give an appropriate unit.

g = ... [1]

(h) (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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