Cambridge
O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5109740711

PHYSICS **5054/31**

Paper 3 Practical Test **May/June 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 **all** questions.
For each of the questions in Section A, you will be allowed to work with the apparatus for a maximum of 20 minutes. For the question in Section B, you will be allowed to work with the apparatus for a maximum of 1 hour.

You are expected to record all your observations as soon as these observations are made.
An account of the method of carrying out the experiments is **not** required.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

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	
3	
4	
Total	

This document consists of **14** printed pages and **2** blank pages.

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Section A

Answer all the questions in this section.

1 *In this experiment, you will investigate the oscillation of a pendulum joined to a spring.*

You are provided with:

- a length of thread
- a 300 g mass
- a stopwatch
- a stand, boss and clamp
- a second boss
- a split cork
- a spring
- a metre rule
- a G-clamp or weight.

The supervisor has set up the apparatus as shown in Fig. 1.1.

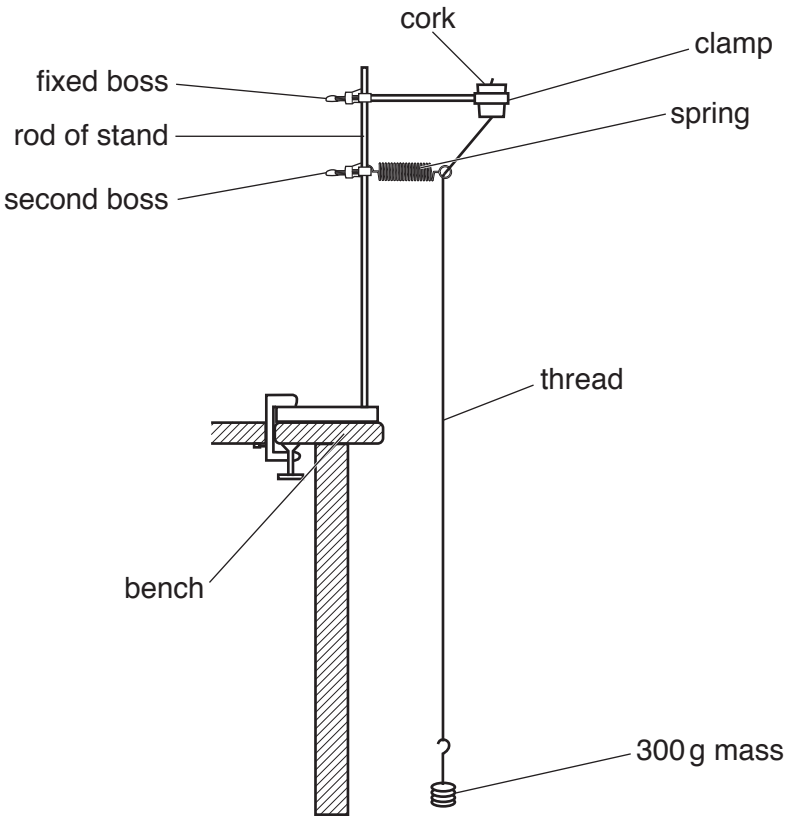


Fig. 1.1

The position of the boss attached to the clamp holding the cork is fixed and must not be changed.

The position of the boss attached to the spring will be adjusted.

Ensure that the distance D between the bosses is 10 cm, as shown in Fig. 1.2.

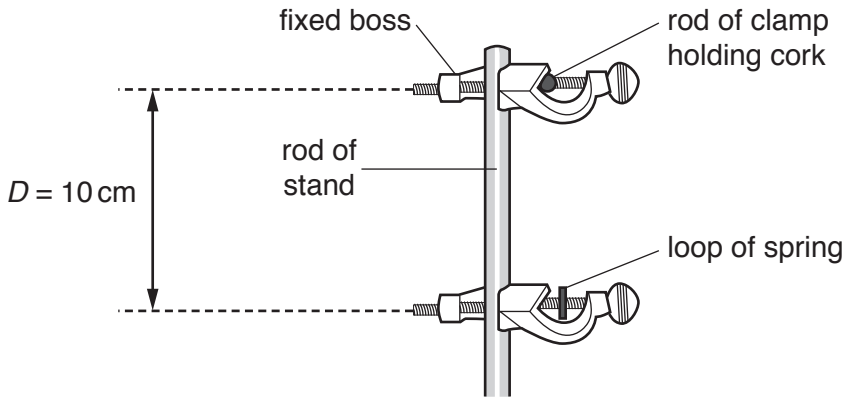


Fig. 1.2

(a) View the apparatus from the side, as shown in Fig. 1.1.

Move the right hand loop of the spring along the thread until the spring is **as close to horizontal as possible**.

Move the mass approximately 5 cm to the right.

Release the mass and observe it swing to the left and then return to its point of release as shown in Fig. 1.3. This is one oscillation.

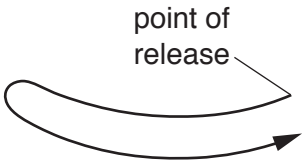


Fig. 1.3

Determine the time T_1 for twenty oscillations of the pendulum.

T_1 = ... [1]

(b) (i) Move the second boss down the rod of the stand until $D = 30\,\text{cm}$. Ensure that the spring is horizontal again.

Determine the time T_2 for twenty oscillations of the pendulum.

$T_2 =$ ..... [1]

(ii) Move the second boss down the rod of the stand until $D = 50\,\text{cm}$. Ensure that the spring is horizontal.

Determine the time T_3 for twenty oscillations of the pendulum.

$T_3 =$ ..... [1]

(c) Describe the trend shown in the results of the experiment.

.....

..... [1]

(d) Another method to determine the time for 20 oscillations is to start and stop the stopwatch as the mass passes through the centre of the oscillation as shown in Fig. 1.4.

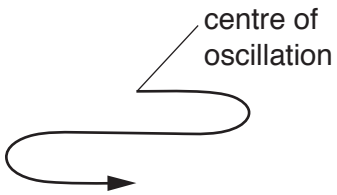


Fig. 1.4

By considering the speed of the mass, suggest why this method is more accurate.

.....

.....

.....

..... [1]

[Total: 5]

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2 *In this experiment, you will investigate the time taken for a voltmeter reading to change.*

You are provided with a circuit consisting of:

- a power supply
- a fixed resistor R_1
- a component C
- a switch
- a voltmeter.

The supervisor has set up the circuit shown in Fig. 2.1.

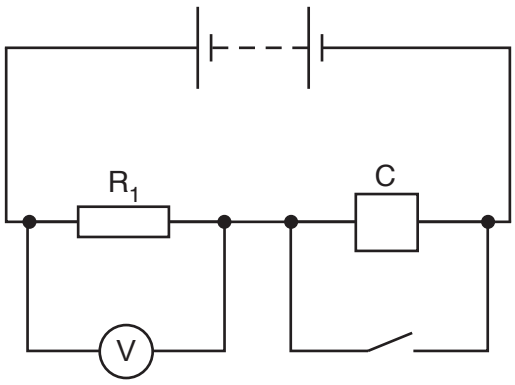


Fig. 2.1

You have also been provided with:

- a stopwatch
- a fixed resistor R_2.

(a) (i) Close the switch.

Record the reading V_0 on the voltmeter.

V_0 = ... [1]

(ii) Open the switch and start the stopwatch.

Determine the average time t_1 taken for the voltmeter reading to decrease to 0.5 V.

t_1 = ... [2]

(b) Replace the resistor R_1 with the resistor R_2. Close the switch.

Repeat **(a)(ii)** to determine the average time t_2 taken for the voltmeter reading to decrease to 0.5 V.

t_2 = ... [1]

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(c) The resistance of resistor R_1 is 10 times greater than the resistance of resistor R_2.

Describe how decreasing the resistance by a factor of 10 affects the time taken for the voltmeter reading to decrease to 0.5 V.

.....

..... [1]

[Total: 5]

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3 *In this experiment, you will investigate how the angle of an L-shaped beam varies with the position of a mass.*

You are provided with:

- an L-shaped beam
- a rod to act as a pivot
- a stand, clamp and two bosses
- a mass on a mass hanger
- a wire hook
- a protractor
- a metre rule
- a set square.

The supervisor has set up the apparatus as shown in Fig. 3.1.

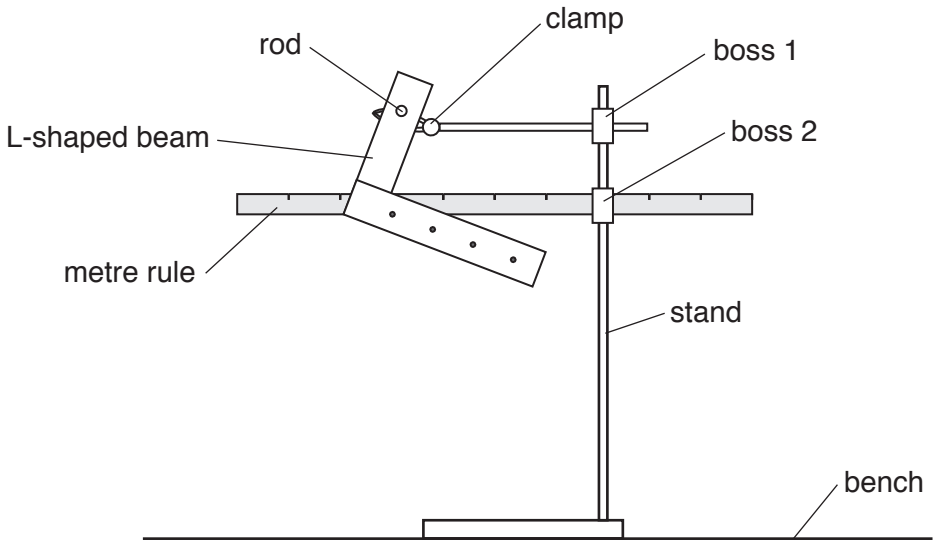


Fig. 3.1

Fig. 3.1 shows the L-shaped beam pivoted on a rod attached to the clamp. The clamp is attached to the stand by boss 1.

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[Turn over

Fig. 3.2 shows θ the angle between one edge of the metre rule and the numbered arm of the L-shaped beam.

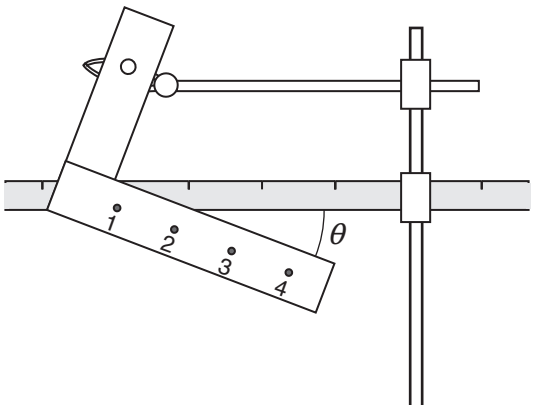


Fig. 3.2

(a) Pass one end of the wire hook through hole 1 in the L-shaped beam. Suspend the 200 g mass from the bottom of the wire hook.

(i) Measure the angle θ between the rule and the numbered arm of the L-shaped beam.

θ = ... [1]

(ii) Remove the wire hook from hole 1 and attach the mass to hole 2 with the wire hook.

Measure the new angle θ.

Repeat for hole 3 and hole 4 and record all your measurements of angle θ in the table of Fig. 3.3.

hole	angle θ/°
1	
2	
3	
4	

[2]

Fig. 3.3

(b) Describe one difficulty you experienced in obtaining an accurate value for the angle θ.

Suggest an improvement to overcome this difficulty.

difficulty .....

.....

.....

improvement .....

.....

.....

[1]

(c) Describe a method to check that the rule is horizontal.

.....

.....

..... [1]

[Total: 5]

Section B

4 *In this experiment, you will investigate the size of an image.*

You are provided with:

- a lamp
- a slit plate attached to a rod
- a 30 cm ruler
- a sheet of paper
- a metre rule.

The supervisor has set up the apparatus as shown in Fig. 4.1.

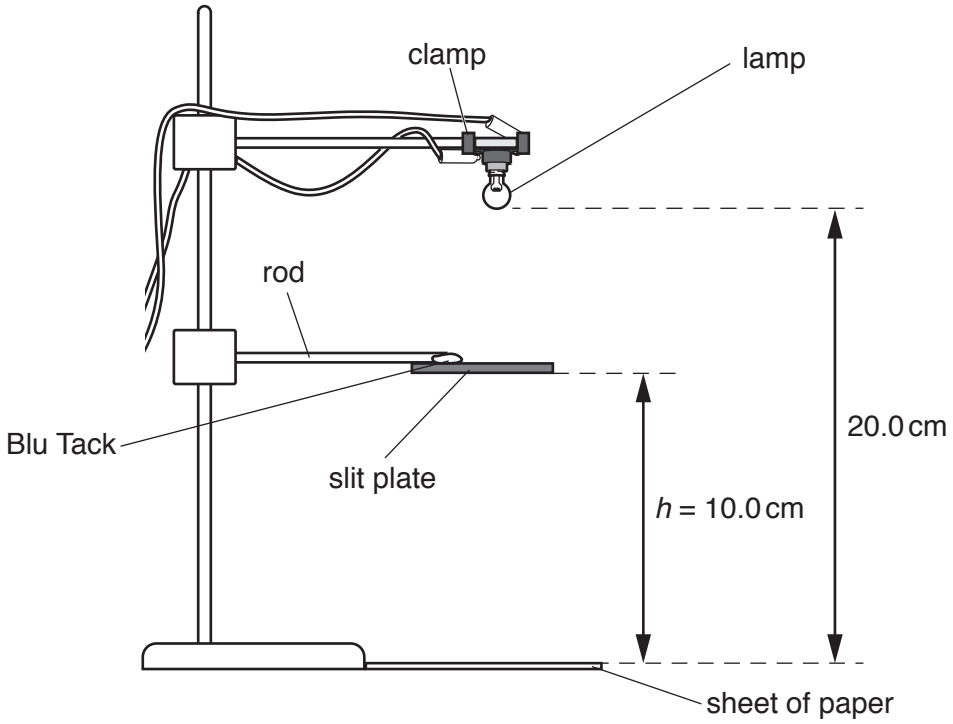


Fig. 4.1

Check that the bottom of the glass bulb of the lamp is 20.0 cm above the centre of the paper. Adjust if necessary.

Check that the midpoint of the two slits in the slit plate is directly beneath the lamp and that the slit plate is a height h = 10.0 cm above the paper. Adjust if necessary.

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(a) Measure:

- the length l of one of the slits in the slit plate
- the distance d between the centres of the slits.

l = ...

d = ...
[2]

(b) Switch on the lamp. Observe the image of the two slits on the paper.

Measure:

- the length l_i of one of the slit images formed on the paper
- the distance d_i between the centres of the images of the two slits.

l_i = ...

d_i = ...
[1]

(c) Continue the experiment. Keep the lamp at the same height. Move the slit plate up and down for values of h in the range $h = 4.0\,\text{cm}$ to $16.0\,\text{cm}$.

Measure h, l_i and d_i for each position of the slit plate.

- Write appropriate headings in the top row of Table 4.1.
- Record all of your results in Table 4.1.
- Switch off the lamp.
- For each of your measurements, calculate $\frac{d_i}{l_i}$ and record your answers in Table 4.1.

  Write an appropriate header for this calculation.

Table 4.1

[4]

(d) On the grid on page 13, plot a graph of l_i on the y-axis against height h on the x-axis.

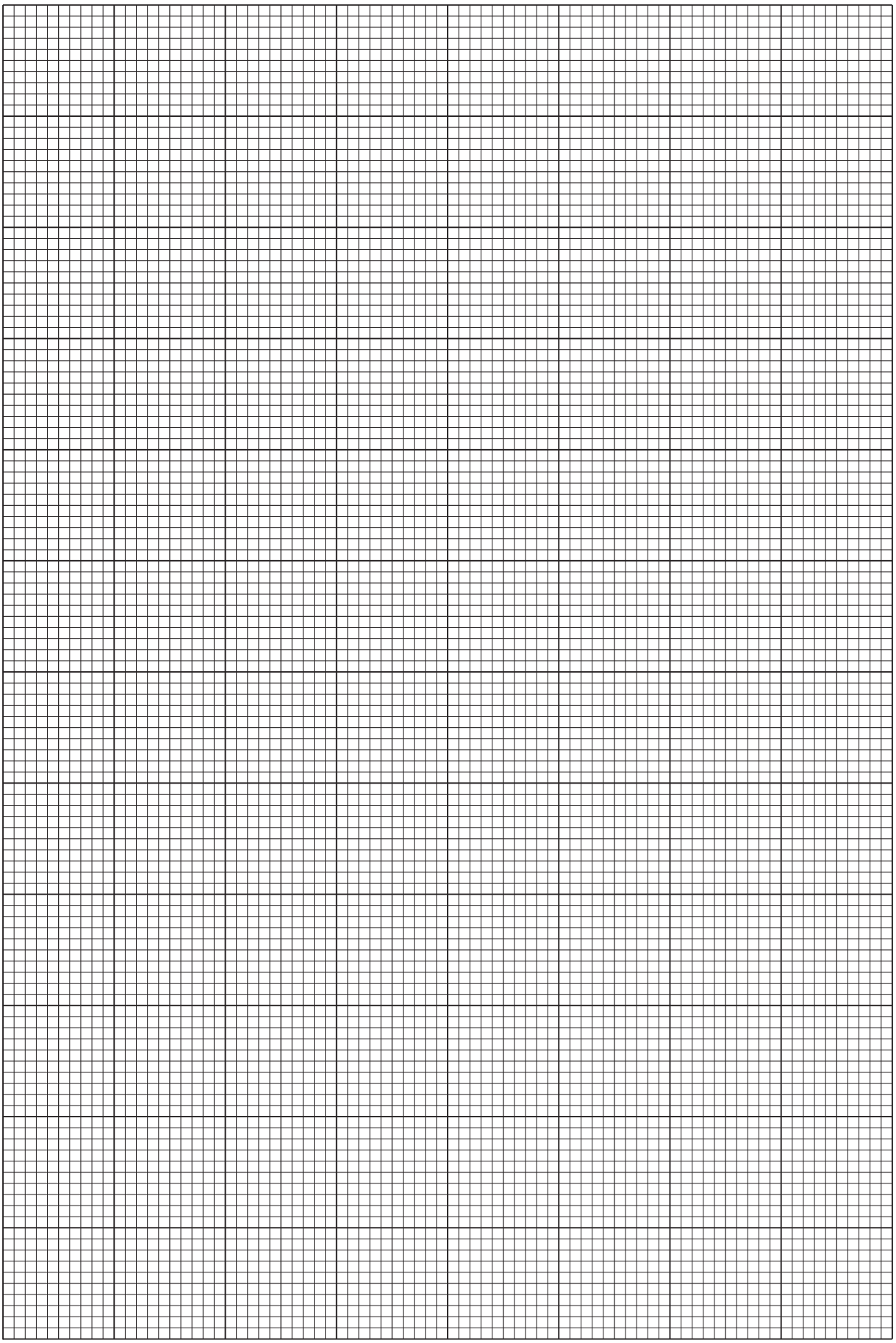
Draw the curved line of best fit. [4]

(e) **(i)** Draw a straight line that passes through your curved line at $h = 8.0\,\text{cm}$ and $h = 12.0\,\text{cm}$ [1]

(ii) Determine the gradient of this straight line.

gradient = ... [2]

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(f) Theory suggests that for all the values of h, the ratio $\frac{d_i}{l_i}$ is the same.

Explain whether your values of $\frac{d_i}{l_i}$ in Table 4.1 support this suggestion.

.....

.....

..... [1]

[Total: 15]

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