Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8973624404

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **May/June 2017**

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 **11** printed pages and **1** blank page.

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

1 In this experiment, you will investigate the motion of a supported copper wire.

(a) You have been provided with a copper wire and two spheres of modelling clay.

(i) Bend the wire about its midpoint so that the two lengths are perpendicular to each other, as shown in Fig. 1.1.

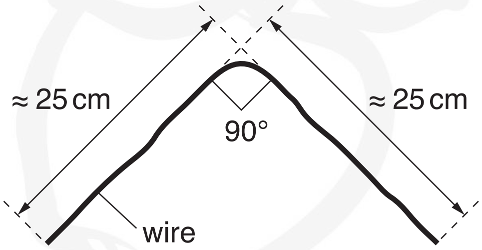

Fig. 1.1

(ii) Push each end of the wire through the centre of a sphere of modelling clay.
Place the spheres approximately half-way along each length of the wire as shown in Fig. 1.2.

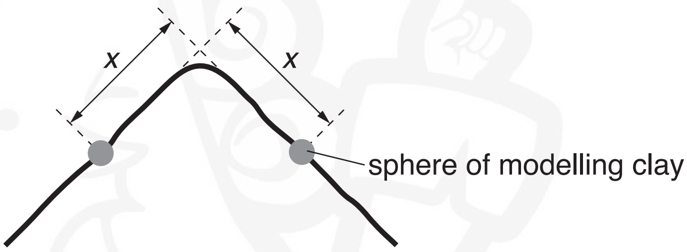

Fig. 1.2

The centres of the spheres should each be the same distance from the midpoint of the wire.
Gently press the modelling clay onto the wire to ensure the spheres stay in position.

(iii) Measure and record the distance x from the midpoint of the wire to the centre of a sphere.

x = ... [1]

(b) (i) Set up the apparatus as shown in Fig. 1.3.

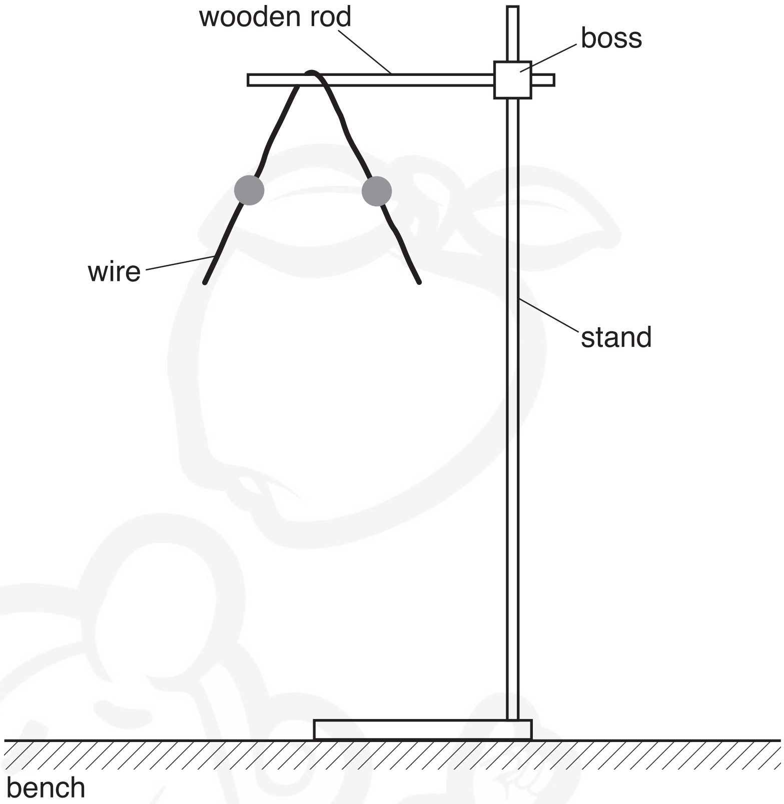

Fig. 1.3

(ii) Move one end of the wire down through a short distance.
Release the wire.

The wire will oscillate.

Determine the period *T* of these oscillations.

T = ...[1]

(c) Vary x and repeat **(a)(iii)** and **(b)** until you have six sets of values of x and T.

Record your results in a table. Include values of x^2 in your table.

[9]

(d) **(i)** Plot a graph of T on the y-axis against x^2 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 x are related by the equation

$$T = Px^2 + Q$$

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]

(f) **(i)** Remove the spheres from the wire.

(ii) Repeat **(b)(ii)**.

T = ...

(iii) Calculate the value of x that corresponds to the value of T in **(f)(ii)**.

x = ...[1]

[Total: 20]

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

2 In this experiment, you will investigate the equilibrium of a system of three identical springs.

(a) Measure the length *L* of the unstretched coiled section of one of the springs as shown in Fig. 2.1.

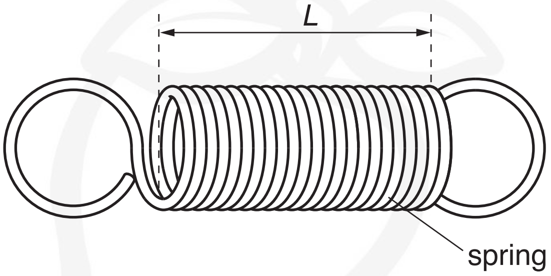

Fig. 2.1

L = ...[1]

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

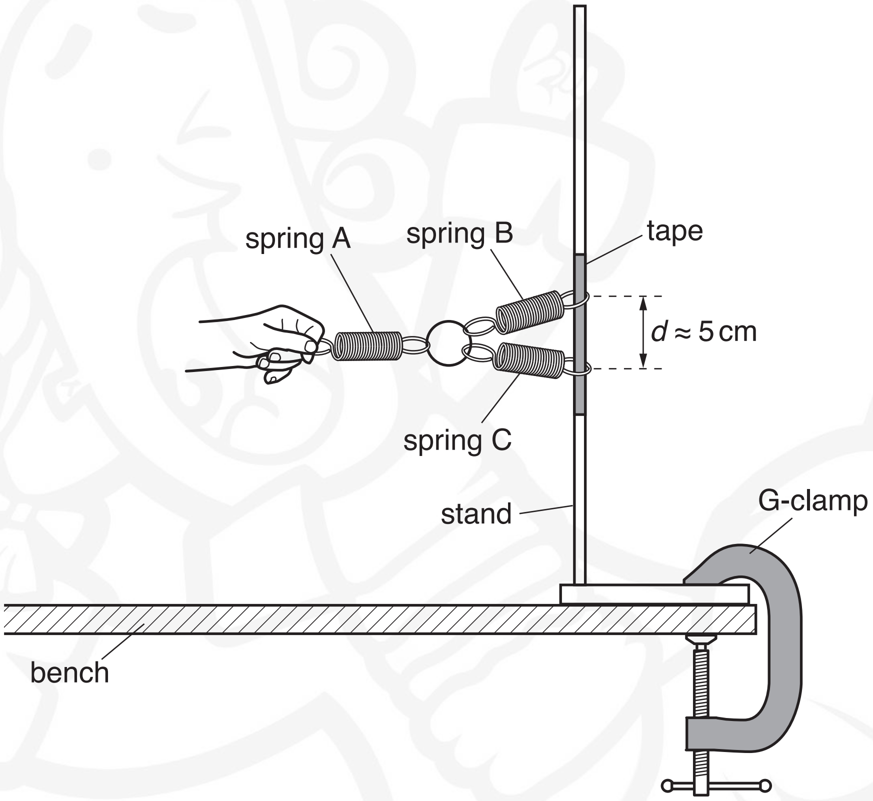

Fig. 2.2 (not to scale)

The springs are identical. Hold spring A as shown in Fig. 2.2.

The distance *d* between the loops of springs B and C on the stand should be approximately 5 cm as shown in Fig. 2.2. Do not mark the tape.

(c) **(i)** Pull spring A until the length of its coiled section is 15 cm as shown in Fig. 2.3.

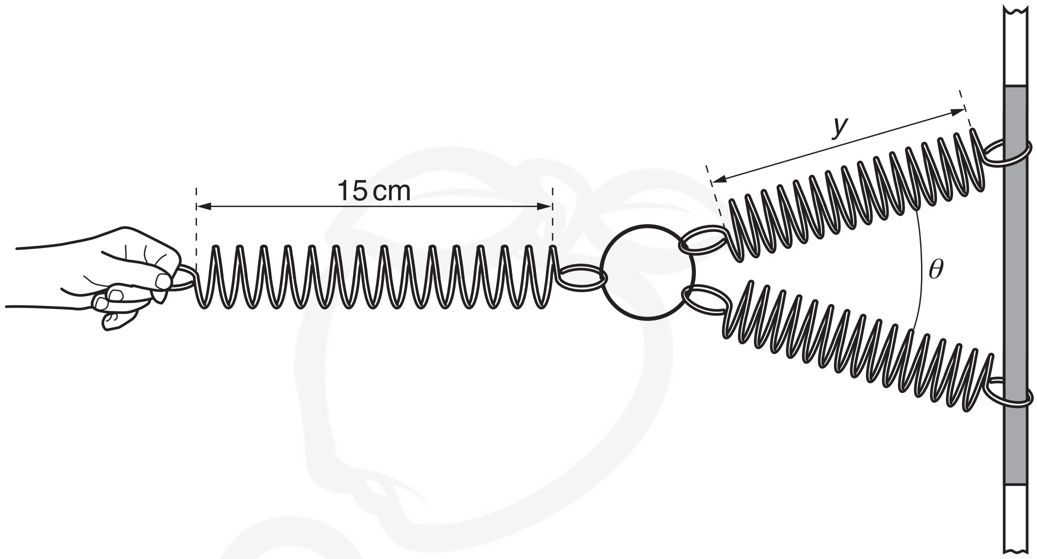

Fig. 2.3 (not to scale)

The length of the coiled section of spring B is *y*. The angle between springs B and C is θ.

(ii) Measure and record *y*.

y = ...[1]

(iii) Measure and record θ.

θ = ... ° [1]

(d) Estimate the percentage uncertainty in your value of θ.

percentage uncertainty = ... [1]

(e) **(i)** Calculate $(y - L)$.

$(y - L)$ = ...[1]

(ii) Calculate $\cos\left(\frac{\theta}{2}\right)$.

$\cos\left(\frac{\theta}{2}\right)$ = ...[1]

(iii) Justify the number of significant figures that you have given for your value of $\cos\left(\frac{\theta}{2}\right)$.

....

....

....[1]

(f) Increase d to approximately 10 cm and repeat **(c)**, **(e)(i)** and **(e)(ii)**.

y = ...

θ = ... °

$(y - L)$ = ...

$\cos\left(\frac{\theta}{2}\right)$ = ...
[3]

(g) It is suggested that the relationship between θ, y and L is

$$\cos\left(\frac{\theta}{2}\right) = \frac{k}{(y - L)}$$

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]

(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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