Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

4241303490

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **May/June 2014**

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 **13** printed pages and **3** 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 due to several forces.

(a) You have been provided with a wooden beam with 11 holes.

Measure and record the distance *k* along the wooden beam between the centres of hole 1 and hole 5 as shown in Fig. 1.1.

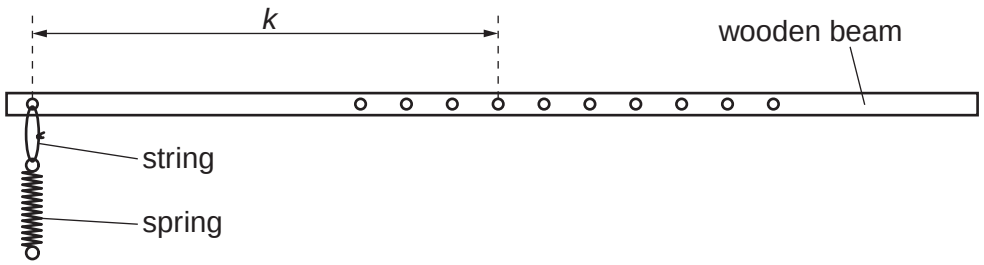


Fig. 1.1

k = ...

(b) **(i)** Set up the apparatus as shown in Fig. 1.2 with the nail through hole 6 of the wooden beam.

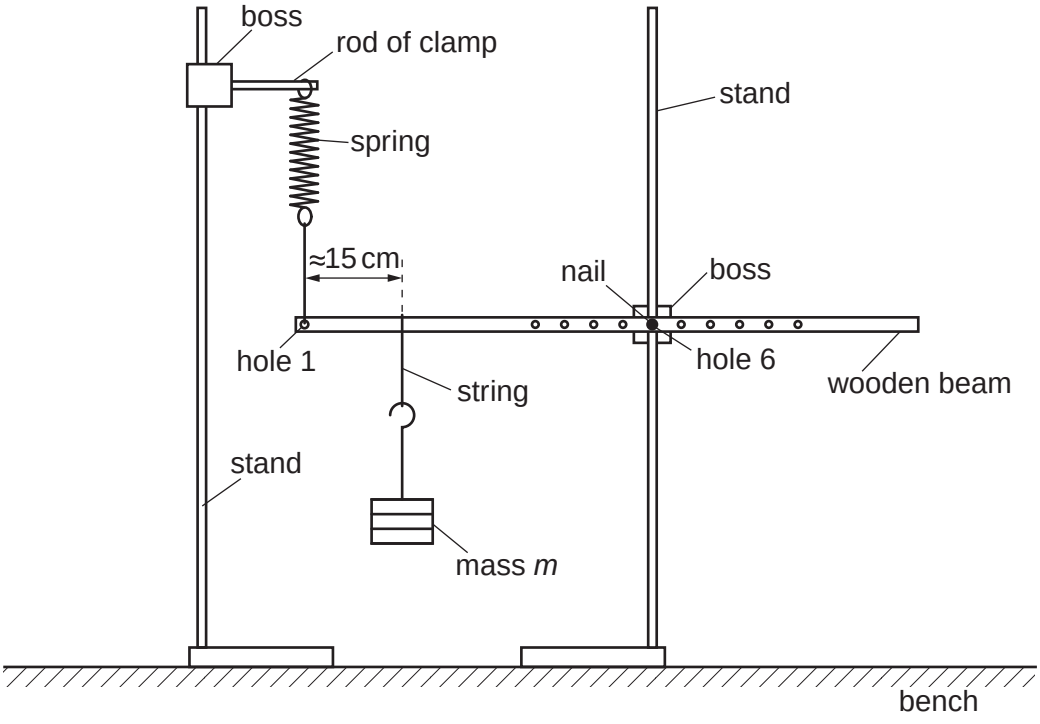


Fig. 1.2

The mass *m* is 300 g. Position the mass *m* approximately 15 cm from hole 1.

(ii) Adjust the apparatus so that the spring is vertical and the wooden beam is horizontal.

The distance *a* is the distance between the nail and the string attached to the spring.

The distance *b* is the distance between the nail and the string attached to the mass as shown in Fig. 1.3.

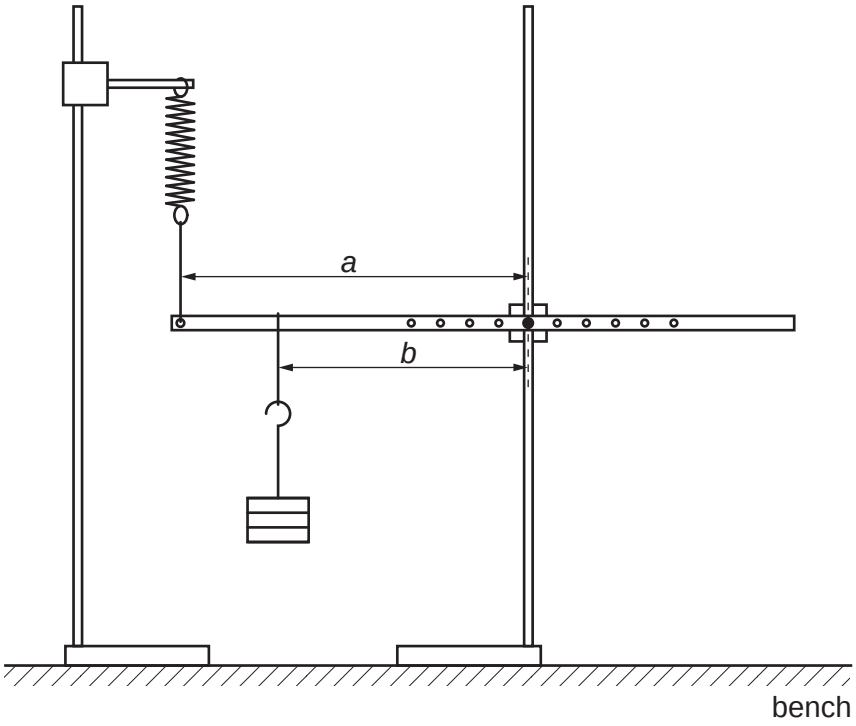


Fig. 1.3

(iii) Measure and record *a* and *b*.

a = ...

b = ...

[1]

(iv) Measure and record the length *L* of the stretched spring as shown in Fig. 1.4.

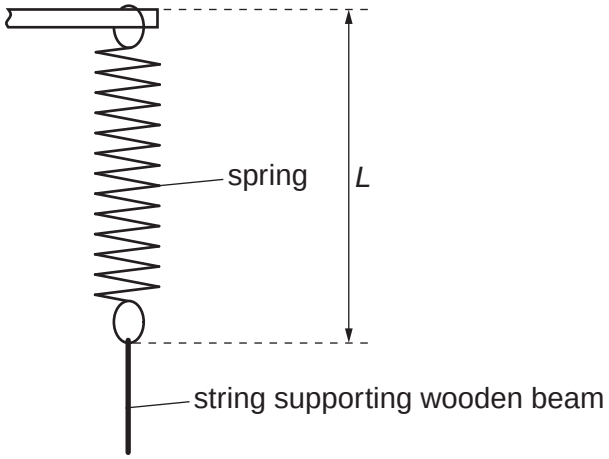


Fig. 1.4

L = ... [1]

(c) Vary *a* by moving the nail to a different hole.

Adjust *b* until the value of *L* is the same as in (b)(iv).

Ensure that the spring is vertical and the beam is horizontal.

Measure and record *a* and *b*.

a = ...

b = ...

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(d) Repeat **(c)** until you have six sets of readings of a and b.

Include values of $\frac{1}{b}$ and $\frac{a}{b}$ in your table.

[10]

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

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

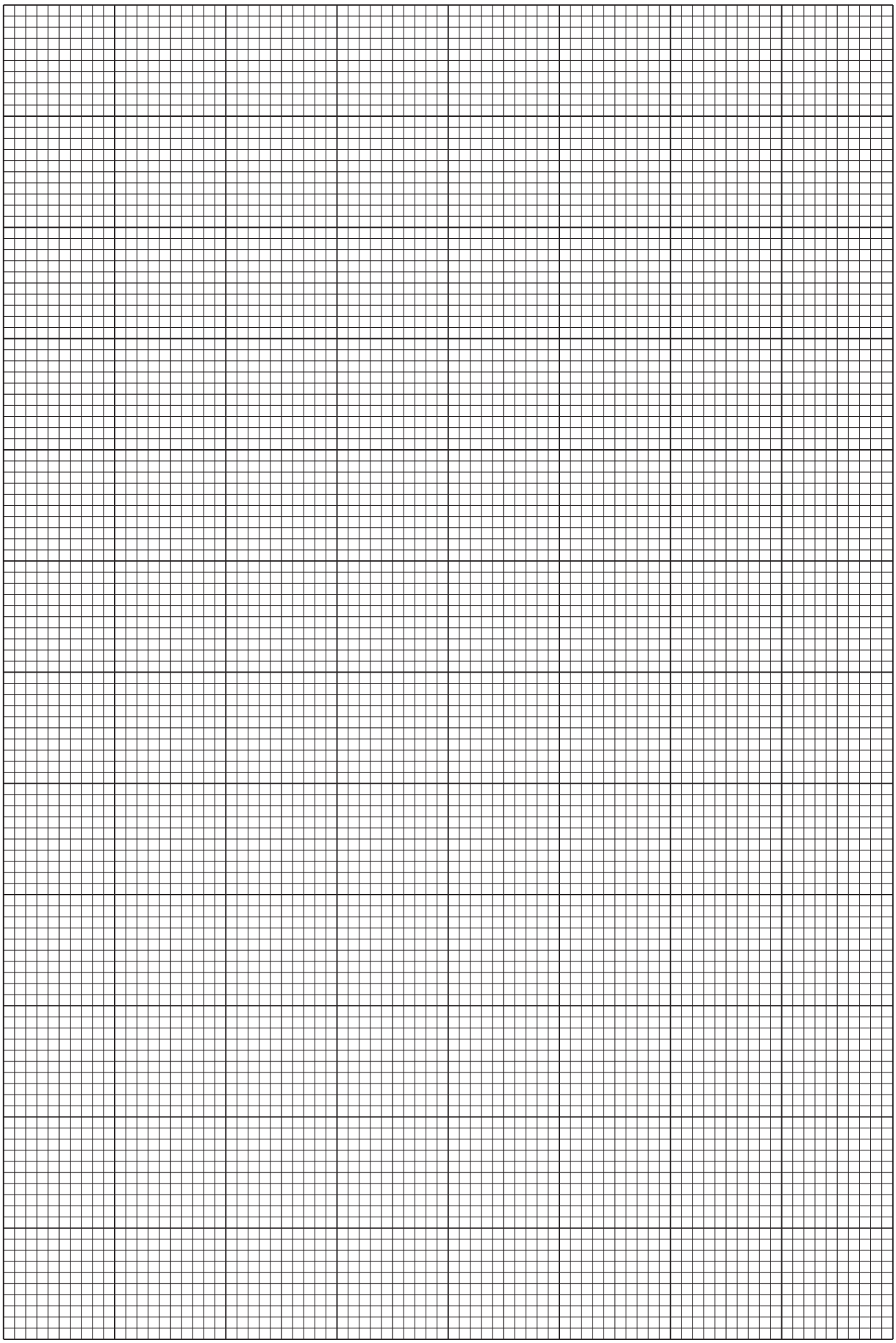
(iii) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...

[2]

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(f) The quantities a and b are related by the equation

$$\frac{1}{b} = -\frac{Pa}{b} + Q$$

where P and Q are constants.

Use your answers in **(e)(iii)** to determine the values of P and Q.
Give appropriate units.

P = ...

Q = ...

[1]

(g) The mass M of the wooden beam is given by

$$M = \frac{m}{kQ}.$$

Use values in **(a)**, **(b)(i)** and **(f)** to determine the value of M.
Include a unit for M.

M = ... [1]

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

2 In this experiment, you will investigate how the extension of a Plasticine cylinder under an applied load depends on the diameter of the cylinder.

(a) (i) Use the boards to roll the Plasticine into a cylinder of uniform diameter and approximate length 20 cm as shown in Fig. 2.1.

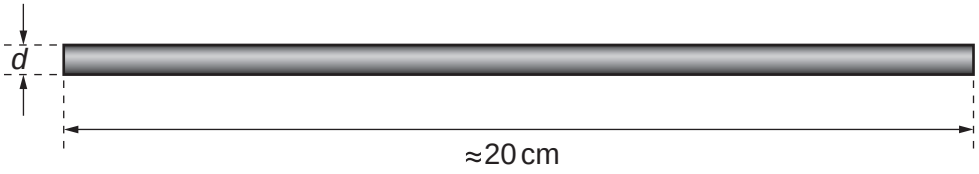


Fig. 2.1

(ii) Use the micrometer to measure the diameter *d* of the cylinder as shown in Fig. 2.1. Record *d*.

d = ... [3]

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

percentage uncertainty = ... [1]

(b) (i) Make two **shallow** marks on the Plasticine cylinder as shown in Fig. 2.2. The distance *x* between the marks should be approximately 10 cm.

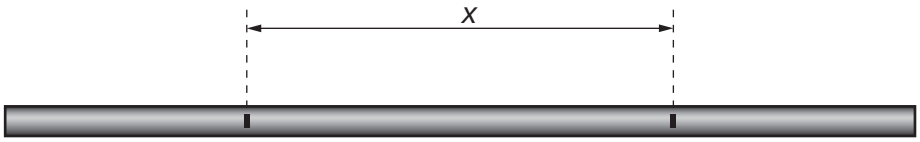


Fig. 2.2

The marks should not be deep enough to affect the strength of the cylinder.

(ii) Measure and record *x*.

x = ...

(c) (i) Attach the clip to one end of the cylinder. Hold the other end of the cylinder so that it hangs vertically as shown in Fig. 2.3.

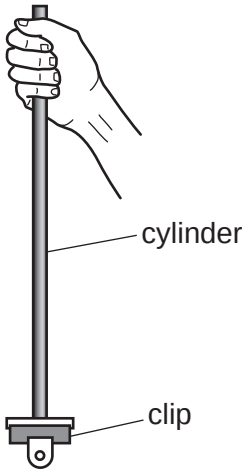


Fig. 2.3

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(ii) Suspend a mass of 400 g from the clip as shown in Fig. 2.4 for a time of 60 s.

If the cylinder breaks within this time, repeat **(a)**, **(b)** and **(c)(i)** and suspend a mass of 300 g for 60 s. If necessary, cross out your answers and write in your new answers. You will not be penalised for this.

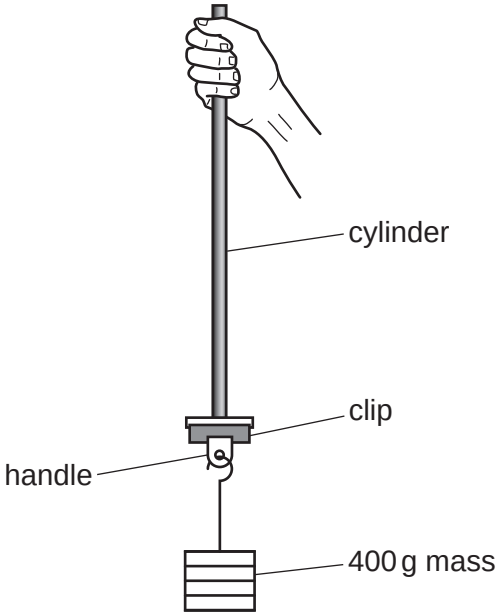


Fig. 2.4

(iii) Carefully remove the mass and clip from the cylinder.

(iv) Measure and record the distance x_1 between the two marks on the cylinder.

x_1 = ... [1]

(v) Calculate the extension e of the cylinder between the marks using

$$e = x_1 - x.$$

e = ... [1]

(d) (i) Use the boards to roll all the Plasticine into a cylinder of uniform diameter and approximate length 15 cm.

(ii) Using the same mass, repeat **(a)(ii)**, **(b)** and **(c)**.

d = ...

x = ...

x_1 = ...

e = ...

[3]

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(e) It is suggested that the relationship between e and d is

$$e = \frac{k}{d^4}$$

where k is a constant.

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

first value of k = ...

second value of k = ... [1]

(ii) Justify the number of significant figures that you have given for your values of k.

.....

.....

..... [1]

(iii) Explain whether your results in **(e)(i)** support the suggested relationship.

.....

.....

.....

..... [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]

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