Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

PHYSICS **9702/33**

Paper 3 Advanced Practical Skills 1 **February/March 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 **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 forces on a wooden strip in equilibrium.

(a) (i) Assemble the apparatus as shown in Fig. 1.1, with the mass resting on the bench.

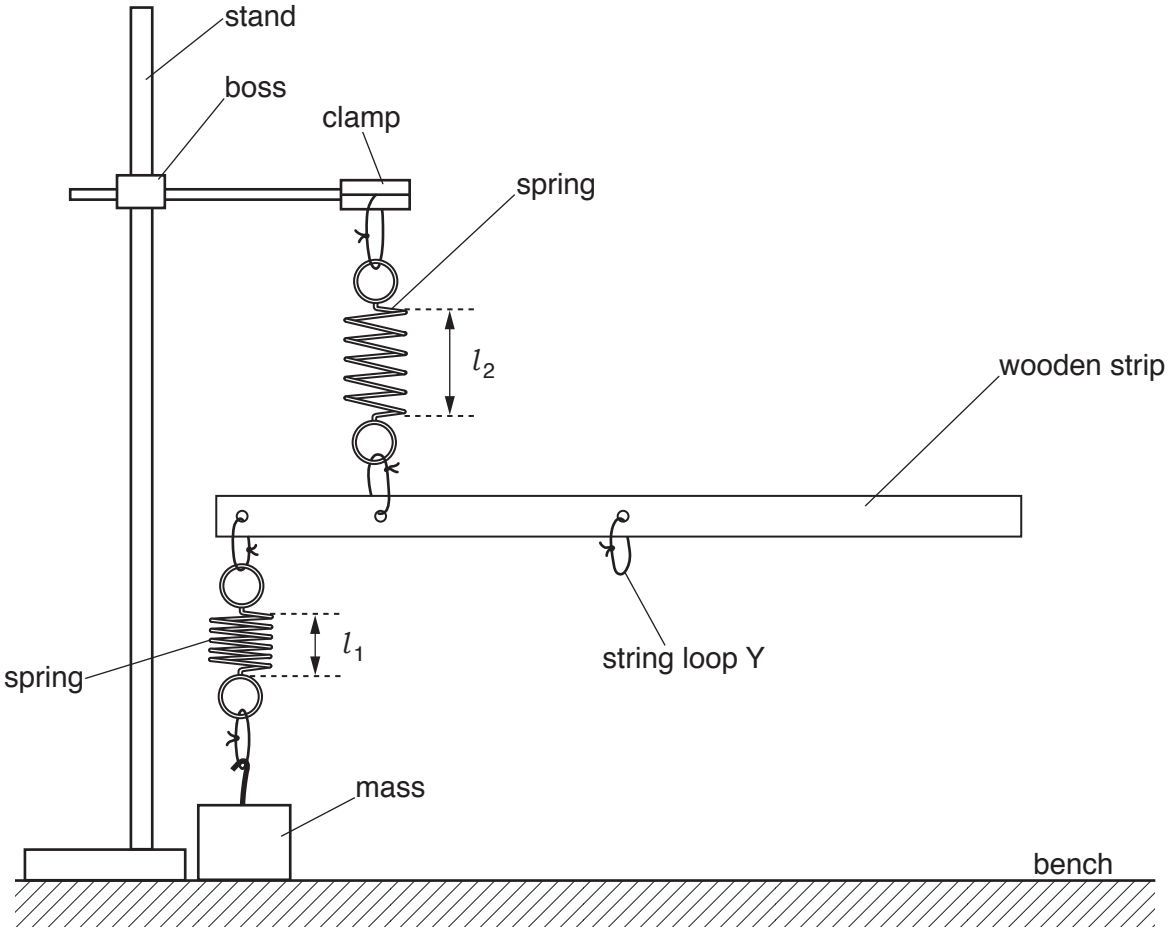

Fig. 1.1 (not to scale)

(ii) Adjust the height of the boss and the position of the mass until the wooden strip is parallel to the bench and the springs are vertical.

(iii) Measure and record the lengths l_1 and l_2 of the coiled sections of the two springs, as shown in Fig. 1.1.

l_1 = ...

l_2 = ...

[1]

(b) You are provided with a wire hook and some metal rings. The card shows the mass of the hook and the mass of one ring.

(i) Hang the hook and about half the rings from string loop Y.

(ii) Repeat **(a)(ii)** and **(a)(iii)**.

l_1 = ...

l_2 = ...

(iii) Using the data from the card, calculate the total mass m hanging from string loop Y.

m = ... [1]

(c) Change m by altering the number of rings on the hook, and repeat **(a)(ii)**, **(a)(iii)** and **(b)(iii)** until you have six sets of values of m, l_1 and l_2.

Record your results in a table.
Include values of $(l_2 - l_1)$ in your table.

[8]

(d) **(i)** Plot a graph of $(l_2 - l_1)$ on the y-axis against m 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 l_1, l_2 and m are related by the equation

$$(l_2 - l_1) = am + b$$

where a and b are constants.

Use your answers from **(d)(iii)** to determine the values of a and b.
Give appropriate units.

a = ...

b = ...
[2]

(f) The spring constant k of each spring can be found using the relationship

$$k = \frac{g}{a}$$

where $g = 9.81\,\text{N kg}^{-1}$.

Calculate k.

k = ... [2]

[Total: 20]

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

2 In this experiment, you will investigate the friction between string and a plastic pipe.

(a) (i) Select the pipe with the **larger** diameter.

(ii) The outside diameter of the pipe is *D*, as shown in Fig. 2.1.

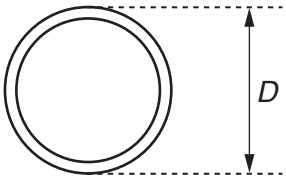

Fig. 2.1

Take measurements to find *D*.
Record *D*.

D = ... cm [2]

(b) (i) Write down the mass *m* of the newton-meter as written on the card.

m = ... kg

(ii) Calculate the weight *W* of the newton-meter using the expression

$$W = mg$$

where $g = 9.81\,\mathrm{N\,kg^{-1}}$.

W = ... N [1]

(iii) Justify the number of significant figures you have given for your value of *W*.

.....

.....

..... [1]

(c) **(i)** Use the stand, boss and clamp to hold the pipe securely parallel to the bench. Adjust the height of the boss until the pipe is approximately 50 cm above the bench. Assemble the rest of the apparatus as shown in Fig. 2.2, with the string passing over the pipe.

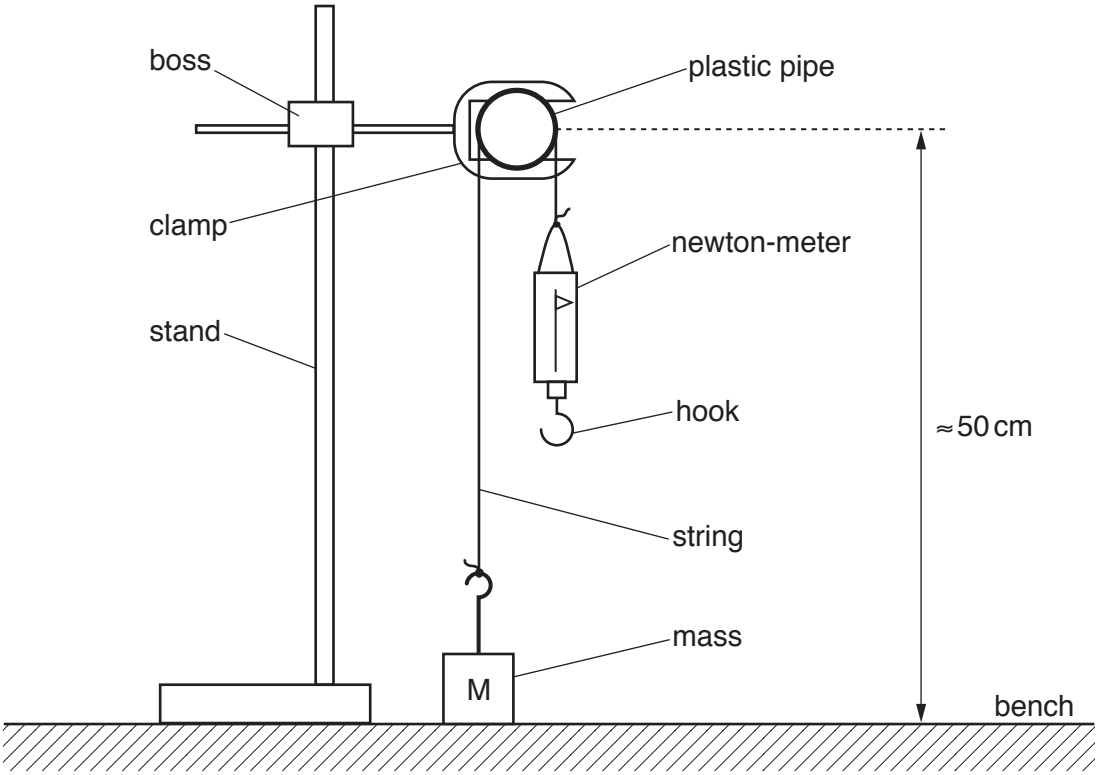

Fig. 2.2

(ii) Slowly pull down the hook of the newton-meter so that the mass is lifted off the bench and continues to rise.

(iii) As the mass is rising steadily, record the reading *F* from the newton-meter.

F = ... N [2]

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

percentage uncertainty = ... [1]

(e) Repeat **(a)(ii)** and **(c)** using the **smaller** diameter plastic pipe.

D = ... cm

F = ... N

[3]

(f) **(i)** It is suggested that the relationship between F, W and D is

$$(F + W)^2 = k\sqrt{D}$$

where k is a constant.

Using your data, calculate two values of k.

first value of k = ...

second value of k = ...

[1]

(ii) Explain whether your results in **(f)(i)** support the suggested relationship.

.....

.....

.....

..... [1]

(g) **(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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