UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

5541723977

PHYSICS **9702/35**

Advanced Practical Skills 1 **May/June 2011**

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 a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, 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 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.
You are reminded of the need for good English and clear presentation in your answers.

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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For Examiner's Use

1 In this experiment you will investigate how the motion of two pendulums depends on the tension in a spring connecting them.

(a) Measure and record the unstretched length l_0 of the coiled part of the spring as shown in Fig. 1.1.

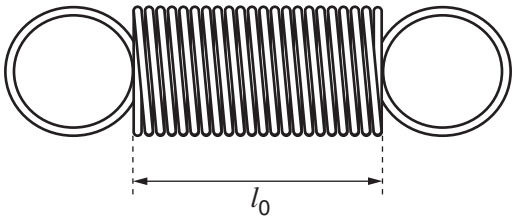


Fig. 1.1

l_0 = ...[1]

(b) (i) Set up the apparatus as shown in Fig. 1.2.

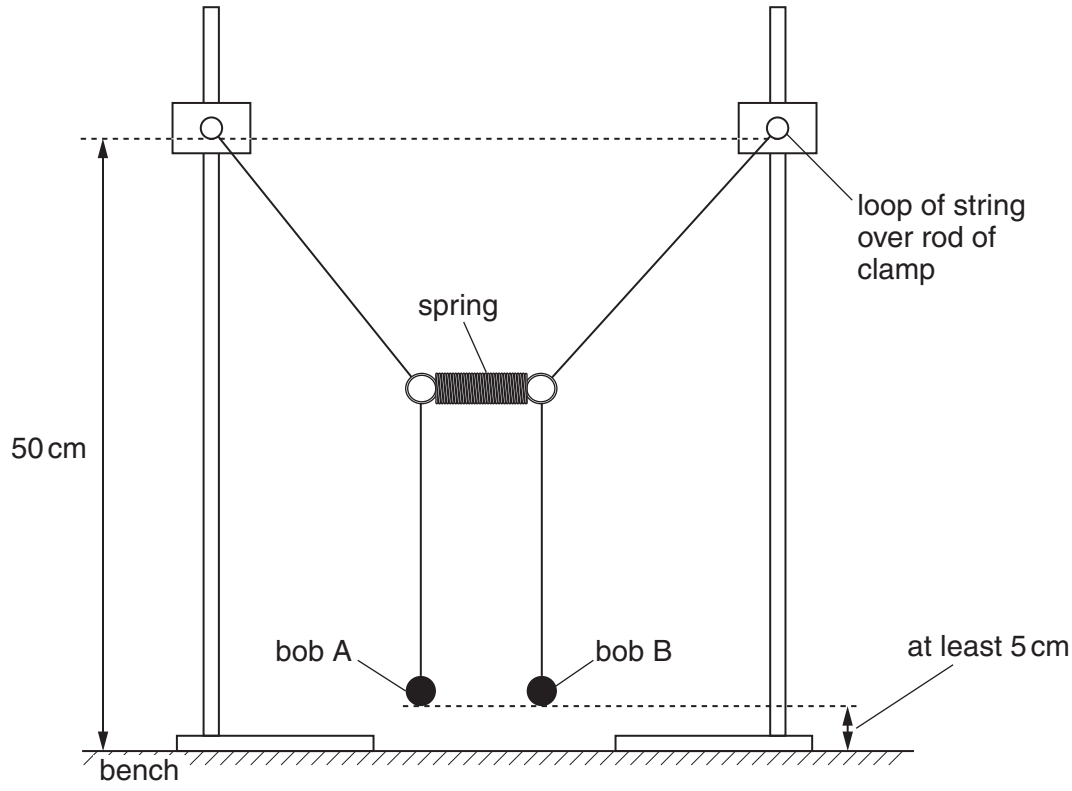


Fig. 1.2

(ii) Position the stands so that the coiled part of the spring has approximate length l_0 + 2 cm (so that the spring is extended by approximately 2 cm).

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(iii) Measure and record the length l of the coiled part of the spring.
Calculate the extension x of the spring, where $x = l - l_0$.

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l = ...

x = ...

(iv) Gently pull bob A towards you. Release the bob and watch the movement of the two bobs.

Bob A will eventually stop and start moving again. It will then stop for a second time.

Determine and record the time T between these two stops.

T = ...[2]

(c) By moving the stands further apart, repeat **(b)(iii)** and **(b)(iv)** until you have six sets of readings of l, x and T, with x in the range $2\,\text{cm} \leqslant x \leqslant 10\,\text{cm}$.

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[9]

(d) (i) Plot a graph of T on the y-axis against x on the x-axis. [3]

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

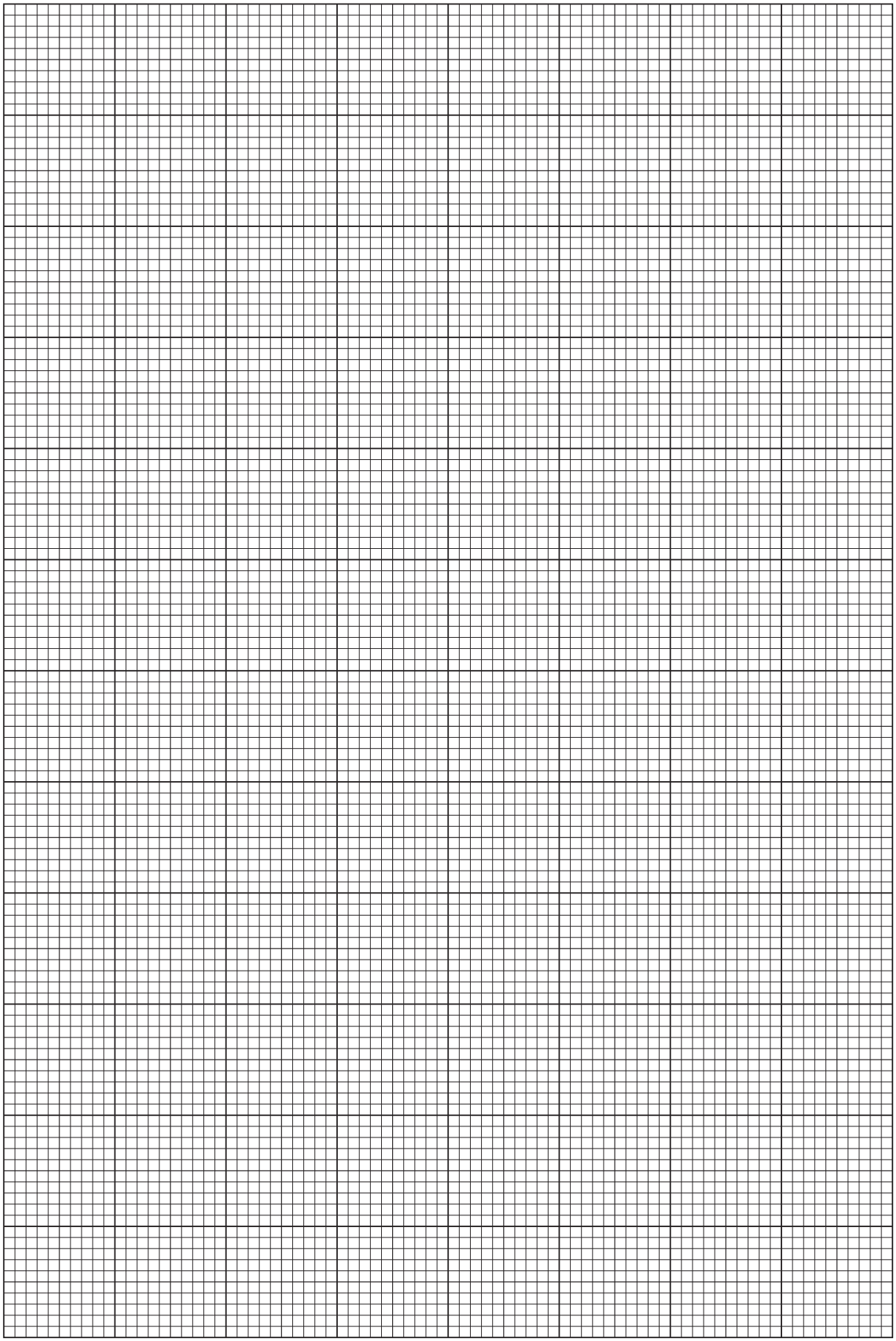
(iii) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...

[2]

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(e) It is suggested that the quantities T and x are related by the equation

$$T = px + q$$

where p and q are constants.

Use your answers in **(d)(iii)** to determine the values of p and q.
Give appropriate units.

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p = ...

q = ...
[1]

(f) Use your values in **(e)** to determine the extension x that would be expected to give a value of $T = 75$ s.

x = ...[1]

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Please turn over for Question 2.

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2 In this experiment you will drop a mass onto a rod standing in sand and investigate the distance that the rod moves into the sand.

(a) You have been provided with two wooden rods of different diameters.
Measure and record the diameter d of the **thicker** rod.

d = ...[2]

(b) Flatten the surface of the sand. Stand the rod vertically in the sand up to the mark drawn on the rod, as shown in Fig. 2.1.

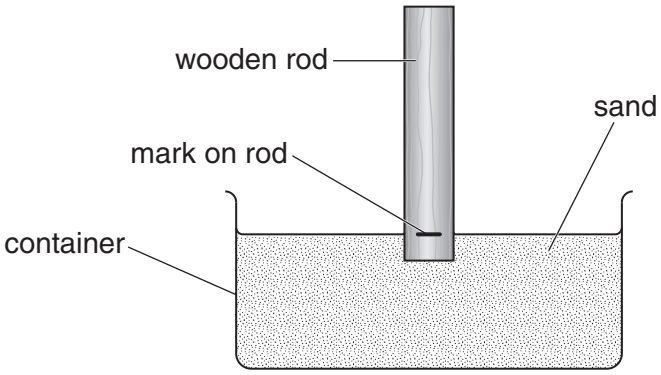


Fig. 2.1

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(c) (i) Hold the mass hanger so that the distance *h* between its bottom and the top of the rod is approximately 10 cm.
The centre of the bottom of the mass hanger should be vertically above the wooden rod, as shown in Fig. 2.2.

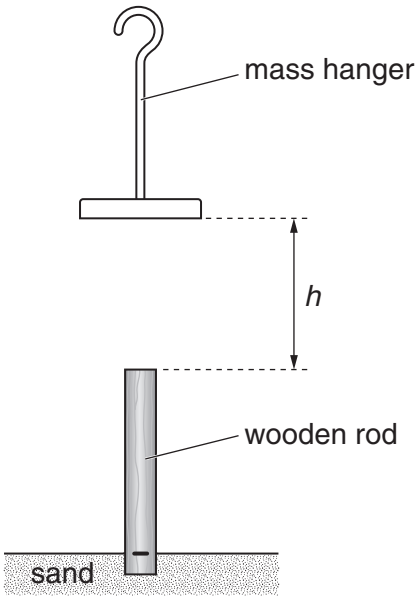


Fig. 2.2

(ii) Measure and record the height *h*.

h = ...[1]

(d) (i) Drop the mass hanger from this height *h* above the rod.

(ii) **Without making a further mark on the rod**, determine the new length *x* of the rod below the surface of the sand, as shown in Fig. 2.3.

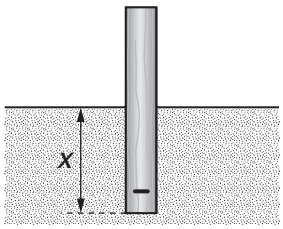


Fig. 2.3

x = ...[1]

(iii) Calculate and record the change in depth y of the rod in the sand as a result of the impact of the mass hanger.

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y = ...[1]

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

percentage uncertainty = ...[1]

(f) Using the **thinner** rod repeat **(a)**, **(b)**, **(c)(i)**, and **(d)**.
Use the same value of h as in **(c)(ii)**.

d = ...

x = ...

y = ...

[3]

(g) It is suggested that the quantities y and d are related by the equation

$$y = \frac{k}{d^2}$$

where k is a constant.

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(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]

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

.....

.....

.....[1]

(h) (i) Describe four sources of uncertainty or limitations of the procedure for this experiment.

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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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