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

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

2315673322

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **May/June 2013**

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 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 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.

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1	
2	
Total	

This document consists of **12** printed pages.

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For Examiner's Use

1 In this experiment, you will investigate how the motion of an oscillating system depends on the mass attached to the system.

(a) (i) Set up the apparatus as shown in Fig. 1.1.

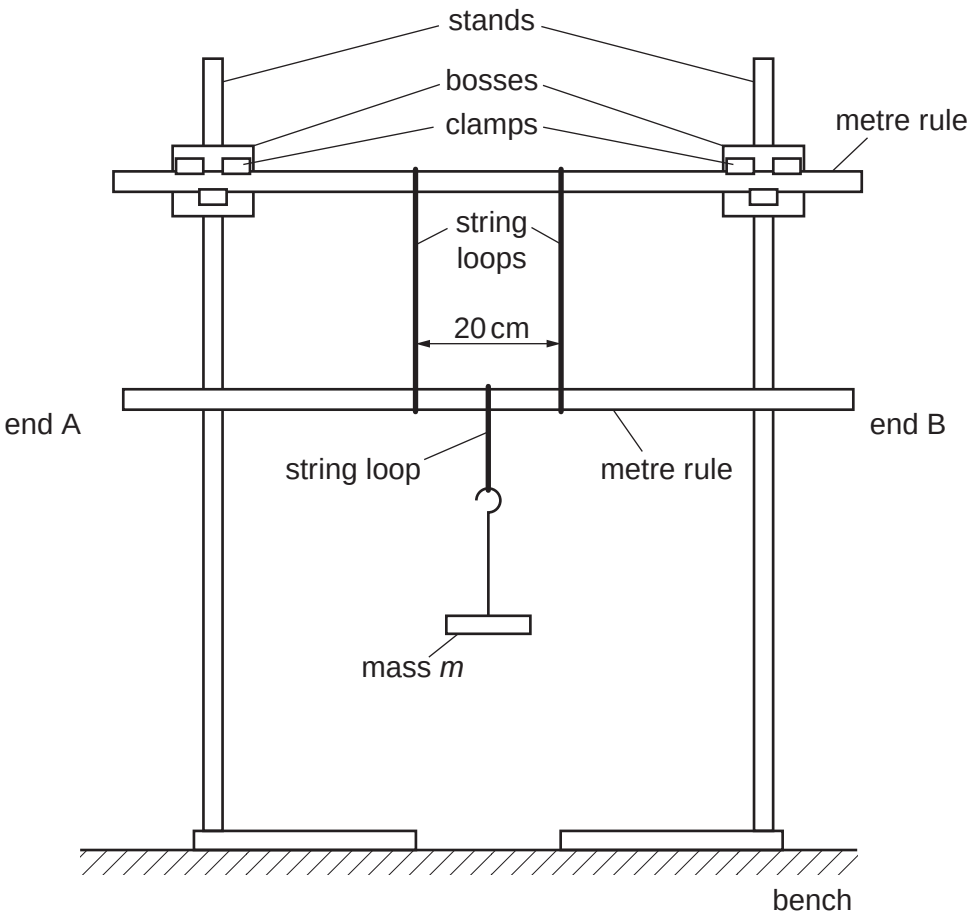


Fig. 1.1

Slide the two longer loops of string onto a rule and fix this rule in the clamps.

Adjust the clamps until the rule is parallel to the bench.

Slide the shorter loop onto the second rule and use the longer loops to support this second rule.

Both rules should have their markings facing you. The strings should be vertical, 20 cm apart and equal distances from the centre of the second rule.

Use the shorter loop of string to suspend a mass m at the 50 cm mark on the second rule, where m = 0.500 kg.

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(ii) Move the end A of the lower rule towards you and the end B away from you.
Release the rule and watch the movement.
End A will move away from you and back towards you, completing a swing.
The time taken for one complete swing is *T*.
By timing several of these complete swings, determine an accurate value for *T*.

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T = ... s [2]

(b) Change m and repeat **(a)(ii)** until you have six sets of values of m and T.

Include values of $\frac{1}{T^2}$ in your table.

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[10]

(c) **(i)** Plot a graph of $\frac{1}{T^2}$ on the y-axis against m on the x-axis. [3]

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

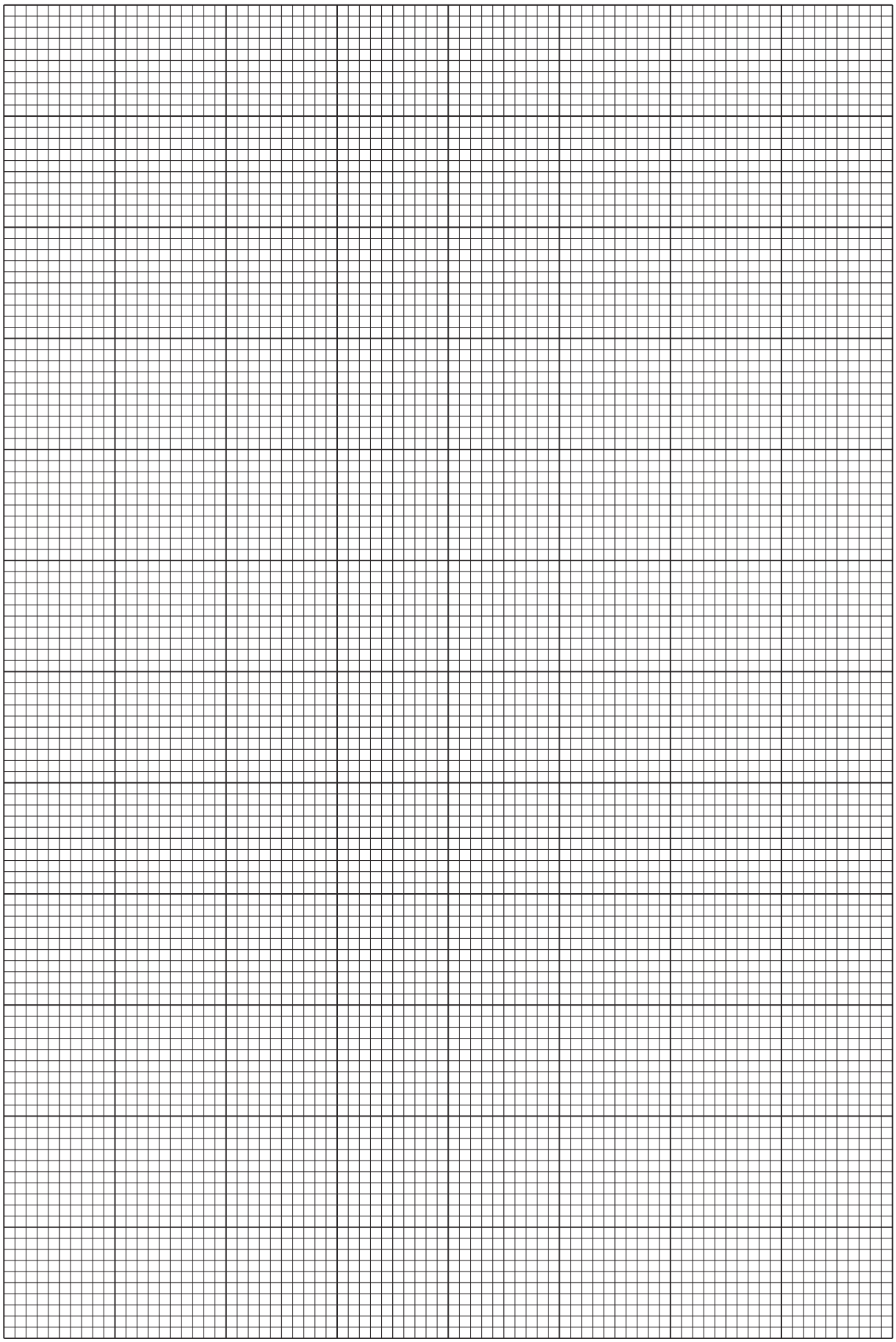
(iii) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...

[2]

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(d) The quantities m and T are related by the equation

$$\frac{1}{T^2} = Pm + Q$$

where P and Q are constants.

Using your answers in **(c)(iii)**, determine the values of P and Q.
Give appropriate units.

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P = ...

Q = ...

[2]

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

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2 In this experiment, you will investigate how the force acting on a straight wire in water depends on its length.

(a) (i) Measure the length L of the shorter wire as shown in Fig. 2.1.

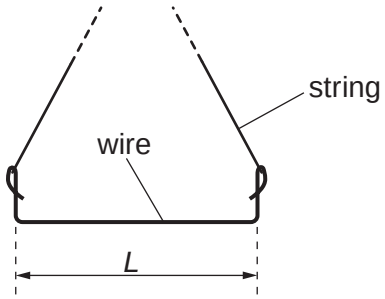


Fig. 2.1

L = ...[1]

(ii) Estimate the percentage uncertainty in your value of L.

percentage uncertainty = ...[1]

(b) (i) Set up the apparatus using the shorter wire as shown in Fig. 2.2.

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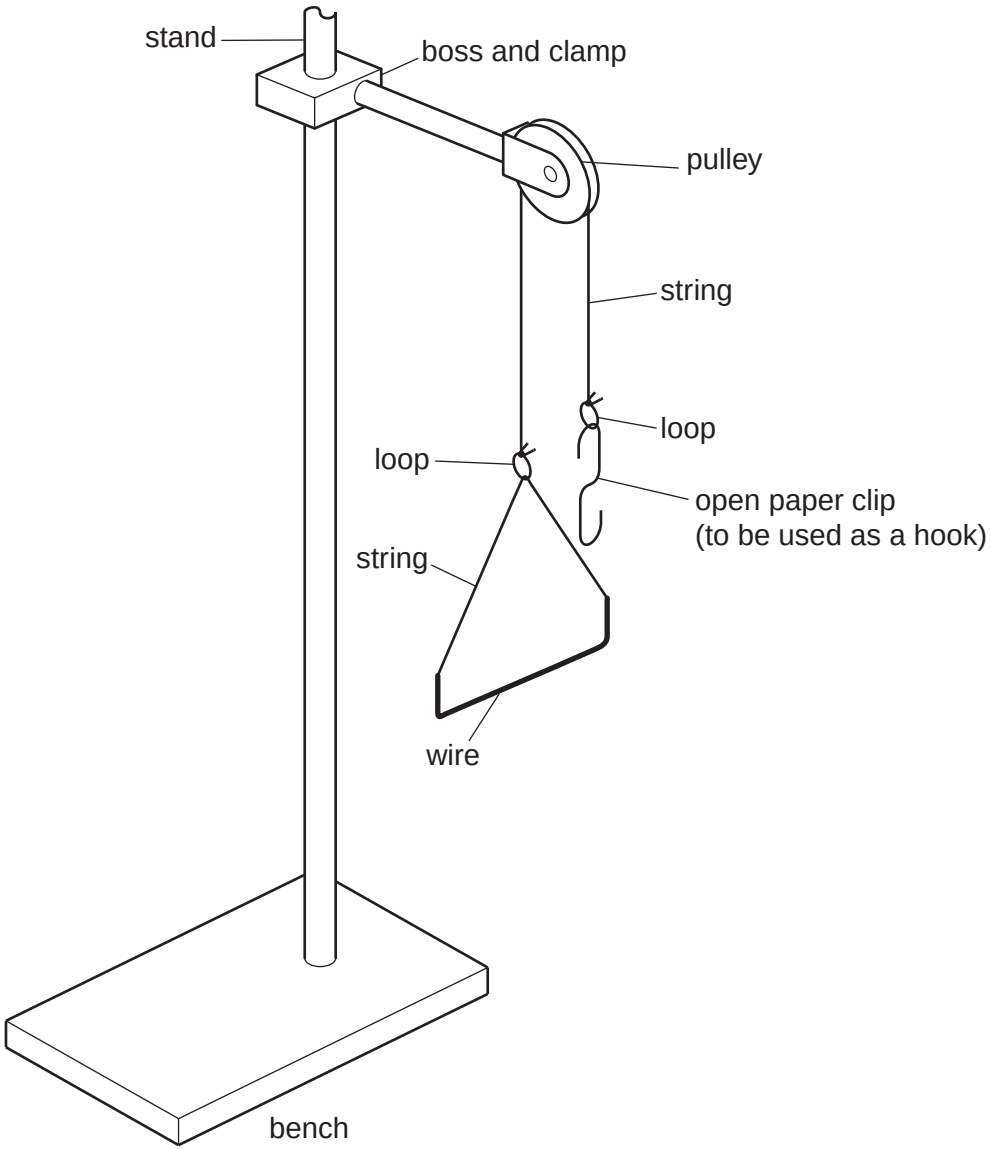


Fig. 2.2

(ii) Gently add paper clips to the hook until the wire moves upwards.

(iii) Count and record the number N_1 of paper clips you have added in **(ii)**.
Do not include the open paper clip which is used as a hook.

N_1 = ... [1]

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(c) (i) You have been provided with a tray containing water.
Set up the apparatus so that it is the same as in Fig. 2.2 but with the wire in the water. It may be necessary to adjust the position of the pulley.

(ii) Gently add paper clips to the hook until the wire rises out of the water.

(iii) Count and record the number N_2 of paper clips you have added in **(ii)**.

N_2 = ...[2]

(d) Calculate the force F needed to remove the wire from the water using

$$F = (N_2 - N_1)mg$$

where the mass m of one paper clip is 4.0×10^{-4} kg, and $g = 9.8\,\text{N kg}^{-1}$.

F = ... N [1]

(e) Repeat **(a)(i)**, **(b)**, **(c)** and **(d)** for the longer wire.

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L = ...

N_1 = ...

N_2 = ...

F = ... N
[3]

(f) It is suggested that the relationship between F and L is

$$F = kL$$

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

.....

.....

..... [1]

(iii) 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.

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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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