Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7911986899

PHYSICS **9702/31**

Paper 3 Advanced Practical Skills 1 **October/November 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.

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1	
2	
Total	

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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 system of masses.

(a) Set up the apparatus as shown in Fig. 1.1, with the shorter length of string above the central loop and the longer length of string below the central loop.
Place four slotted masses in the bottom loop and four slotted masses in the central loop.

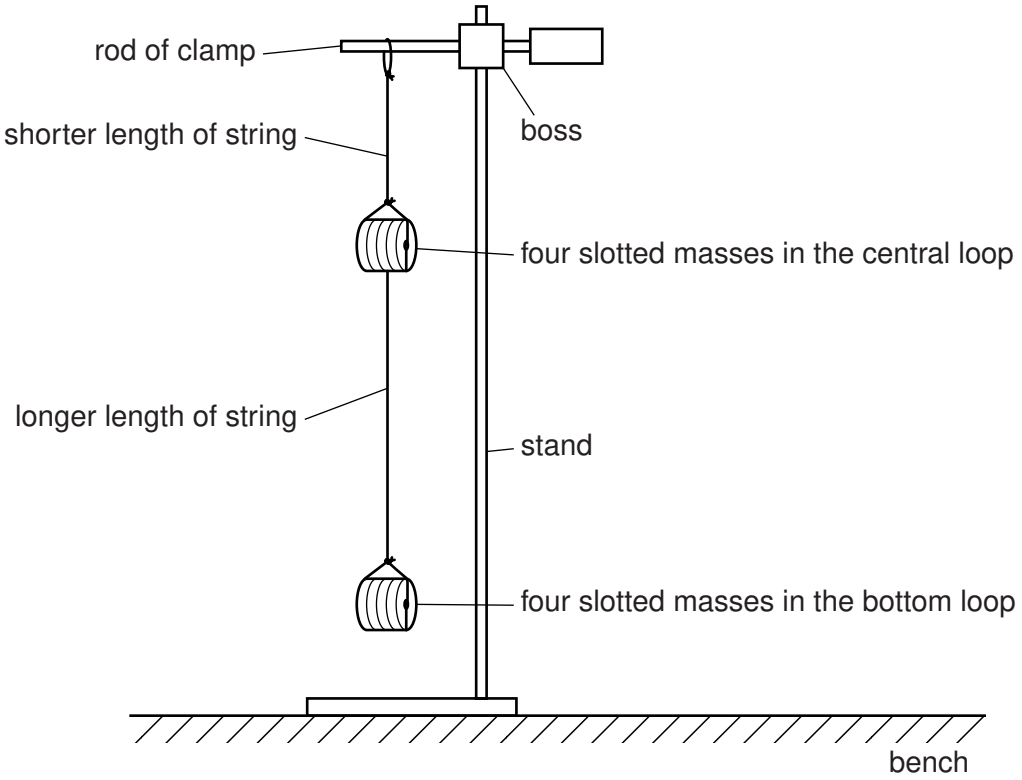

Fig. 1.1

(b) Move the slotted masses in the bottom loop to the left.

Release the slotted masses and watch the movement.

The slotted masses will move to the right and then to the left again, completing a swing as shown in Fig. 1.2.

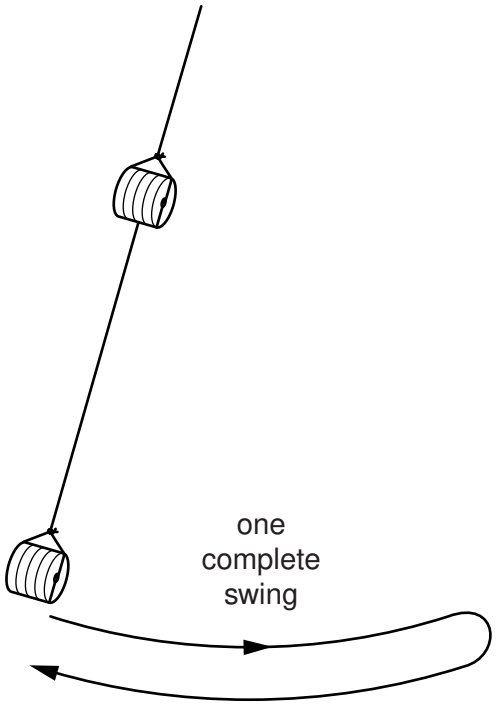

Fig. 1.2

Measure and record the time for at least 10 complete swings.
Record enough readings to determine an accurate value for the time *T* taken for one complete swing.

T = ...[2]

(c) Change the number of slotted masses in each loop. Use **all** the eight slotted masses.

(i) Count and record the number *B* of slotted masses in the bottom loop.

B = ...

(ii) Count and record the number *C* of slotted masses in the central loop.

C = ...

(iii) Repeat **(b)**.

T = ...

(d) Repeat **(c)** until you have six sets of values of B, C and T. Include your results from **(b)** and **(c)**.

For each set of values, use all eight slotted masses.

Include values of $\frac{T^2}{B}$ and $\frac{C}{B}$ in your table.

[10]

(e) (i) Plot a graph of $\frac{T^2}{B}$ on the y-axis against $\frac{C}{B}$ 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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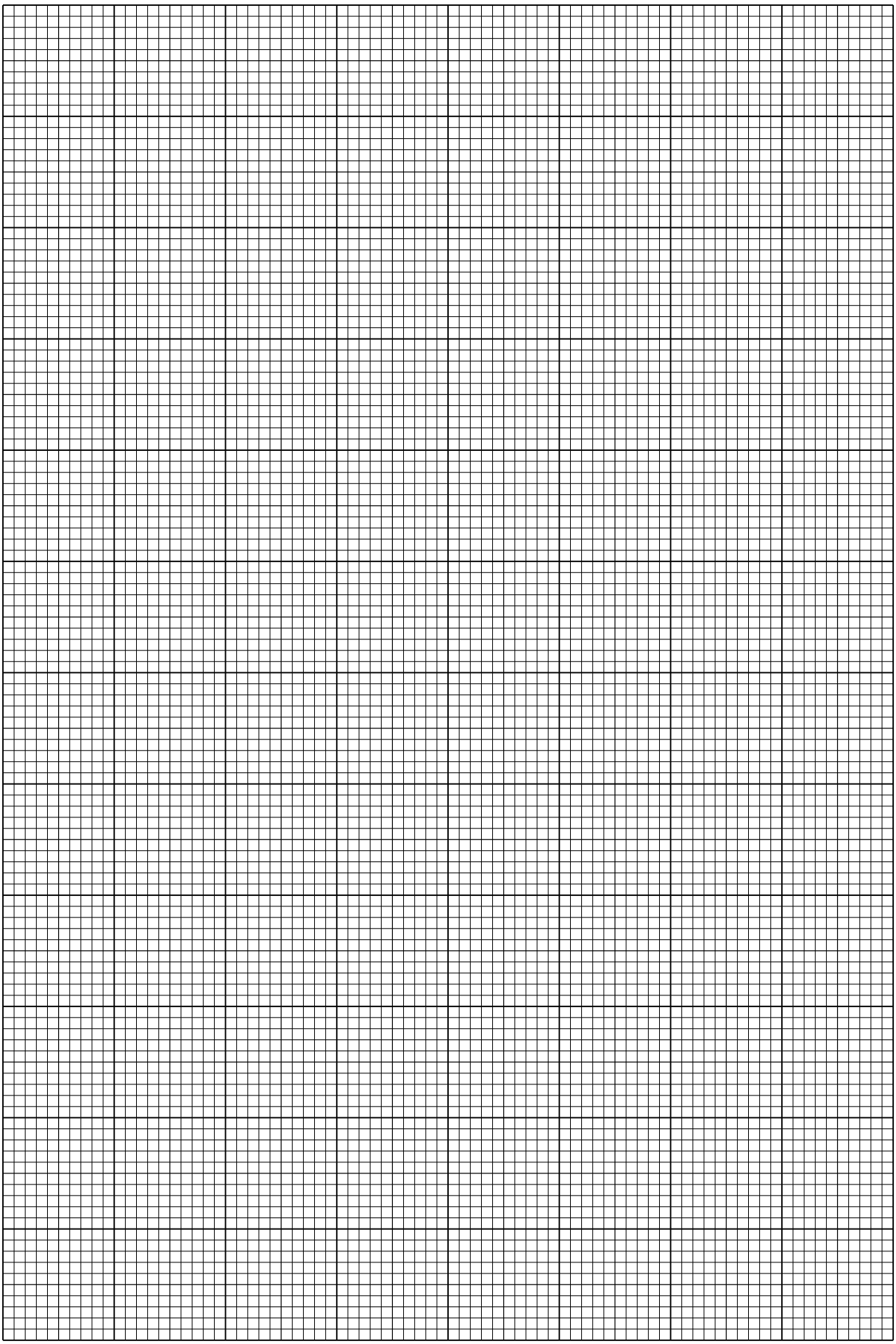

(f) The quantities T, B and C are related by the equation

$$\frac{T^2}{B} = \frac{FC}{B} + G$$

where F and G are constants.

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

F = ...

G = ...

[2]

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

2 In this experiment, you will investigate how the number of turns of wire around a rod depends on the diameter of the wire.

(a) You have been provided with a wooden rod and two lengths of wire.

(i) Measure and record the diameter D of the rod as shown in Fig. 2.1.

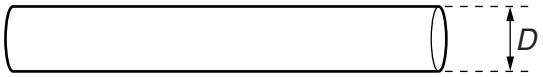

Fig. 2.1

D = ...[1]

(ii) Measure and record the diameter d of the **thinner** wire.

d = ...[1]

(iii) Calculate $\left(D + \frac{d}{2}\right)$.

$\left(D + \frac{d}{2}\right)$ = ...[1]

(b) (i) Cut the thinner wire so that its length is **exactly** 50.0 cm.

(ii) Wrap the thinner wire around the rod.

Count and record the number $(n + t)$ of turns of wire around the rod, where n is the number of complete turns and t is your estimate of the remaining part of a turn.

$(n + t)$ = ...[2]

(iii) Estimate the percentage uncertainty in your value of $(n + t)$.

percentage uncertainty = ...[1]

(c) Repeat **(a)(ii)**, **(a)(iii)**, **(b)(i)** and **(b)(ii)** for the **thicker** wire.

d = ...

$\left(D + \frac{d}{2}\right)$ = ...

$(n + t)$ = ...
[3]

(d) It is suggested that the relationship between $(n + t)$, d and D is

$$(n + t) = \frac{k}{\left(D + \frac{d}{2}\right)}$$

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 **(d)(i)** support the suggested relationship.

.....

.....

.....

.....[1]

(e) (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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