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

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

9326541517

PHYSICS **9702/33**

Paper 3 Advanced Practical Skills 1 **October/November 2012**

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.

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1	
2	
Total	

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

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1 In this experiment, you will investigate how the motion of a thin card shape depends on where the shape is supported.

(a) You are provided with a T-shaped card. The card has a mark on it and 14 holes.
Label the holes on the card, 1 to 14, starting from the top end as shown in Fig. 1.1.

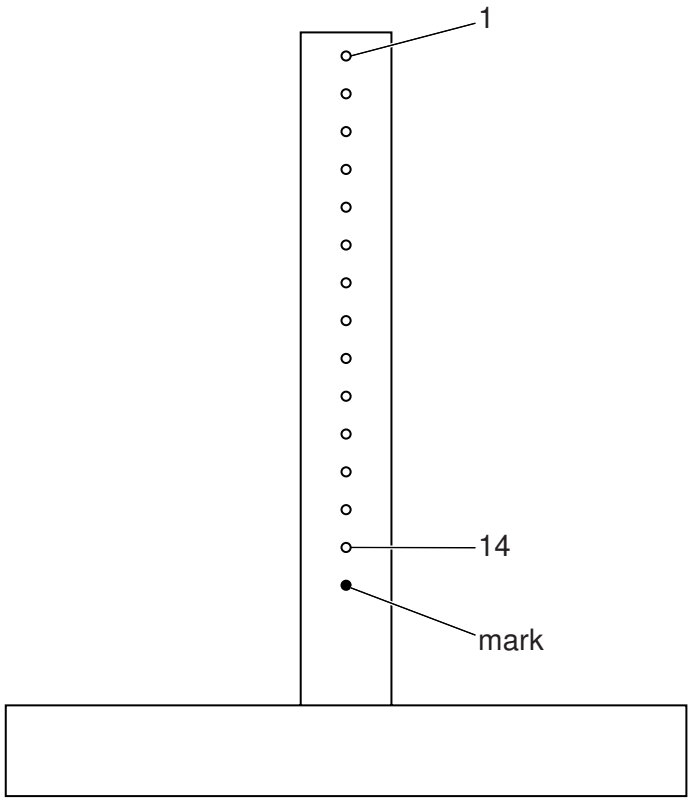

Fig. 1.1

(b) (i) Set up the apparatus, placing the pin through hole number 9, as shown in Fig. 1.2.

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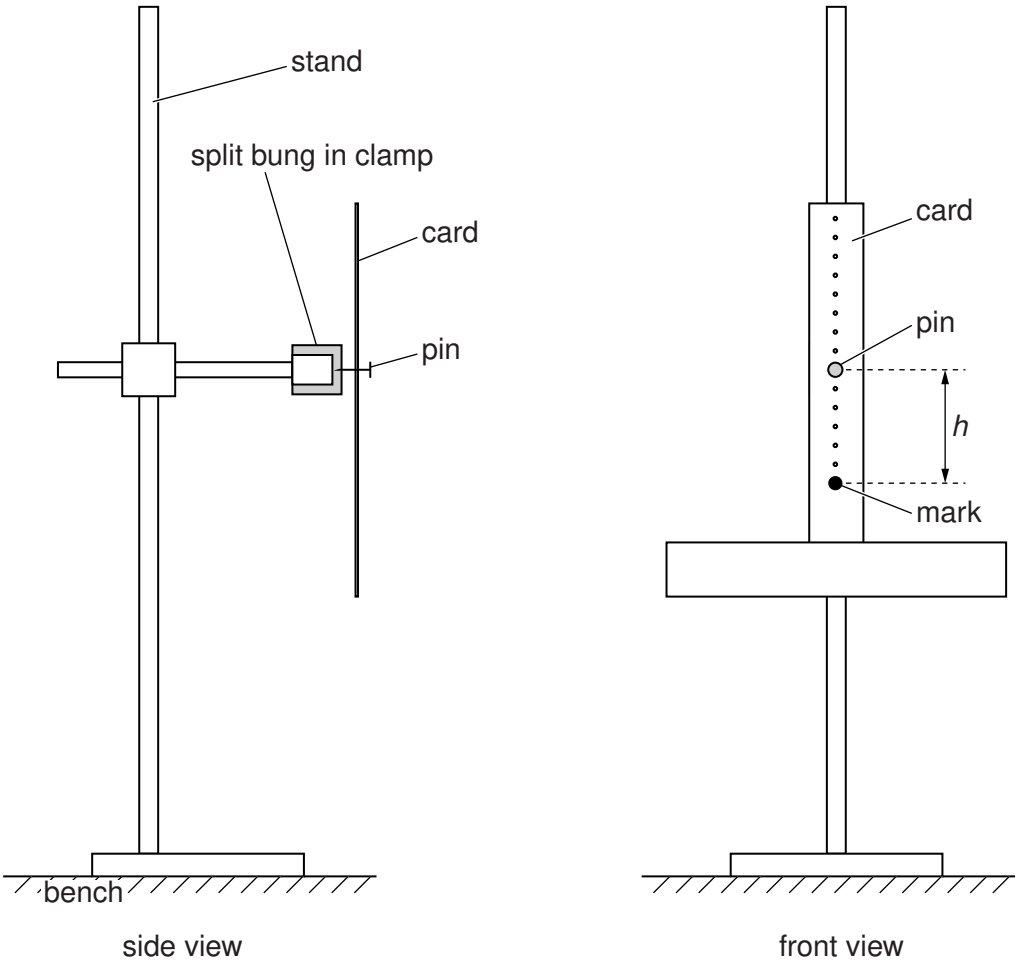

Fig. 1.2

(ii) Measure and record the distance *h* between the pin and the mark.

h = ... m [1]

(c) Displace the card shape to the left. Release the shape and watch its movement.
The shape will move to the right and then to the left again, completing a swing as shown in Fig. 1.3.

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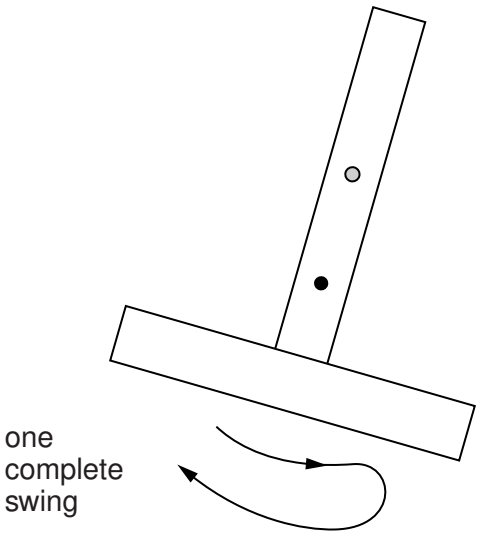

Fig. 1.3

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

T = ... [2]

(d) Vary h, by changing the hole through which the pin is placed, and repeat **(b)(ii)** and **(c)** until you have six sets of values of h and T.

Include values of T^2h and h^2 in your table.

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[9]

(e) (i) Plot a graph of T^2h on the y-axis against h^2 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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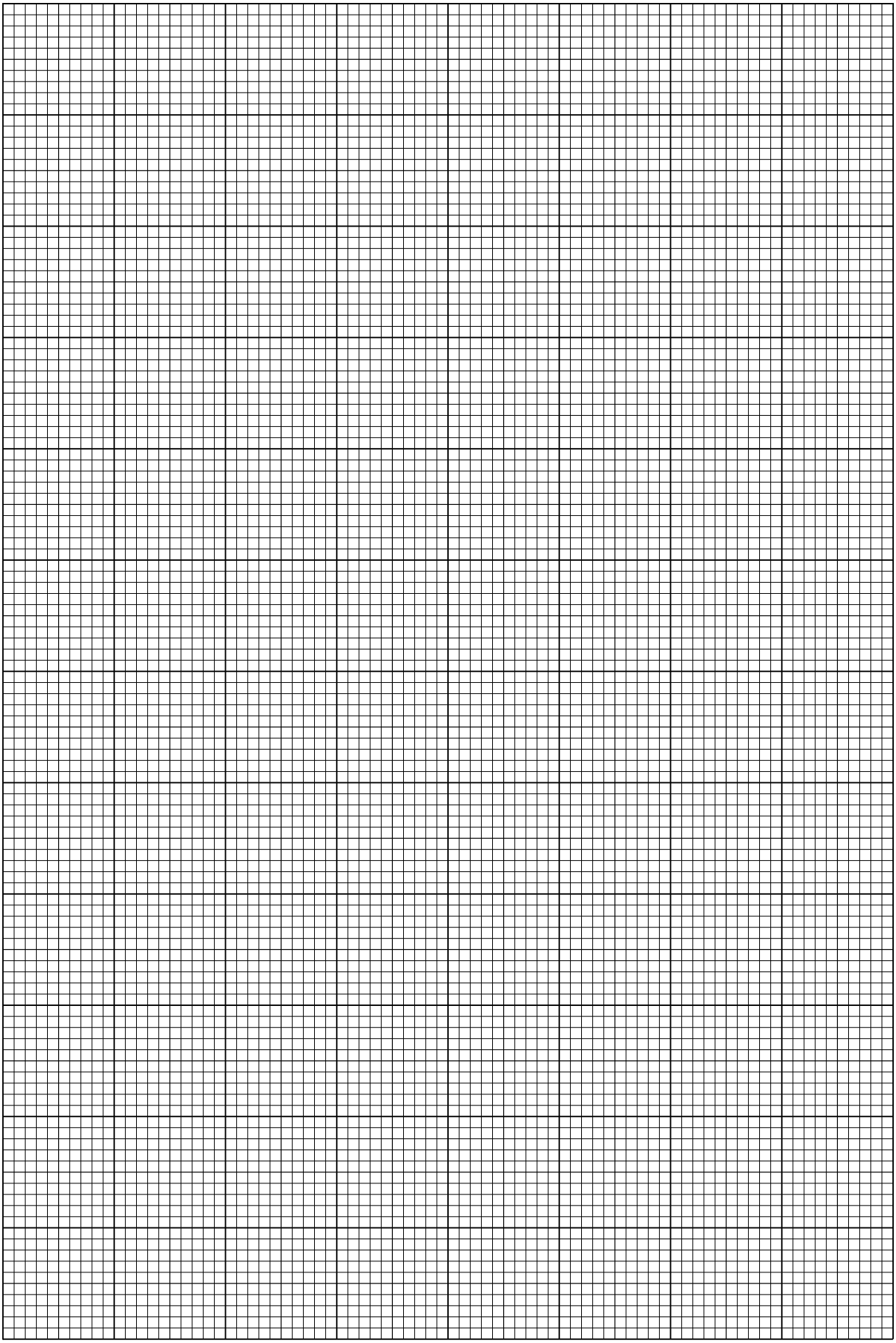

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(f) The quantities T and h are related by the equation

$$T^2h = Ph^2 + Q$$

where P and Q are constants.

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

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$P =$ .....

$Q =$ .....

[2]

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2 In this experiment, you will investigate how the stopping distance of a model vehicle depends on its mass.

(a) (i) Record the mass m of the model. This information is given on the card.

m = ... g

(ii) Measure and record the total length L of the model, as shown in Fig. 2.1.

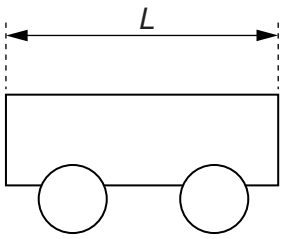

Fig. 2.1

L = ... [1]

(b) (i) Support the board as shown in Fig. 2.2.

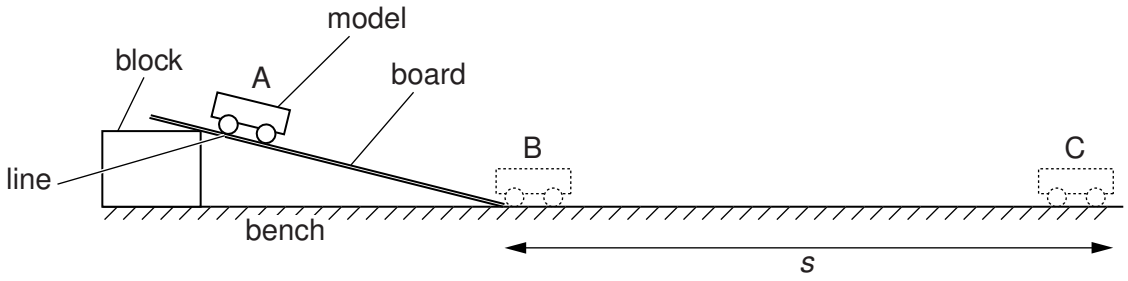

Fig. 2.2

Place the **back** wheels of the model on the line. This is position A.

Release the model. It travels a distance of 40 cm down the board until all the wheels are on the bench. This is position B.

The model moves a distance along the bench before stopping. This is position C.

Distance s is measured from the end of the board to the front of the model as shown in Fig. 2.2.

(ii) Repeat **(b)(i)** until s is approximately 60 cm.
It may be necessary to adjust the slope of the board before releasing the model.

Do not adjust the slope of the board throughout the remainder of the experiment.

Measure and record the distance s.

s = ... [2]

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

percentage uncertainty = ... [1]

(iv) Use your values from **(a)(ii)** and **(b)(ii)** to determine the distance x moved by the model between B and C, where

$$x = s - L.$$

x = ... [1]

(c) Replace the model at A.
Release the model.
Measure and record the time t taken to move from B to C and the distance s.
Calculate x.

t = ...

s = ...

x = ...
[1]

(d) **(i)** Calculate the average speed v of the model between B and C using the relationship

$$v = \frac{x}{t}.$$

v = ... [1]

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

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.....

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..... [1]

(e) (i) Fix the 100 g mass on top of the model using the Blu-Tack.

(ii) Calculate and record the total mass M of the model and the 100 g mass.

M = ... g

(iii) Repeat **(c)** and **(d)(i)**.

t = ...

s = ...

x = ...

v = ...

[3]

(f) It is suggested that v remains constant when M is changed.

Explain whether your results support the suggested relationship.

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.....

..... [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. .....

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2. .....

.....

3. .....

.....

4. .....

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[4]

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