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

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8154329572

PHYSICS **9702/34**

Paper 3 Advanced Practical Skills 2 **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 submitted 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.

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1 In this experiment, you will investigate how a force acting on a pivoted wooden strip changes as the pivot position is moved.

(a) (i) Assemble the apparatus as shown in Fig. 1.1 with the nail through the **central** hole in the wooden strip.

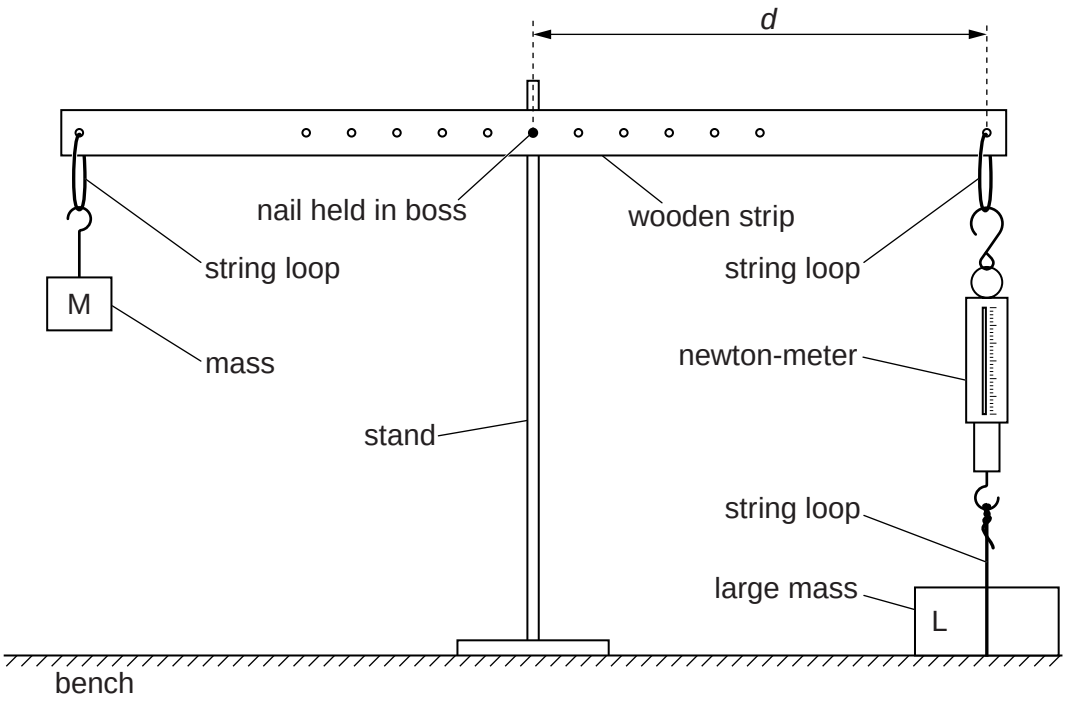


Fig. 1.1

(ii) Adjust the nail height so that the wooden strip is parallel to the bench.
Adjust the position of the stand or the large mass so that the newton-meter is vertical.

(b) (i) Measure and record the distance *d* from the nail to the string loop attached to the newton-meter, as shown in Fig. 1.1.

d = ... [1]

(ii) Record the force *F* indicated by the newton-meter.

F = ... N

(c) Reposition the strip with the nail through different holes and repeat **(a)(ii)** and **(b)** until you have six sets of values of d and F.
Include values of $\frac{1}{d}$ in your table.

Do not use holes that result in a force outside the range of the newton-meter.

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[11]

(d) (i) Plot a graph of F on the y-axis against $\frac{1}{d}$ on the x-axis. [3]

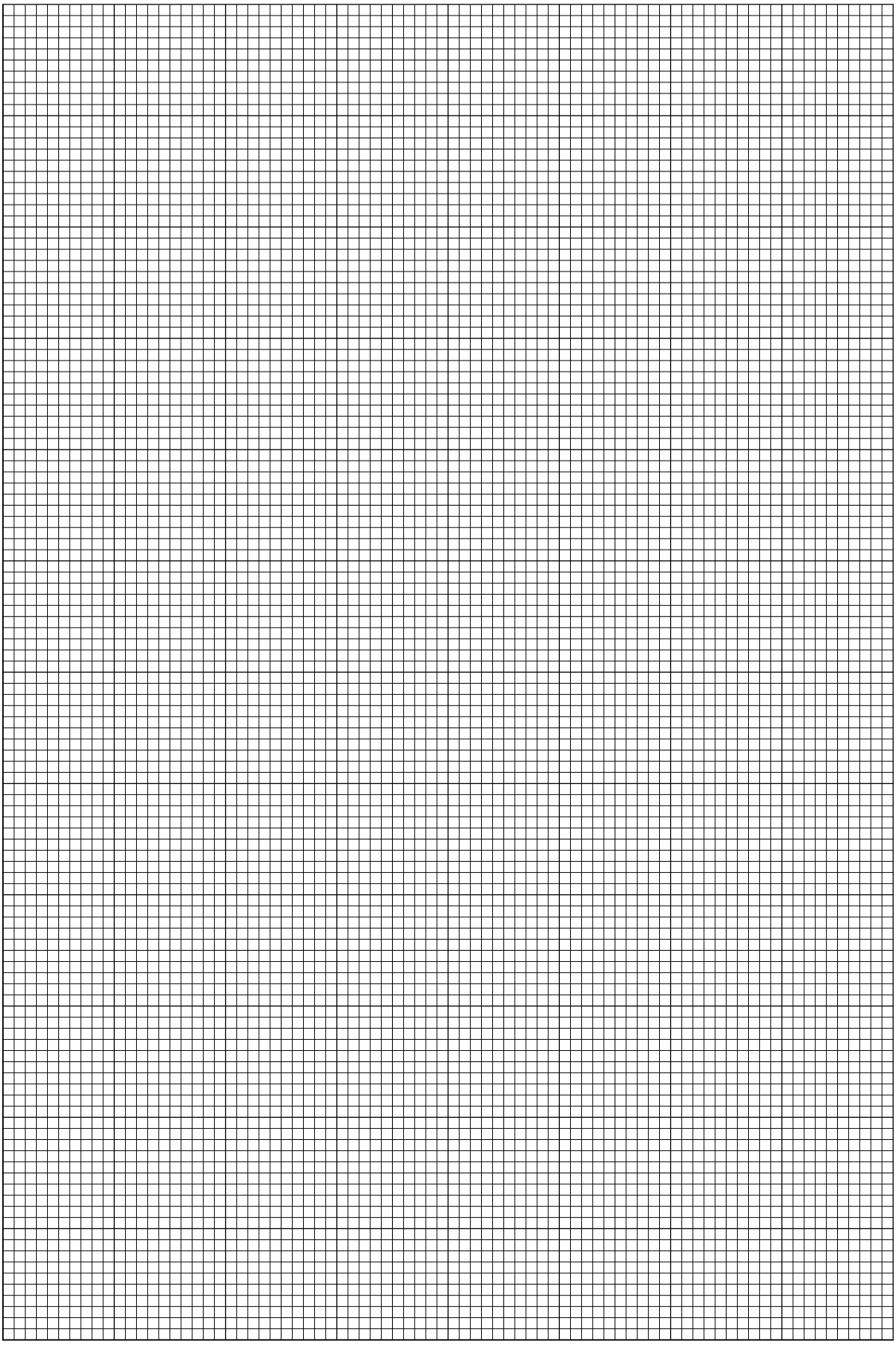
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...
[2]

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(e) The quantities F and d are related by the equation

$$F = \frac{a}{d} + b$$

where a and b are constants.

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

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a = ...

b = ...

[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 speed of water flowing through a tube depends on the tube length.

(a) (i) Take measurements to determine the internal diameter D of the flexible tube, as shown in Fig. 2.1.



Fig. 2.1

D = ... cm [2]

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

percentage uncertainty = ... [1]

(b) Remove the plunger from the syringe body.

(c) (i) Measure the length l of the flexible tube.

l = ... [1]

(ii) Push the nozzle of the syringe body securely into one end of the flexible tube and then assemble the apparatus as shown in Fig. 2.2. Attach enough modelling clay near the bottom of the tube to make it hang vertically.

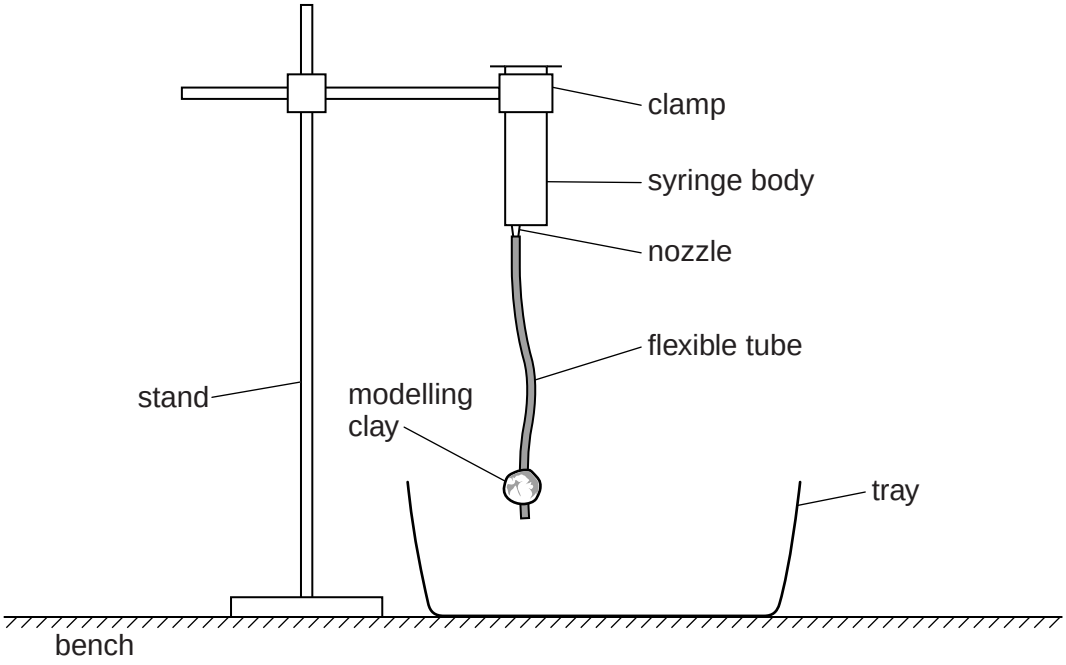


Fig. 2.2

(iii) Fill the syringe body to the top with water.
As the water level falls in the syringe body, take measurements to find the time t for the level to fall from the 40 cm^3 graduation to the 10 cm^3 graduation. (Note that 1 ml = 1 cm^3.)

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t = ... s [1]

(iv) Calculate the average speed v of the water in the tube using the relationship

$$v = \frac{120}{\pi D^2 t}.$$

v = ... $cm\,s^{-1}$ [1]

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

.....

.....

..... [1]

(e) **(i)** Detach the tube from the syringe body and reduce its length by cutting it in half.

(ii) Repeat **(c)** with one of the shorter tubes.

l = ...

t = ... s

v = ... $cm\,s^{-1}$
[3]

(f) It is suggested that the relationship between v and l is

$$v^2 = kl$$

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) Explain whether your results 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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