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

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

8129304547

PHYSICS **9702/34**

Paper 3 Advanced Practical Skills 2 **October/November 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	

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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 forces supporting a wooden strip change as the position of a suspended mass is moved.

(a) (i) Suspend the single spring and the mass hanger from the rod of one of the clamps. Measure and record the height h_1 of the mass hanger above the bench, as shown in Fig. 1.1.

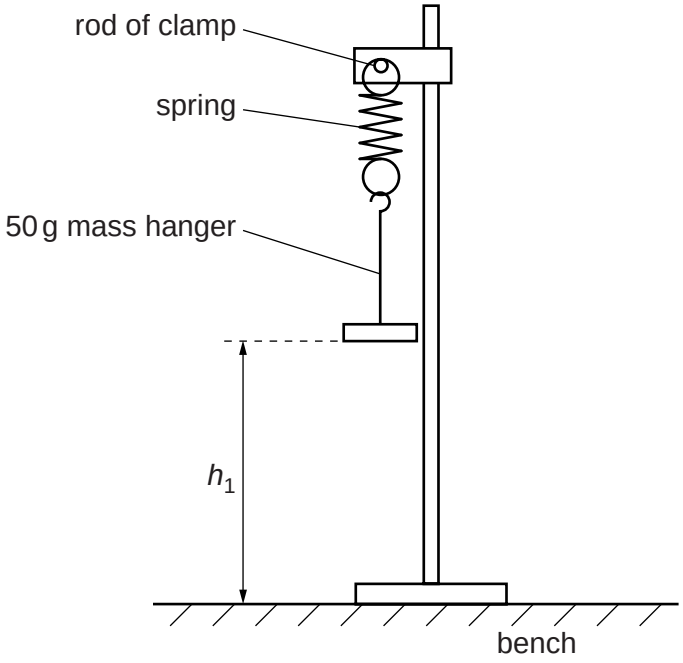


Fig. 1.1

h_1 = ...

(ii) Add the 50 g slotted mass to the hanger. Measure and record the new height h_2 of the mass hanger above the bench.

h_2 = ...
[1]

(iii) Calculate the change in height C, where $C = h_1 - h_2$.

C = ...

(b) (i) Assemble the apparatus as shown in Fig. 1.2, with the mass M near to the middle of the wooden strip.

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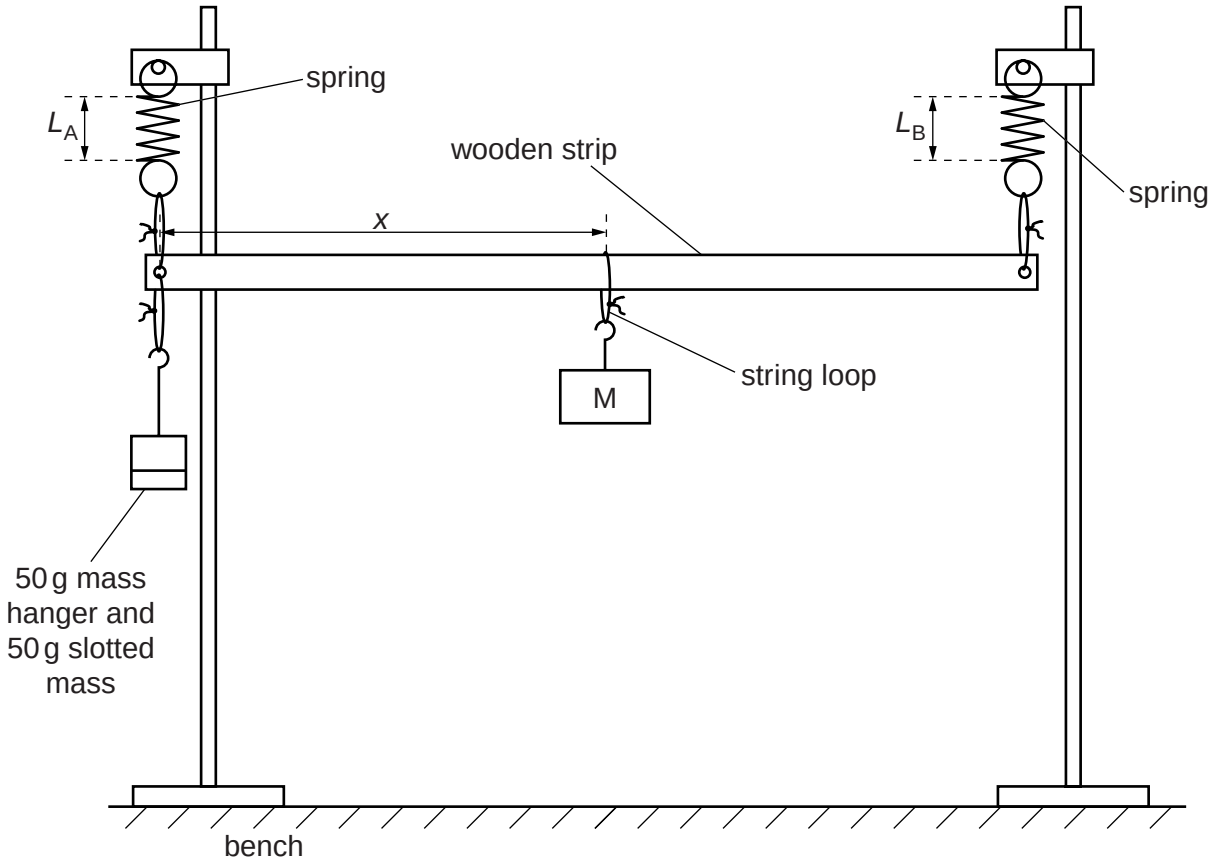


Fig. 1.2

(ii) Adjust the apparatus so that the wooden strip is horizontal and the springs are vertical.

(iii) Measure and record the distance x from the left-hand hole in the wooden strip to the string loop supporting M, as shown in Fig. 1.2.

x = ...

(iv) Measure and record the length L_A of the coiled section of the left-hand spring, and the length L_B of the coiled section of the right-hand spring.

L_A = ...

L_B = ...

[1]

(c) Reposition the string loop supporting M.
Repeat **(b)(ii)**, **(b)(iii)** and **(b)(iv)** until you have six sets of values of x, L_A and L_B.

Include values for $(L_A - L_B)$ and for $\frac{(L_A - L_B)}{C}$ in your table.

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[10]

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

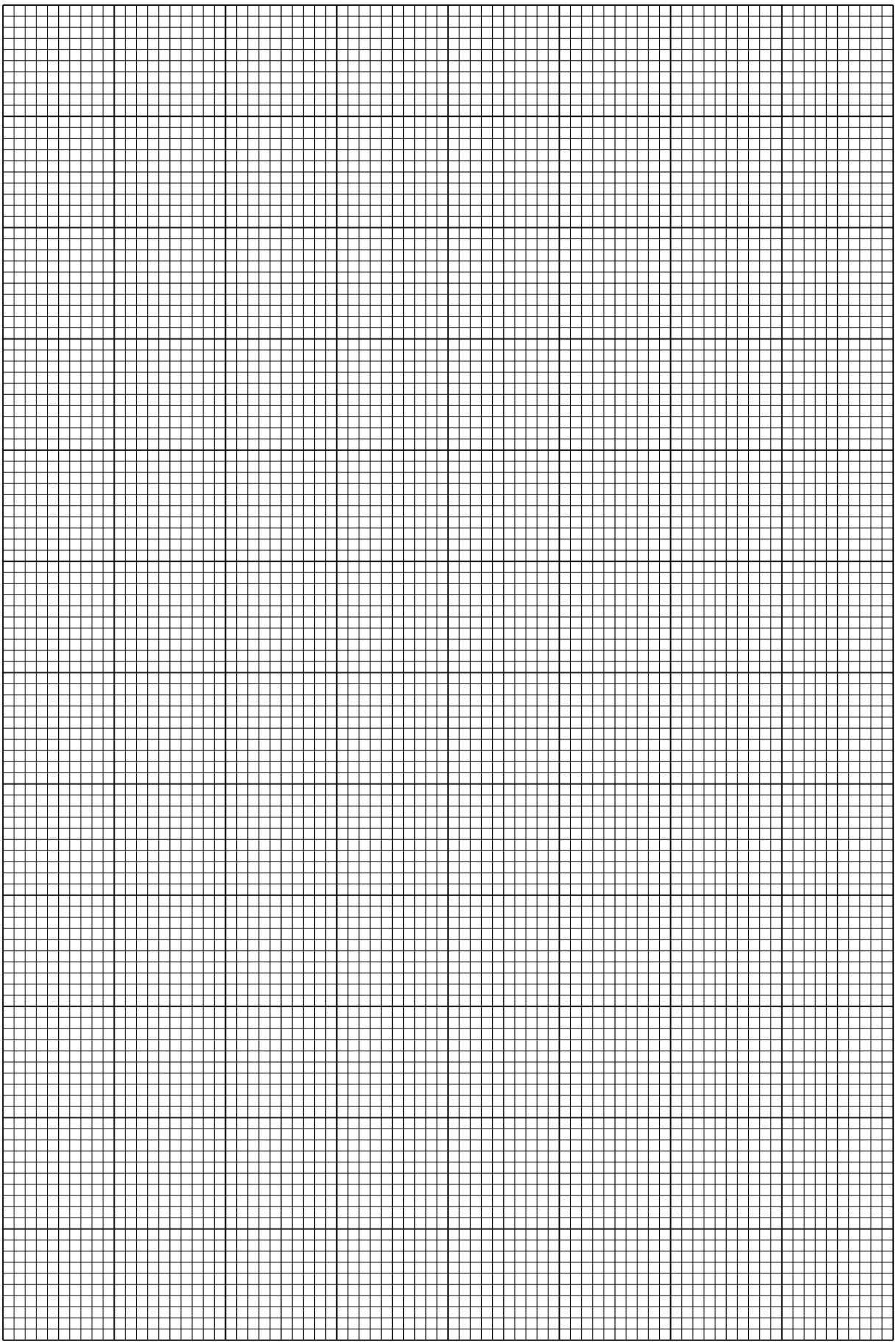
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...
[2]

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(e) The quantities L_A, L_B, C and x are related by the equation

$$\frac{(L_A - L_B)}{C} = ax + b$$

where a and b are constants.

Use your answers from **(d)(iii)** to 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 the equilibrium of a spool of thread.

(a) (i) Using the smaller of the two spools provided, take measurements to determine the outside diameter *D* and the inner diameter *d*, as shown in Fig. 2.1.

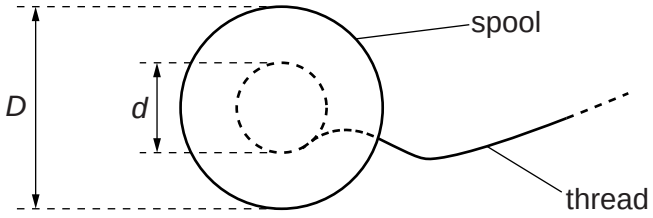


Fig. 2.1

D = ...mm

d = ...mm
[2]

(ii) Calculate the ratio *R*, where $R = \frac{d}{D}$.

R = ...[1]

(b) Justify the number of significant figures that you have given for your value of *R*.

.....

.....

.....

.....[1]

(c) Use the stand, boss and clamp to support the protractor as shown in Fig. 2.2.

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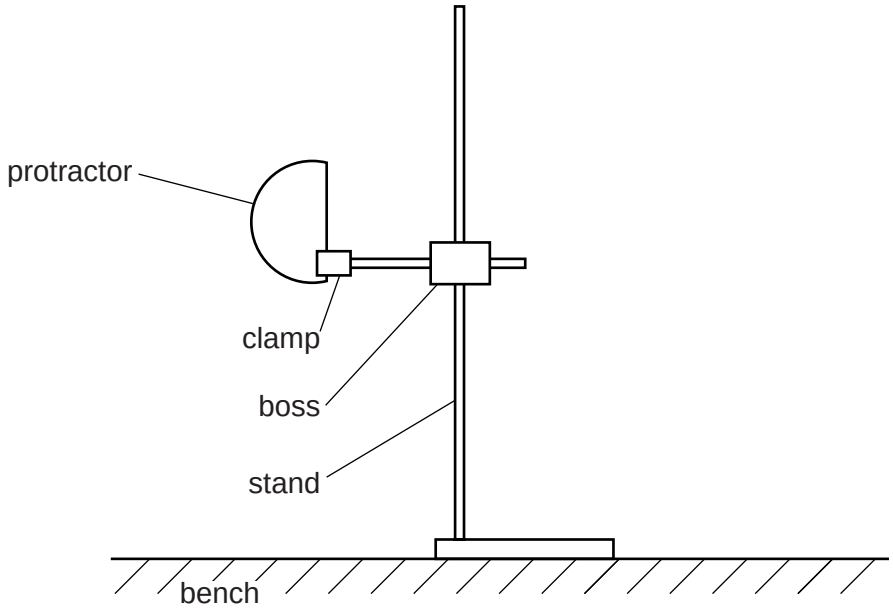


Fig. 2.2

(d) (i) Using the smaller of the two spools, wrap the thread around its inner diameter until there is about 30 cm of thread left unwound.

(ii) With the spool on the bench, gently pull the thread vertically as shown in Fig. 2.3.

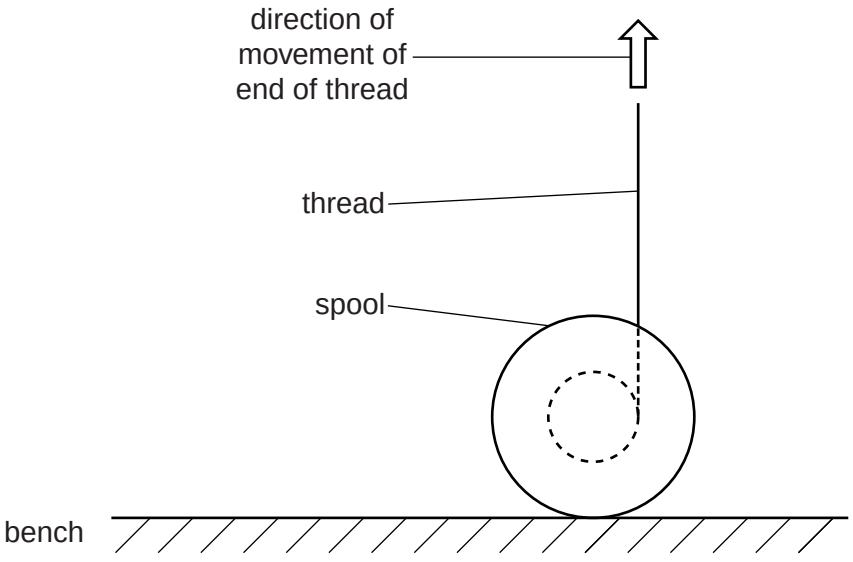


Fig. 2.3

(iii) The spool will move to the left until the thread reaches a constant angle θ to the vertical with the spool rotating but not moving along the bench, as shown in Fig. 2.4.

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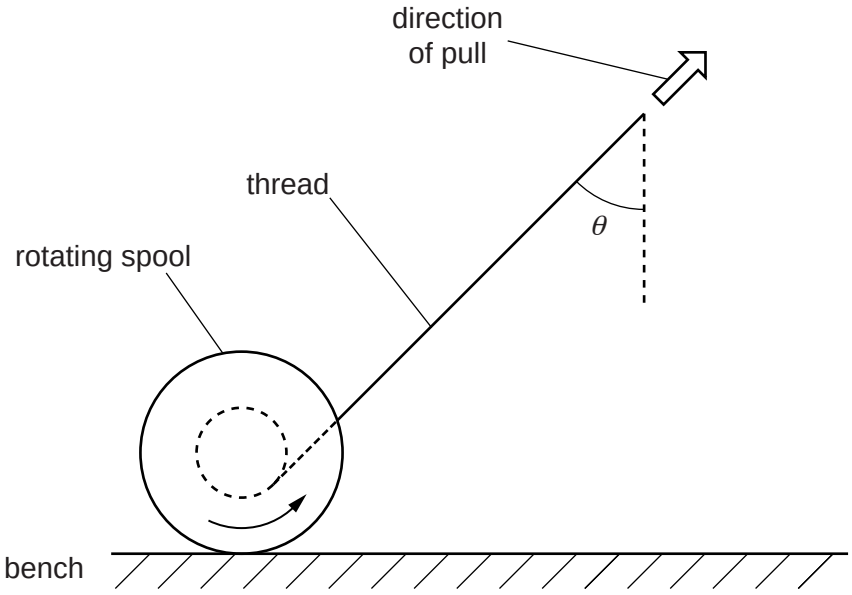


Fig. 2.4

(iv) Measure and record the angle θ.

θ = ...[2]

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

percentage uncertainty = ...[1]

(f) Repeat **(a)** and **(d)** but using the larger of the two spools.

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D = ...

d = ...

R = ...

θ = ...

[3]

(g) It is suggested that the relationship between θ and R is

$$\sin\theta = kR$$

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]

(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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