Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9212440494

PHYSICS **9702/35**

Paper 3 Advanced Practical Skills 1 **October/November 2018**

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.

For Examiner's Use	
1	
2	
Total	

This document consists of **11** printed pages and **1** blank page.

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

1 In this experiment, you will investigate the extension of a spring.

(a) You have been provided with a spring.

- Measure and record the length x_0 of the unstretched coiled section of the spring, as shown in Fig. 1.1.

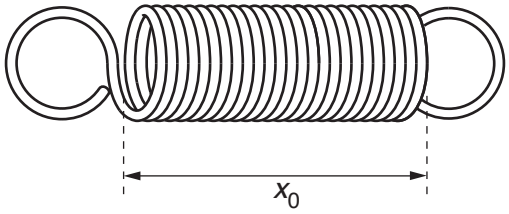


Fig. 1.1

x_0 = ...[1]

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(b) • Set up the apparatus as shown in Fig. 1.2.

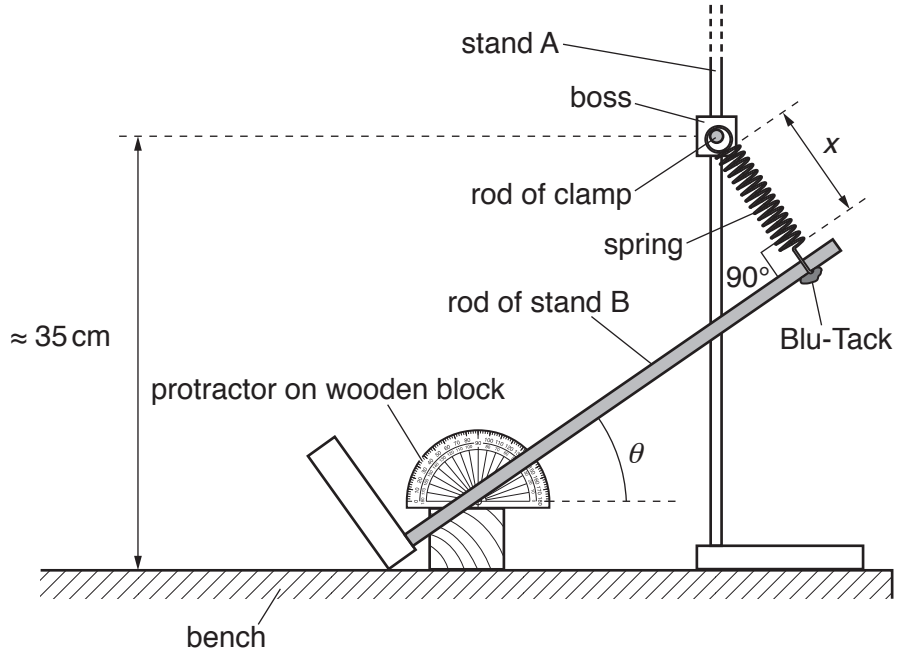


Fig. 1.2

The protractor should be attached to the wooden block using some of the Blu-Tack.

The height of the rod of the clamp above the bench should be approximately 35 cm.

One loop of the spring should be around the rod of the clamp.

The other loop of the spring should be around the rod of stand B close to the top of the rod and secured using Blu-Tack.

- Slide the base of stand B until the angle between the rod of stand B and the stretched spring is 90°.

- The length of the coiled section of the spring is x.
  The angle between the rod of stand B and the horizontal is θ.

  Measure and record x and θ.

x = ...

θ = ...

- Calculate e where

$$e = (x - x_0).$$

e = ...
[1]

(c) Change the height of the boss. Slide the base of stand B until the angle between the rod of stand B and the stretched spring is again 90°.
Measure and record x and θ. Repeat until you have six sets of values.

Record your results in a table. Include values of e, $\frac{e}{\cos\theta}$ and $\tan\theta$ in your table.

[10]

(d) **(i)** Plot a graph of $\frac{e}{\cos\theta}$ on the y-axis against $\tan\theta$ on the x-axis. [3]

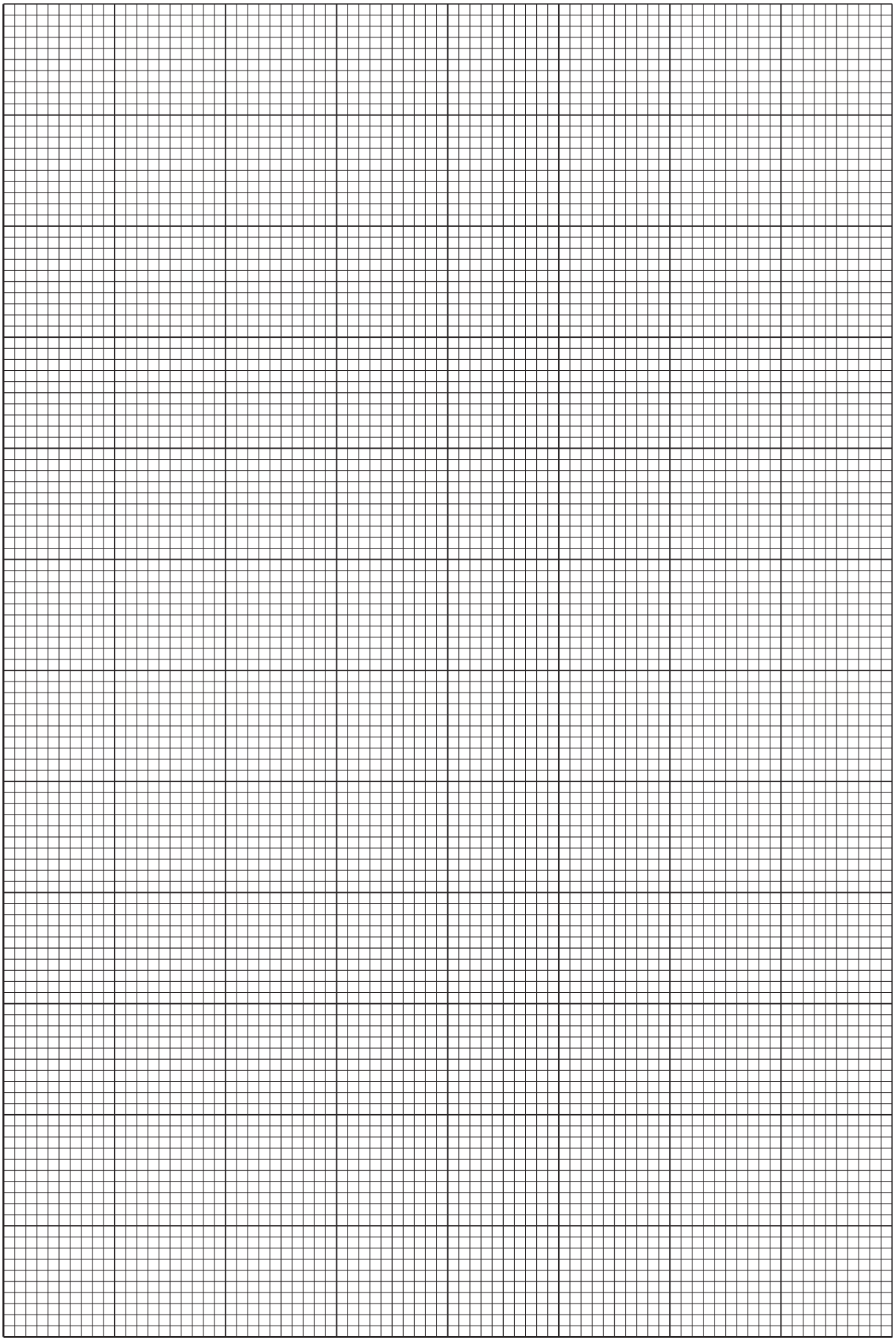
(ii) Draw the straight line of best fit. [1]

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

gradient = ...

y-intercept = ...
[2]

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[Turn over

(e) It is suggested that the quantities e and θ are related by the equation

$$\frac{e}{\cos\theta} = N\tan\theta + M$$

where N and M are constants.

Using your answers in **(d)(iii)**, determine the values of N and M.
Give appropriate units.

$N =$ .....

$M =$ .....
[2]

[Total: 20]

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

2 In this experiment, you will investigate the friction between string and a pulley.

(a) (i) You have been provided with two lengths of string.

Measure and record the diameter d of the **thicker** string.

d = ...mm [2]

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

percentage uncertainty = ...[1]

(iii) Calculate the cross-sectional area A of the string using

$$A = \frac{\pi d^2}{4}.$$

A = ...[1]

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

.....

.....

.....[1]

(b) (i) You have been provided with two mass hangers and a pulley.

- Rotate the pulley to ensure that it rotates freely.
- Using the **thicker** string, set up the apparatus as shown in Fig. 2.1.

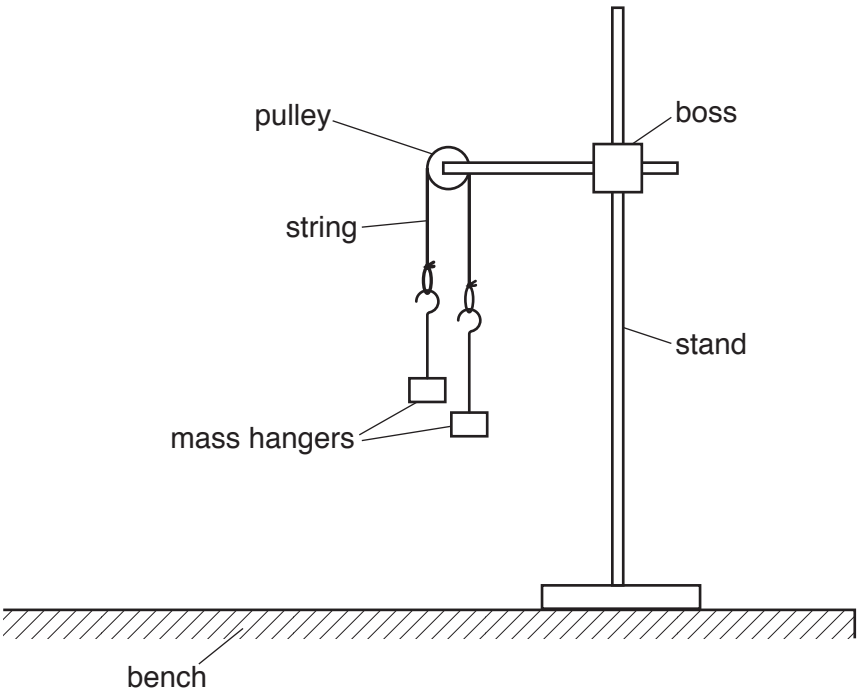


Fig. 2.1

- Add paper clips to **one** of the mass hangers until the mass hangers start to move.
- Record the number *p* of paper clips added to the mass hanger.

p = ...[1]

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(ii) • Remove the paper clips from the mass hanger.

• Add paper clips to the **other** mass hanger until the mass hangers start to move.

• Record the number q of paper clips added to the mass hanger.

$q =$ .....

• Calculate $\frac{(p + q)}{2}$.

$\frac{(p + q)}{2} =$ .....
[1]

(c) Using the **thinner** string, repeat **(a)(i)**, **(a)(iii)** and **(b)**.

$d =$ ..... mm

$A =$ .....

$p =$ .....

$q =$ .....

$\frac{(p + q)}{2} =$ .....
[3]

(d) It is suggested that the relationship between p, q and A is

$$\left[\frac{(p+q)}{2}\right]^3 = kA$$

where k is a constant.

(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]

(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]

[Total: 20]

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