Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1140028382

PHYSICS **9702/34**

Paper 3 Advanced Practical Skills 2 **May/June 2016**

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 behaviour of an electrical circuit.

(a) The positive terminals of C and the d.c. supply are already connected. Complete the circuit shown in Fig. 1.1, making sure that the positive terminals are connected as indicated on the diagram.

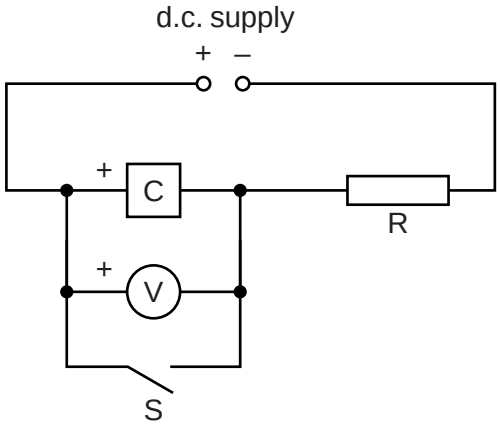


Fig. 1.1

(b) (i) Switch S should be **open**.

When the d.c. supply is switched on, the voltmeter reading will rise and become constant.
Switch on the d.c. supply and record the voltmeter reading V_S after approximately 60 s.

V_S = ...V

(ii) Calculate the value of $0.9V_S$.

$0.9V_S$ = ...V [1]

(c) (i) Close switch S. The voltmeter reading will fall to zero.

(ii) Open S and measure the time t for the voltmeter reading to rise to a value V_C of approximately 4.0 V.

Record t and V_C.

t = ... s

V_C = ...V
[1]

(d) (i) Write down your value of $0.9V_S$ from **(b)(ii)**.

$0.9V_S$ = ...V

(ii) Repeat **(c)** for different values of V_C in the range 0 to $0.9V_S$ until you have six sets of values of t and V_C.

[8]

(e) (i) Plot a graph of V_C on the y-axis against t on the x-axis. [2]

(ii) Draw a smooth curve through your points. [1]

(f) (i) Calculate the value of $0.5V_S$.

$0.5V_S$ = ...V

(ii) Draw the tangent to your curve at $V_C = 0.5V_S$. [1]

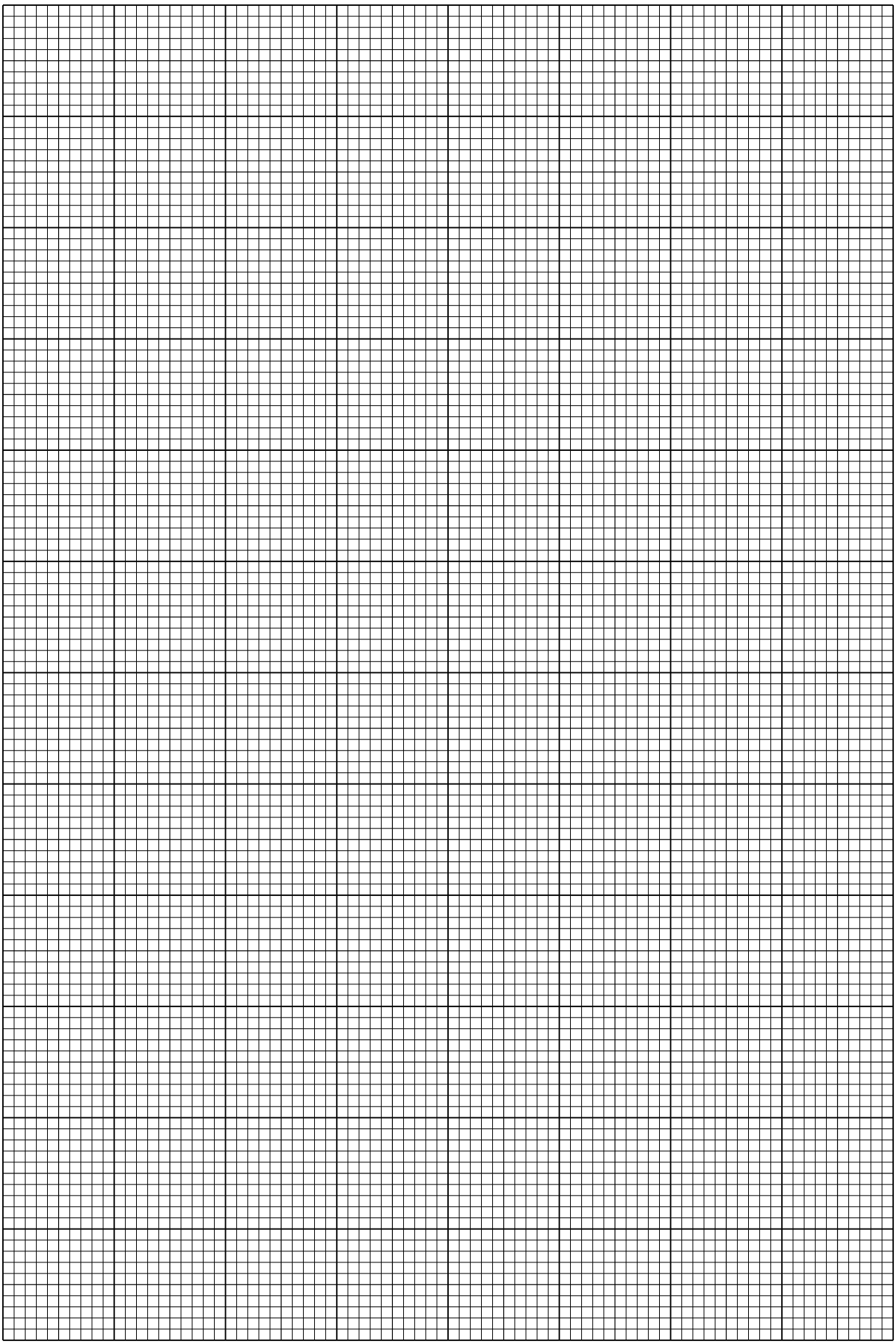
(iii) Determine the gradient and y-intercept of this tangent.

gradient = ...

y-intercept = ...

[2]

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(g) The tangent has the equation

$$V_C = at + b$$

where a and b are constants.

Use your answers in **(f)(iii)** to determine the values of a and b.
Give appropriate units.

$a =$ .....

$b =$ .....
[2]

(h) Calculate the value of T using the relationship

$$T = \frac{V_S}{2a}.$$

$T =$ .....[2]

[Total: 20]

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

2 In this experiment, you will investigate the relationship between the dimensions of a spring and its spring constant.

You are provided with two lengths of copper wire with the same diameter.

(a) Measure and record the diameter d of the wire.

d = ...[1]

(b) **(i)** Wind one of the lengths of wire around the rod labelled A so that it makes a spring, as shown in Fig. 2.1.

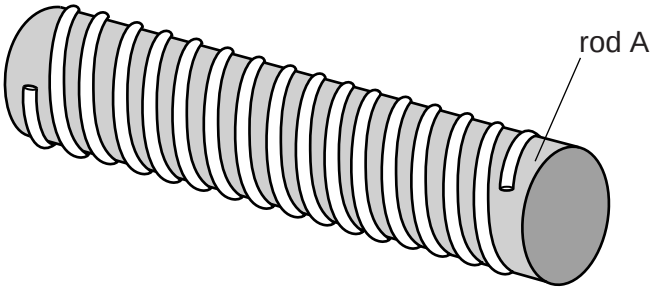


Fig. 2.1

(ii) Slide the spring off the rod and then twist the ends to give a loop at each end, as shown in Fig. 2.2.

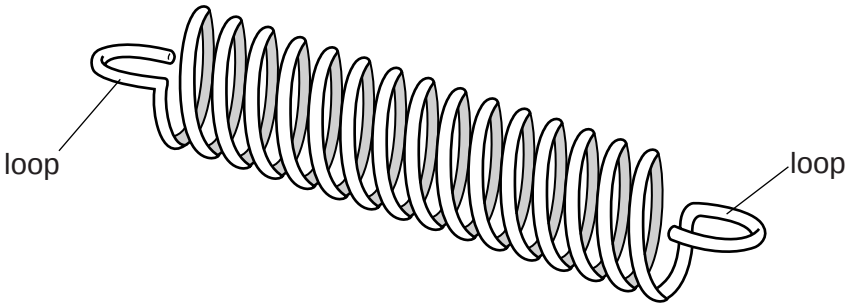


Fig. 2.2

(iii) Count and record the number *n* of coils in your spring, and measure and record the outside diameter *x* of your spring, as shown in Fig. 2.3.

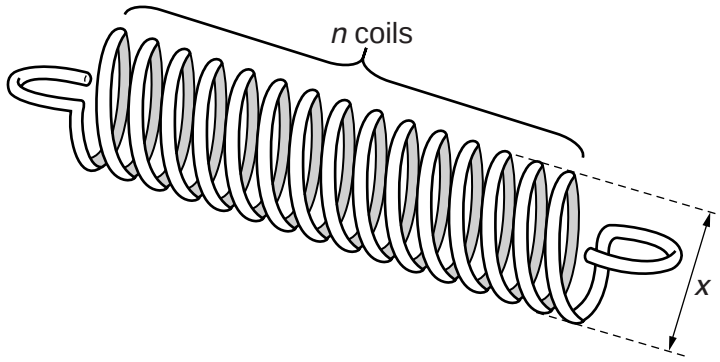


Fig. 2.3

n = ...

x = ...
[2]

(c) Estimate the percentage uncertainty in your value of *x*.

percentage uncertainty = ...[1]

(d) Calculate the value of *D* using the expression

$$D = x - d.$$

D = ...

(e) (i) Set up the apparatus as shown in Fig. 2.4, with the boss approximately 25 cm above the bench.

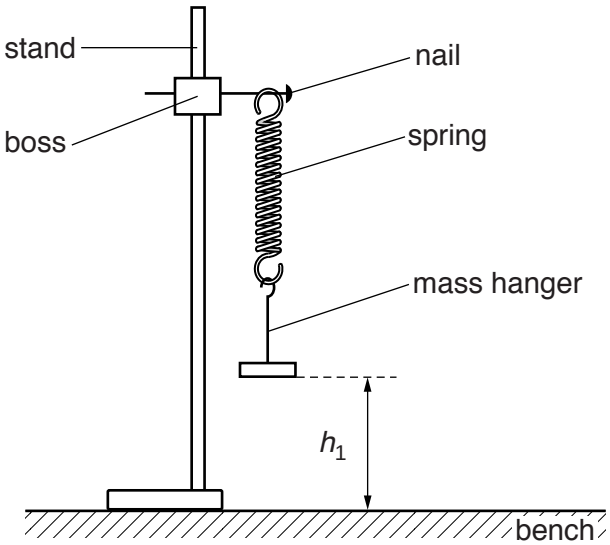


Fig. 2.4

(ii) Measure and record the height h_1 of the bottom of the mass hanger above the bench.

h_1 = ...[1]

(iii) Add the 50 g mass to the mass hanger and measure the height h_2 of the bottom of the mass hanger above the bench, as shown in Fig. 2.5.

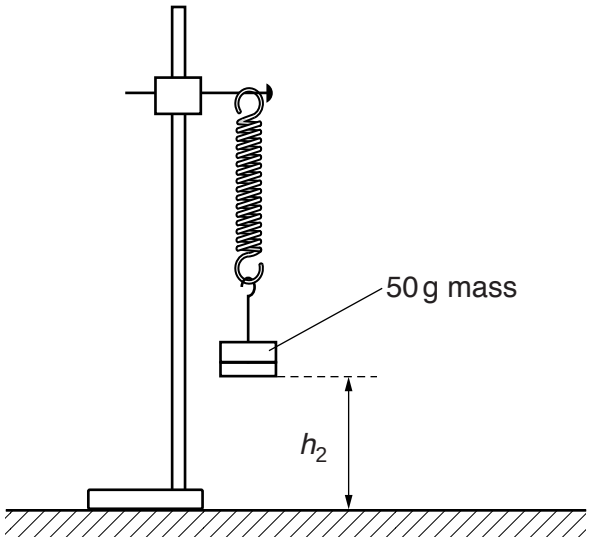


Fig. 2.5

h_2 = ...

(iv) Calculate the spring constant k using the expression

$$k = \frac{mg}{(h_1 - h_2)}$$

where $m = 0.050\,\text{kg}$ and $g = 9.81\,\text{N kg}^{-1}$.

Give your answer to an appropriate number of significant figures.

$k =$ .....[2]

(f) Repeat **(b)**, **(d)** and **(e)** using the rod labelled B and the other length of wire.

$n =$ .....

$x =$ .....

$D =$ .....

$h_1 =$ .....

$h_2 =$ .....

$k =$ .....
[3]

(g) It is suggested that the relationship between k, D and n is

$$k = \frac{c}{D^3 n}$$

where c is a constant.

(i) Using your data, calculate two values of c.

first value of c = ...

second value of c = ... [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.

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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