

--

--	--	--	--	--

--	--	--	--

9702/31

May/June 2010

2 hours

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

DO NOT WRITE IN ANY BARCODES.

You may lose marks if you do not show your working or if you do not use appropriate units.

You are reminded of the need for good English and clear presentation in your answers.

All questions in this paper carry equal marks.

For Examiner's Use	
1	
2	
Total	

This document consists of **9** printed pages and **3** blank pages.

BLANK PAGE

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

For
Examiner's
Use

- 1 In this experiment, you will measure the potential difference (p.d.) across a set of resistors in series and the current through the resistors.

(a) Measure and record the e.m.f. of the power supply.

e.m.f. = ... V

- (b) (i) Connect the circuit of Fig. 1.1, ensuring that the movable lead is connected between resistors 1 and 2.

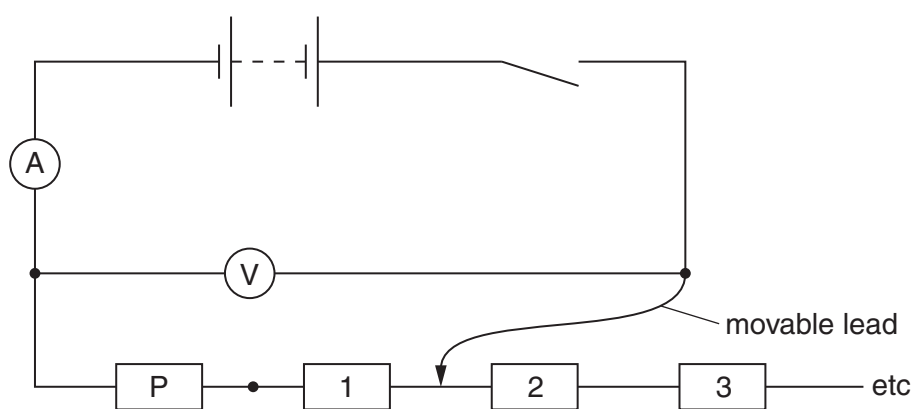


Fig. 1.1

- (ii) Close the switch and record the voltmeter reading V and the ammeter reading I .

After recording your results, open the switch.

$V =$ V

$I =$ A

- (iii) Using your answer to (b)(ii), calculate the total resistance R of resistor P in series with resistor 1.

$$(R = \frac{V}{I})$$

$R =$ Ω

- (c) By adjusting the movable lead, the resistor P may be connected in series with a number N of other resistors, giving different values of the total resistance R . In (b), $N = 1$.

Repeat (b)(ii), for different values of N , until you have six sets of readings for N , V and I .

Include values of $\frac{1}{R}$ in your table of results.

For
Examiner's
Use

- (d) (i) Plot a graph of I on the y -axis against $\frac{1}{R}$ on the x -axis.
- (ii) Draw the line of best fit.
- (iii) Determine the gradient and y -intercept of the line of best fit.

gradient = ...

y -intercept = ...

For
Examiner's
Use

- (e) The quantities I and R are related by the equation

$$I = \frac{M}{R} + L$$

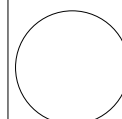
For
Examiner's
Use

where M and L are constants.

Using your answers from (d)(iii), determine values for M and L . You should include units where appropriate.

$M =$

$L =$



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

*For
Examiner's
Use*

- 2** In this experiment, you will investigate how the time of swing of a tube depends on its length.

(a) You are provided with two tubes and a string that has a loop at each end.

- (i)** Pass the string through the shorter tube, as shown in Fig. 2.1a. Pass one loop through the other loop, as shown in Fig. 2.1b, to secure the tube in place, as shown in Fig. 2.1c.



Fig. 2.1a

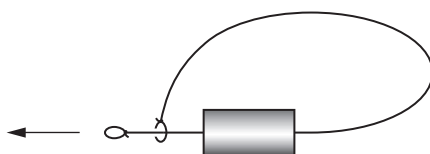


Fig. 2.1b



Fig. 2.1c

- (ii)** Hang the string from the clamp, as shown in Fig. 2.2.

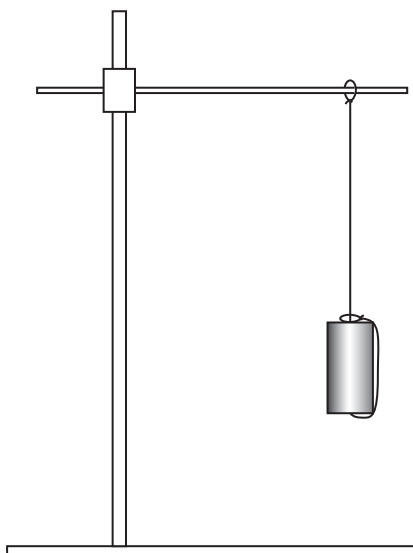


Fig. 2.2

- (b) Displace the tube, as shown in Fig. 2.3.
Release the tube.

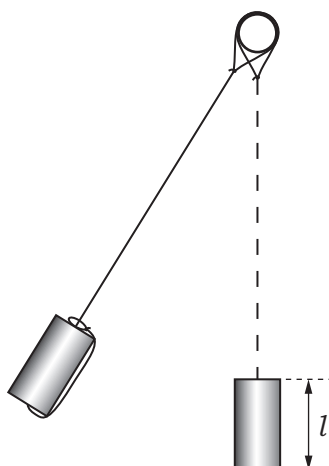


Fig. 2.3

The time the tube takes to return to the release position for the first time is the time period T . This may be determined accurately by measuring the time taken for the tube to complete several swings, backwards and forwards.

Showing all your working, determine an accurate value for the time period T .

$T = \dots\dots\dots$ s

- (c) (i) Using the vernier calipers, measure the length l of the shorter tube, as shown in Fig. 2.3.

$l = \dots\dots\dots$

- (ii) Explain how you have made this measurement as accurate as possible.

.....
.....
.....

- (iii) Estimate the percentage uncertainty in this measurement of l . Show all your working.

percentage uncertainty = ...

For
Examiner's
Use

- (d) (i) Pass the string through the longer tube so that it rests above the shorter tube, as shown in Fig. 2.4.

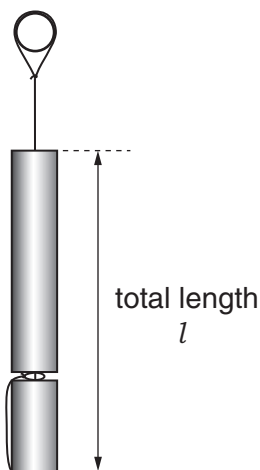


Fig. 2.4

- (ii) Repeat (b) to determine the new value of T .

new value of $T = \dots\dots\dots$

- (iii) Measure the length of the longer tube.

length of the longer tube = $\dots\dots\dots$

- (iv) Use your answers to (c)(i) and (d)(iii) to determine the new value of l (the total length of the two tubes), as shown in Fig. 2.4.

new value of $l = \dots\dots\dots \text{cm}$

- (e) It is suggested that T and l are related by the equation

$$T^2 = k l$$

where k is a constant. By calculating values of k , explain whether your results support this relationship.

.....

.....

.....

.....

For
Examiner's
Use

.....

.....

.....

.....

.....

.....

- (f) (i) Describe four sources of uncertainty or limitations of the procedure in this experiment.

For
Examiner's
Use

1.

.....

2.

.....

3.

.....

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.

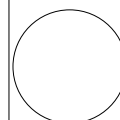
.....

3.

.....

4.

.....



BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.



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

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

PHYSICS

9702/32

Paper 32 Advanced Practical Skills 2

May/June 2010

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 submitted 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.

All questions in this paper carry equal marks.

For Examiner's Use

1

2

Total

This document consists of **9** printed pages and **3** blank pages.



BLANK PAGE

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

For
Examiner's
Use

1 In this experiment, you will measure the current through a set of resistors.

- (a) (i)** Connect the circuit of Fig. 1.1, ensuring that the movable lead is connected between resistors 1 and 2.

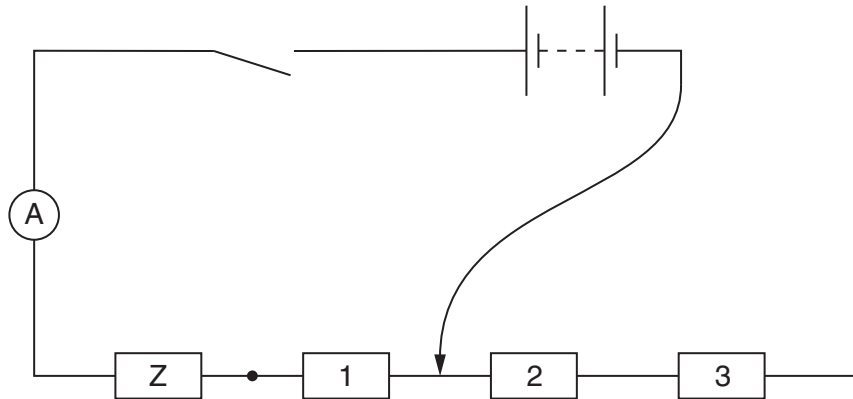


Fig. 1.1

- (ii)** Close the switch and record the ammeter reading I . Open the switch after recording your measurement.

$I = \dots\dots\dots$ A

- (b) By adjusting the movable lead, the resistor Z may be connected in series with a number N of other resistors. Each of the resistors labelled 1 to 12 has a resistance of $22\ \Omega$.

Repeat (a)(ii) for different values of N until you have six sets of readings for N and I .

Include in your table of results values of $\frac{1}{I}$ and the total resistance R of the $22\ \Omega$ resistors connected into the circuit.

(The total resistance R of the $22\ \Omega$ resistors in series can be determined using the formula $R = R_1 + R_2 + R_3 + \dots$)

For
Examiner's
Use

- (c) (i) Plot a graph of R on the y-axis against $\frac{1}{I}$ on the x-axis.
- (ii) Draw the line of best fit.
- (iii) Determine the gradient and y-intercept of the line of best fit.

gradient = ...

y-intercept = ...

For
Examiner's
Use

- (d) The quantities R and I are related by the equation

$$R = \frac{G}{I} + H$$

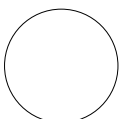
where G and H are constants.

Use your answers to **(c)(iii)** to determine values for G and H . You should include units where appropriate.

For
Examiner's
Use

$G =$

$H =$



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

For
Examiner's
Use

- 2 In this question, you will investigate how the attractive force between two magnets depends on their separation.
- (a) You are provided with a pair of magnets, one of which is fixed to the bench. You are also provided with some microscope slides, adhesive tape, a loop of cotton and a newton meter. You also have access to a micrometer screw gauge.
- (i) Place the loop of cotton around the magnet that is **not** fixed, as shown in Fig. 2.1, and use the adhesive tape to secure the cotton to the sides.

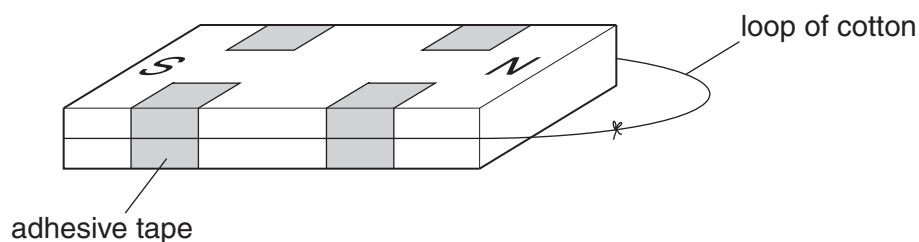


Fig. 2.1

- (ii) Place the magnet with the loop of cotton end-to-end with the fixed magnet, so that they are attracting, as shown in Fig. 2.2.

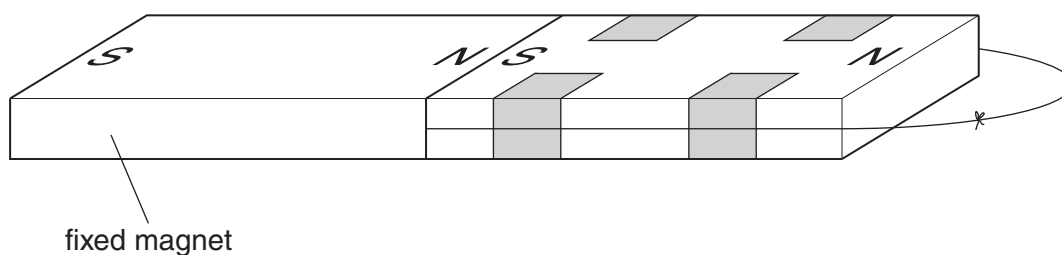


Fig. 2.2

- (b) (i) Using the newton meter, measure the maximum force F required to pull the magnets apart, as shown in Fig. 2.3.

For
Examiner's
Use

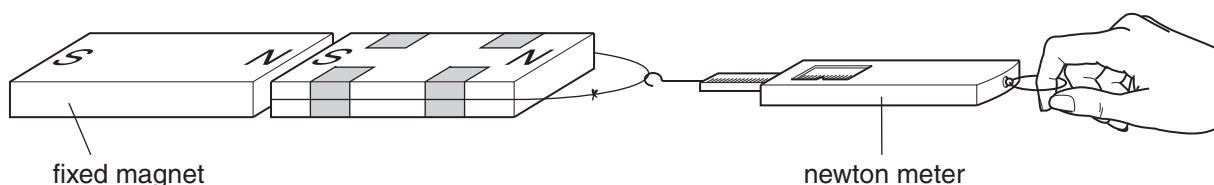


Fig. 2.3

$F = \dots\dots\dots$ N

- (ii) Explain why it is difficult to determine this force accurately.

.....

.....

.....

- (iii) Estimate the percentage uncertainty in the maximum force required to separate the attracting magnets. Show all your working.

percentage uncertainty = ...

- (c) (i) Using the micrometer screw gauge, measure the total thickness t of three of the microscope slides, as shown in Fig. 2.4.

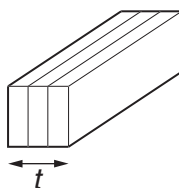


Fig. 2.4

$t = \dots\dots\dots$ mm

- (ii) Explain how you have made this measurement as accurate as possible.

.....

.....

.....

- (iii) Place the three slides between the two attracting magnets, as shown in Fig. 2.5. Use the newton meter to find the maximum force F needed to separate the magnets.

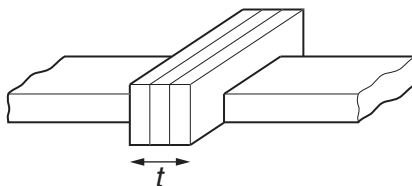


Fig. 2.5

$F =$

- (d) Repeat (c)(i) and (c)(iii) for a single slide placed between the attracting magnets.

$t =$ mm

$F =$

- (e) It is suggested that F and t are related by the equation

$$F = \frac{k}{t}$$

where k is a constant.

By calculating values of k , explain whether your results support this relationship.

.....

.....

.....

.....

For
Examiner's
Use

- (f) (i) Describe four sources of uncertainty or limitations of the procedure in this experiment.

For
Examiner's
Use

1.

.....

2.

.....

3.

.....

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.

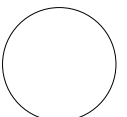
.....

3.

.....

4.

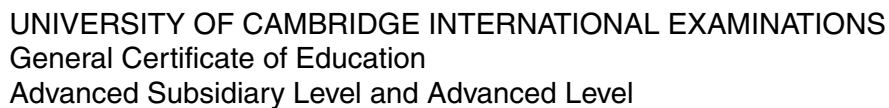
.....



BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.



--

--	--	--	--	--

--	--	--	--

9702/33

May/June 2010

2 hours

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

DO NOT WRITE IN ANY BARCODES.

You may lose marks if you do not show your working or if you do not use appropriate units.

You are reminded of the need for good English and clear presentation in your answers.

All questions in this paper carry equal marks.

For Examiner's Use	
1	
2	
Total	

This document consists of **9** printed pages and **3** blank pages.

BLANK PAGE

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

For
Examiner's
Use

- 1** In this experiment, you will investigate how the current through a semiconductor diode depends on the voltage across it.

- (a)** Assemble the circuit of Fig. 1.1.
Make sure that the diode is connected the correct way round.

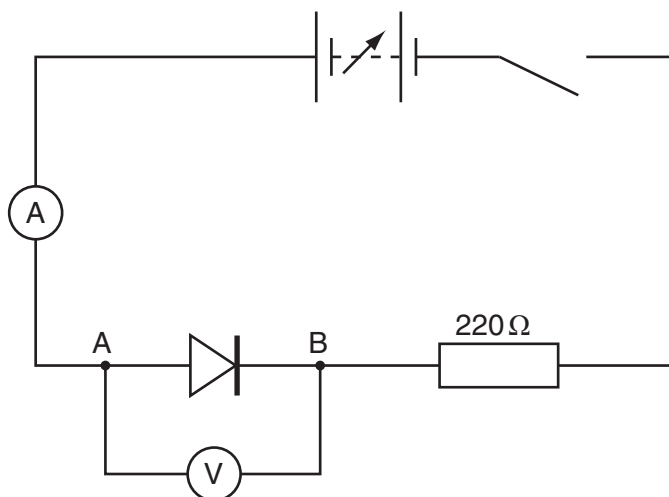


Fig. 1.1

- (b)** Set the power supply voltage to 12V and close the switch.
Record the voltmeter reading V and the ammeter reading I .
You should find that I is at least 0.02 A.

$V =$

$I =$

- (c) Reduce the power supply voltage, recording V and I until you have six sets of readings.

Open the switch when you have finished your measurements.

Include in your table of results the values of V^{10} .
 $(V^{10} = V \times V \times V \times V \times V \times V \times V \times V \times V \times V)$

For
Examiner's
Use

☐
☐
☐
☐
☐
☐
☐

- (d) (i) Plot a graph of I on the y-axis against V^{10} on the x-axis.

(ii) Draw the straight line of best fit.

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

gradient = ...

y-intercept = ...

☐
☐

For
Examiner's
Use

- (e) It is suggested that the relationship between I and V is

$$I = aV^{10} + b$$

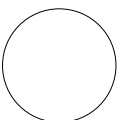
where a and b are constants.

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

For
Examiner's
Use

$a =$

$b =$



BLANK PAGE

Please turn over for Question 2.

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

For
Examiner's
Use

- 2** In this experiment, you will investigate how the speed of a glass ball falling through oil depends on its size.

The apparatus has been set out for you as shown in Fig. 2.1.

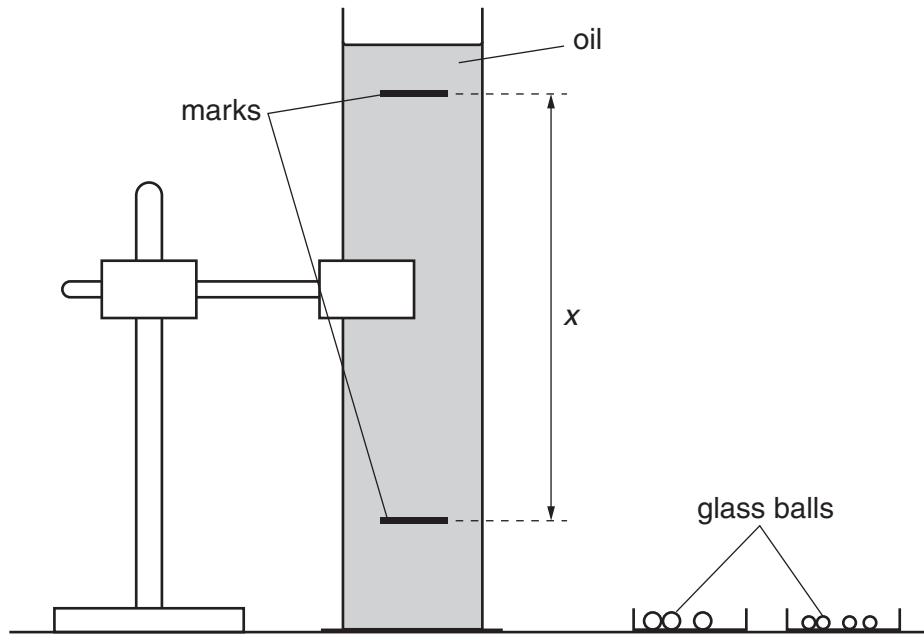


Fig. 2.1

- (a)** Measure and record the distance x between the upper and lower marks on the measuring cylinder.

$x =$



- (b) (i) You have been provided with two different sizes of glass ball: large and small. Take measurements to determine the diameter d of the small glass balls.

For
Examiner's
Use

$d = \dots\dots\dots$ mm

- (ii) Take measurements to determine the time t for a small glass ball to fall distance x through the oil.
Do not remove any balls from the oil. You may ask for more glass balls if needed.

$t = \dots\dots\dots$ s

- (c) Estimate the percentage uncertainty in your value of t .

percentage uncertainty = $\dots\dots\dots$

- (d) Calculate the speed v of a small glass ball falling distance x through the oil.

$$(v = \frac{x}{t})$$

$v = \dots\dots\dots$

- (e) Repeat (b) and (d) for the large glass balls.

For
Examiner's
Use

$d = \dots\dots\dots$ mm

$t = \dots\dots\dots$ s

$v = \dots\dots\dots$

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

$$v = kd^2$$

where k is a constant.

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

first value of $k = \dots\dots\dots$

second value of $k = \dots\dots\dots$

- (ii) Explain whether your results support the suggested relationship.

.....
.....
.....

- (iii) Justify the number of significant figures that you have given for your values of k in (i).

.....
.....
.....

- (g) (i) Describe four sources of uncertainty or limitations of the procedure in this experiment.

For
Examiner's
Use

1.

.....

2.

.....

3.

.....

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.

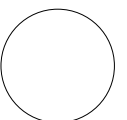
.....

3.

.....

4.

.....



BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.



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

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

PHYSICS

9702/34

Paper 32 Advanced Practical Skills 2

May/June 2010

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 submitted 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.

All questions in this paper carry equal marks.

For Examiner's Use

1

2

Total

This document consists of **9** printed pages and **3** blank pages.



BLANK PAGE

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

For
Examiner's
Use

- 1** In this experiment, you will investigate the length of a loaded spring as the load is varied.

(a) Measure and record the length L of the metal rod.

$L = \dots\dots\dots$ m

(b) (i) Support the rod as shown in Fig. 1.1.

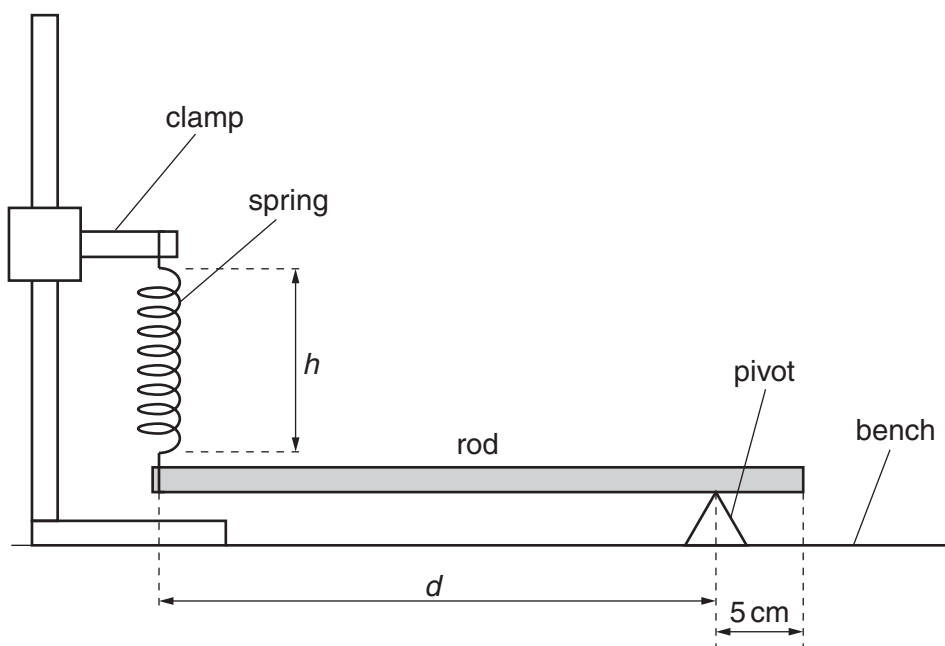


Fig. 1.1

- (ii)** Adjust the position of the pivot so that it is approximately 5 cm from the free end of the rod.
- (iii)** Adjust the clamp so that the rod is horizontal and the spring is vertical.
- (c)** Measure and record the length h of the coiled part of the spring and the distance d from the pivot to the point where the spring is attached to the rod.

$h = \dots\dots\dots$ m

$d = \dots\dots\dots$ m

- (d) Repeat (b)(iii) and (c) for different positions of the pivot along the rod until you have six sets of readings of d and h . Include values of $1/d$ in your table of results.

For
Examiner's
Use

☐
☐
☐
☐
☐
☐

- (e) (i) Plot a graph of h on the y -axis against $\frac{1}{d}$ on the x -axis.
 (ii) Draw the line of best fit.
 (iii) Determine the gradient and y -intercept of this line.

gradient = ...

y -intercept = ...

☐
☐

For
Examiner's
Use

- (f) It is suggested that the relationship between d and h is

$$h = \frac{A}{d} + B$$

where A and B are constants.

The value of A is equal to $\frac{Wz}{k}$

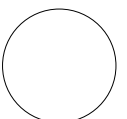
where W is the weight of the rod,
 k is the spring constant of the spring
 and z is a constant.

The values for W and k are given on the card.

Use your answer from **(e)(iii)** and the values on the card to calculate z .
 Give the appropriate unit.

For
Examiner's
Use

$z =$



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

For
Examiner's
Use

- 2** In this experiment, you will investigate the effect of an electric current on a nearby magnet.

- (a)** A circuit has been set up for you as shown in Fig. 2.1. Do not adjust the position of the stands.

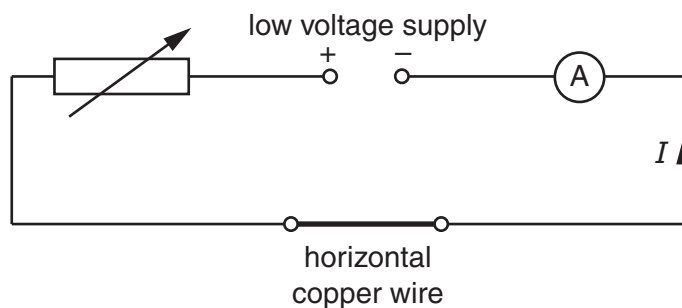


Fig. 2.1

Switch on the current. Use the variable resistor to adjust the current I to about 2 A. Record your value of current.

$I = \dots\dots\dots$ A

- (b)** Switch off the current. Place the thread over the horizontal copper wire, so that the magnet hangs as shown in Fig. 2.2.

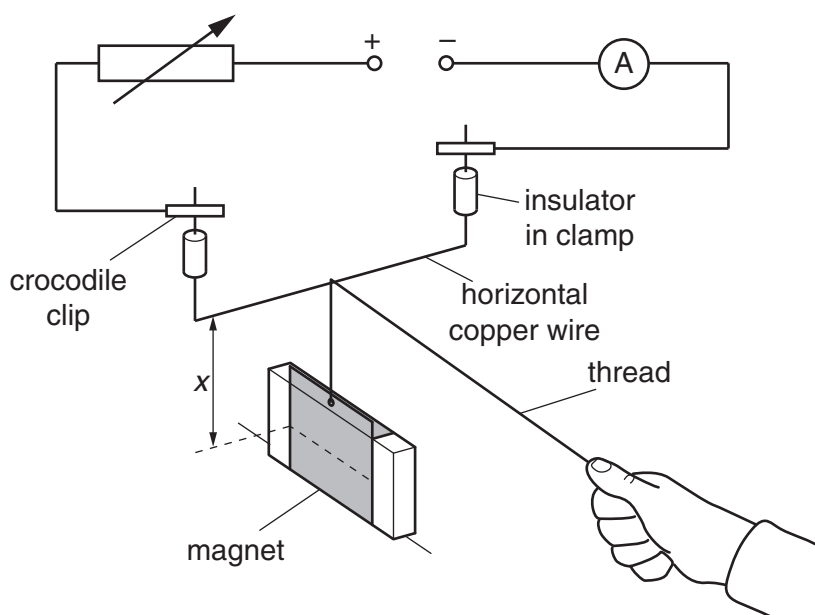


Fig. 2.2

- (c)** By moving your hand, adjust the distance x between the copper wire and the dotted line along the side of the magnet to about 7 cm. Record your value of x .

$x = \dots\dots\dots$ cm

- (d) Place the protractor on the bench beneath the magnet.
Switch on the current. The magnet will turn through an angle. Wait until the magnet comes to rest.
Measure and record the angle θ turned through by the magnet.
Switch off the current.

For
Examiner's
Use

$\theta = \dots\dots\dots^\circ$

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

percentage uncertainty in $\theta = \dots\dots\dots$

- (f) (i) Reverse the direction of the current in the copper wire.
Repeat (d) to find a second value of θ .

$\theta = \dots\dots\dots^\circ$

- (ii) Use your answers to (d) and (f)(i) to determine an average value of the magnitude of θ .

average value of $\theta = \dots\dots\dots^\circ$

- (g) Change x to about 4 cm.
Adjust the value of I so that the deflection θ is the same as in (f)(ii).
Record x and I .

$x = \dots\dots\dots$ cm

$I = \dots\dots\dots$ A

- (h) It is suggested that, for a given value of θ , the relationship between I and x is

$$I = kx$$

where k is a constant.

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

first value of $k = \dots\dots\dots$

second value of $k = \dots\dots\dots$

- (ii) Explain whether your results support the suggested relationship.

.....

- (iii) Justify the number of significant figures that you have given for your values of k .

.....

For
Examiner's
Use

☐
☐
☐

- (i) (i) Describe four sources of uncertainty or limitations of the procedure in this experiment.

For
Examiner's
Use

1.

.....

2.

.....

3.

.....

4.

.....

- (ii) (ii) Describe four improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

1.

.....

2.

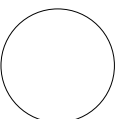
.....

3.

.....

4.

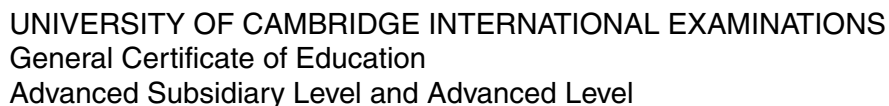
.....



BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.



--

--	--	--	--	--

--	--	--	--

9702/35

May/June 2010

2 hours

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

You may lose marks if you do not show your working or if you do not use appropriate units.

You are reminded of the need for good English and clear presentation in your answers.

All questions in this paper carry equal marks.

For Examiner's Use	
1	
2	
Total	

This document consists of **9** printed pages and **3** blank pages.

BLANK PAGE

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

For
Examiner's
Use

- 1 In this experiment, you will investigate the relationship between the power dissipated in a filament lamp and the resistance of the lamp.

(a) Assemble the circuit of Fig. 1.1.

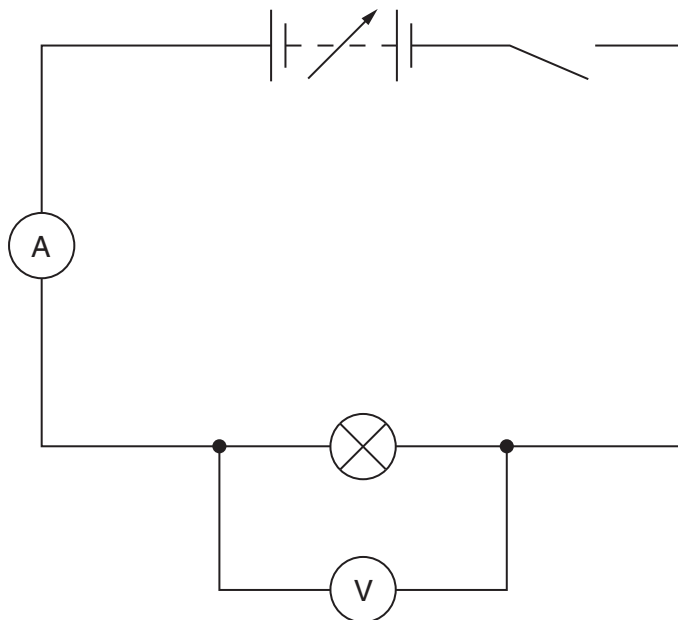


Fig. 1.1

- (b) Set the power supply voltage to 12V and close the switch so that the lamp lights. Record the voltmeter reading V and the ammeter reading I .

$V =$ V

$I =$ A

- (c) Reduce the power supply voltage, recording V and I until you have six sets of readings.

Open the switch when you have finished your measurements.

Include in your table of results values of P , R and R^4 , where P is the power dissipated in the lamp and R is the resistance of the lamp.

$$(P = VI \text{ and } R = \frac{V}{I})$$

For
Examiner's
Use

☐
☐
☐
☐
☐
☐
☐

- (d) (i) Plot a graph of P on the y -axis against R^4 on the x -axis.
 (ii) Draw the straight line of best fit.
 (iii) Determine the gradient and y -intercept of this line.

gradient = ...

y -intercept = ...

☐
☐

For
Examiner's
Use

- (e) It is suggested that the relationship between P and R is

$$P = aR^4 + b$$

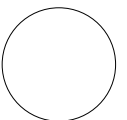
where a and b are constants.

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

For
Examiner's
Use

$a =$

$b =$



BLANK PAGE

Please turn over for Question 2.

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

For
Examiner's
Use

- 2** In this experiment, you will investigate how the movement of a tube is affected by fluid friction.

The apparatus has been set up for you as shown in Fig. 2.1. The mass hanger will move up and down if it is pulled down and released.

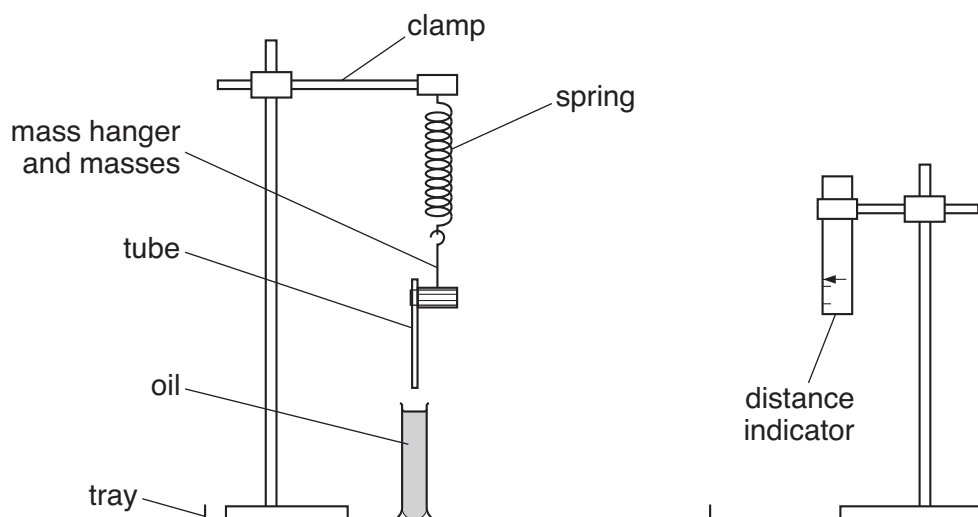


Fig. 2.1

- (a)** (i) By adjusting the position of the clamp, lower the spring and mass hanger so that the bottom of the tube is immersed centrally in the oil to a depth d of about 5 cm, as shown in Fig. 2.2.
- (ii) Measure and record d .

$d = \dots\dots\dots$

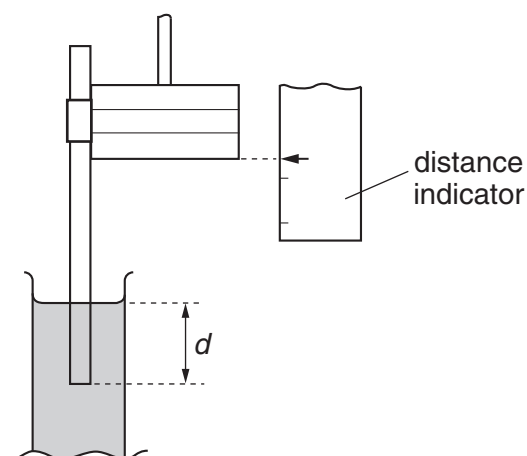


Fig. 2.2

- (b) Adjust the distance indicator so that its arrow is level with the bottom of the mass hanger, as shown in Fig. 2.2.

For
Examiner's
Use

- (c) (i) Pull down the mass hanger about 3 cm and release it so that it moves up and down.
Each time the mass hanger moves down, you will see that the **lowest** position that it reaches changes gradually from 3 cm to 0 cm below the arrow.
- (ii) Repeat (i) and start the stopwatch when the mass hanger's lowest position is 2.0 cm below the arrow. Stop the stopwatch when the lowest position has become 0.5 cm below the arrow.
Record this time t .

$t =$

- (d) Estimate the percentage uncertainty in t .

percentage uncertainty = ...

- (e) (i) By again adjusting the position of the clamp, lower the spring and mass hanger so that d is about 10 cm.
- (ii) Repeat (a)(ii), (b) and (c).

$d =$

$t =$

- (f) (i) It is suggested that the relationship between t and d is

$$t^4 = \frac{k}{d^3}$$

where k is a constant.

Using your data, calculate two values of k .

first value of k = ...

second value of k = ...

- (ii) Explain whether your results support the relationship in (i).

.....

- (iii) Justify the number of significant figures that you have used for your values of k .

.....

For
Examiner's
Use

- (g) (i) Describe four sources of uncertainty or limitations of the procedure in this experiment.

For
Examiner's
Use

1.

.....

2.

.....

3.

.....

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.

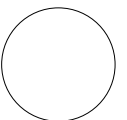
.....

3.

.....

4.

.....



BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.