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

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3823421500

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.

© UCLES 2010

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.

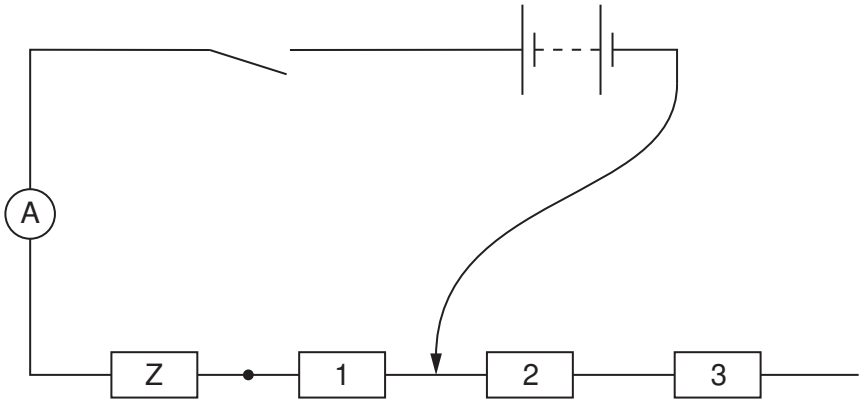


Fig. 1.1

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

I = ... A

© UCLES 2010

[Turn over

(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 Ω.

For Examiner's Use

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 Ω resistors connected into the circuit.

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

(c) **(i)** Plot a graph of R on the y-axis against $\frac{1}{I}$ on the x-axis.

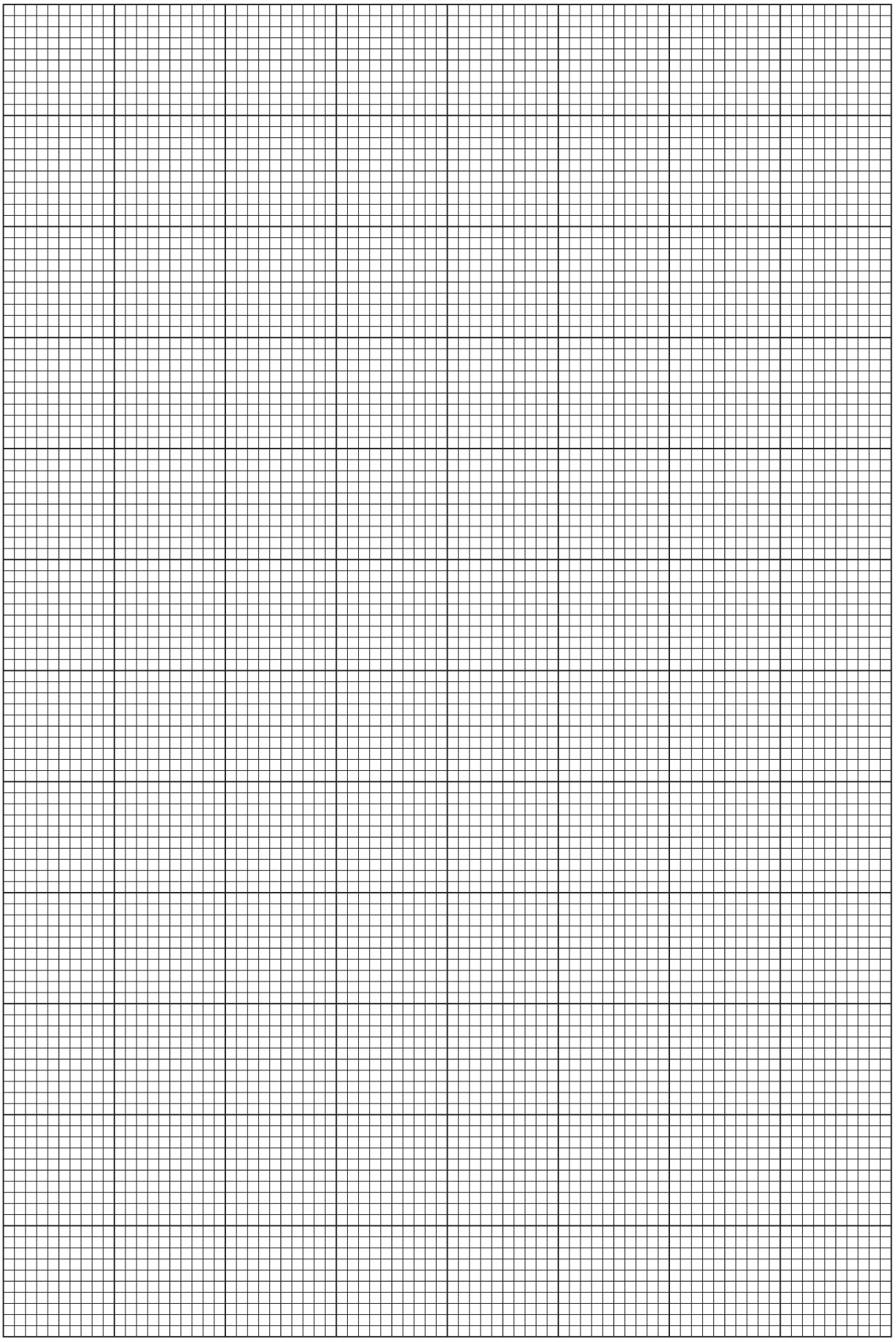
(ii) Draw the line of best fit.

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

gradient = ...

y-intercept = ...

© UCLES 2010



For Examiner's Use

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

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

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.

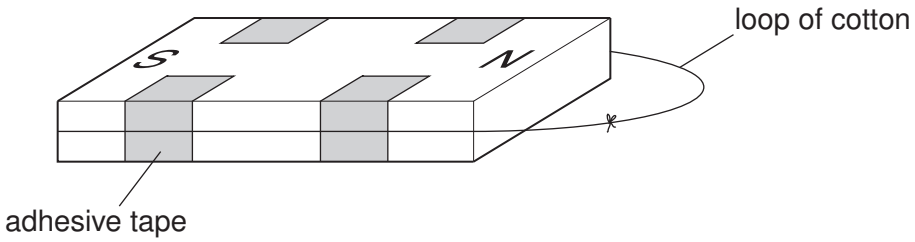


Fig. 2.1

(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.

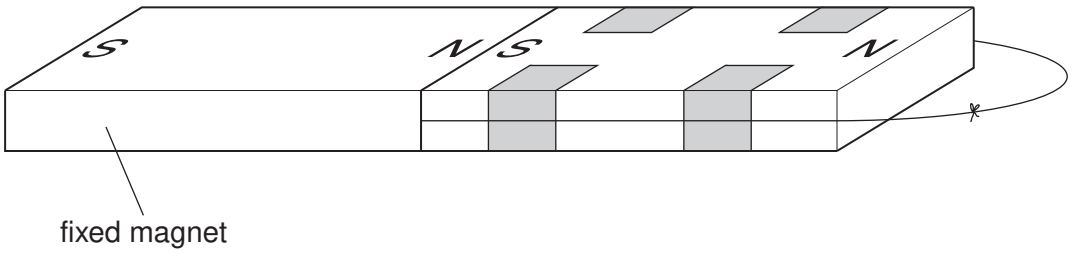


Fig. 2.2

© UCLES 2010

[Turn over

For Examiner's Use

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

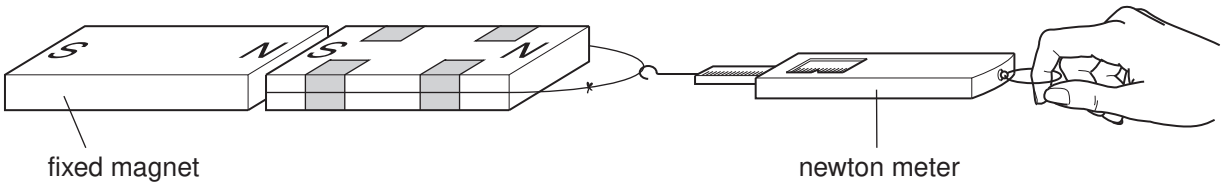


Fig. 2.3

F = ... 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.

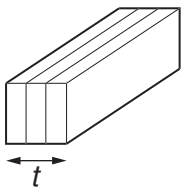


Fig. 2.4

t = ... mm

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

.....

.....

.....

© UCLES 2010

(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.

For Examiner's Use

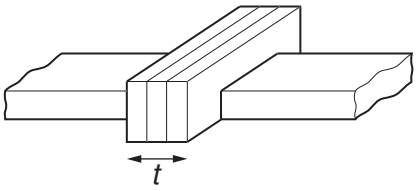


Fig. 2.5

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.

.....

.....

.....

.....

(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. .....

.....

© UCLES 2010

BLANK PAGE

© UCLES 2010

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.

© UCLES 2010