UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

4570897825

PHYSICS **9702/52**

Paper 5 Planning, Analysis and Evaluation **May/June 2013**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

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 **all** questions.

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

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 A student is investigating how the peak alternating current I_0 varies with frequency f in a circuit containing a coil of wire.

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It is suggested that

$$\left(\frac{V_0}{I_0}\right)^2 = R^2 + 4\pi^2 f^2 L^2$$

where R is the resistance of the coil, V_0 is the peak voltage and L is a constant.

Design a laboratory experiment to test the relationship between I_0 and f and determine a value for L. You should draw a diagram, on page 3, showing the arrangement of your equipment. In your account you should pay particular attention to

(a) the procedure to be followed,

(b) the measurements to be taken,

(c) the control of variables,

(d) the analysis of the data,

(e) the safety precautions to be taken.

[15]

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Diagram

For Examiner's Use

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For Examiner's Use

For Examiner's Use	Defining the problem	Methods of data collection	Method of analysis	Safety considerations	Additional detail

2 An electron beam is accelerated by a voltage V before entering a uniform electric field of electric field strength E between two parallel plates.

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The electron beam travels a horizontal distance a parallel to the plates before hitting the top plate after being deflected through a vertical distance b. The path of the electrons is shown in Fig. 2.1.

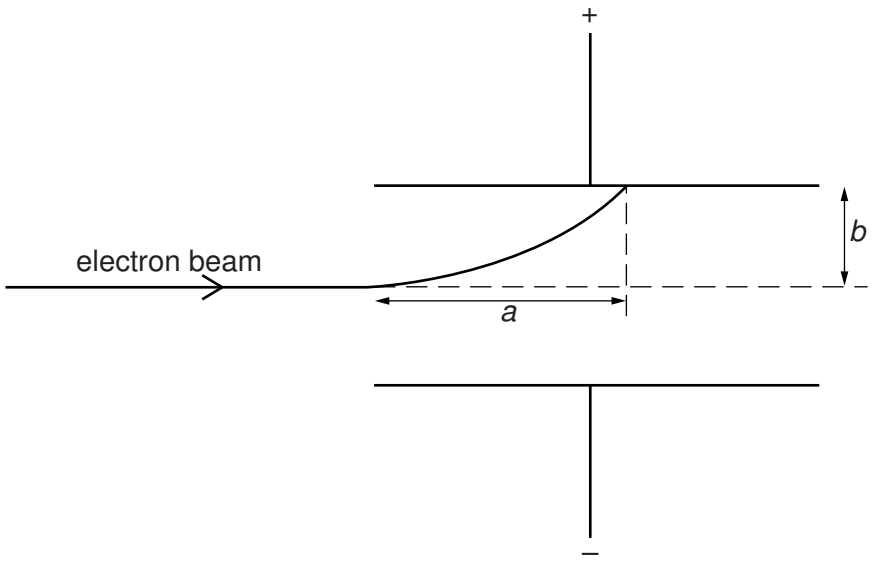

Fig. 2.1

For different values of V, the horizontal distance a is recorded.

Question 2 continues on the next page.

It is suggested that V and a are related by the equation

$$a = \sqrt{\frac{4Vb}{E}}.$$

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(a) A graph is plotted of a^2 on the y-axis against V on the x-axis. Determine an expression for the gradient in terms of E.

gradient = ...[1]

(b) Values of V and a are given in Fig. 2.2.

V/V	$a/10^{-2}$ m	
1000	6.6 ± 0.1	
1200	7.2 ± 0.1	
1400	7.8 ± 0.1	
1600	8.4 ± 0.1	
1800	8.9 ± 0.1	
2000	9.4 ± 0.1	

Fig. 2.2

Calculate and record values of $a^2/10^{-4}\,m^2$ in Fig. 2.2. Include the absolute uncertainties in a^2. [3]

(c) **(i)** Plot a graph of $a^2/10^{-4}\,m^2$ against V/V. Include error bars for a^2. [2]

(ii) Draw the straight line of best fit and a worst acceptable straight line on your graph. Both lines should be clearly labelled. [2]

(iii) Determine the gradient of the line of best fit. Include the uncertainty in your answer.

gradient = ... [2]

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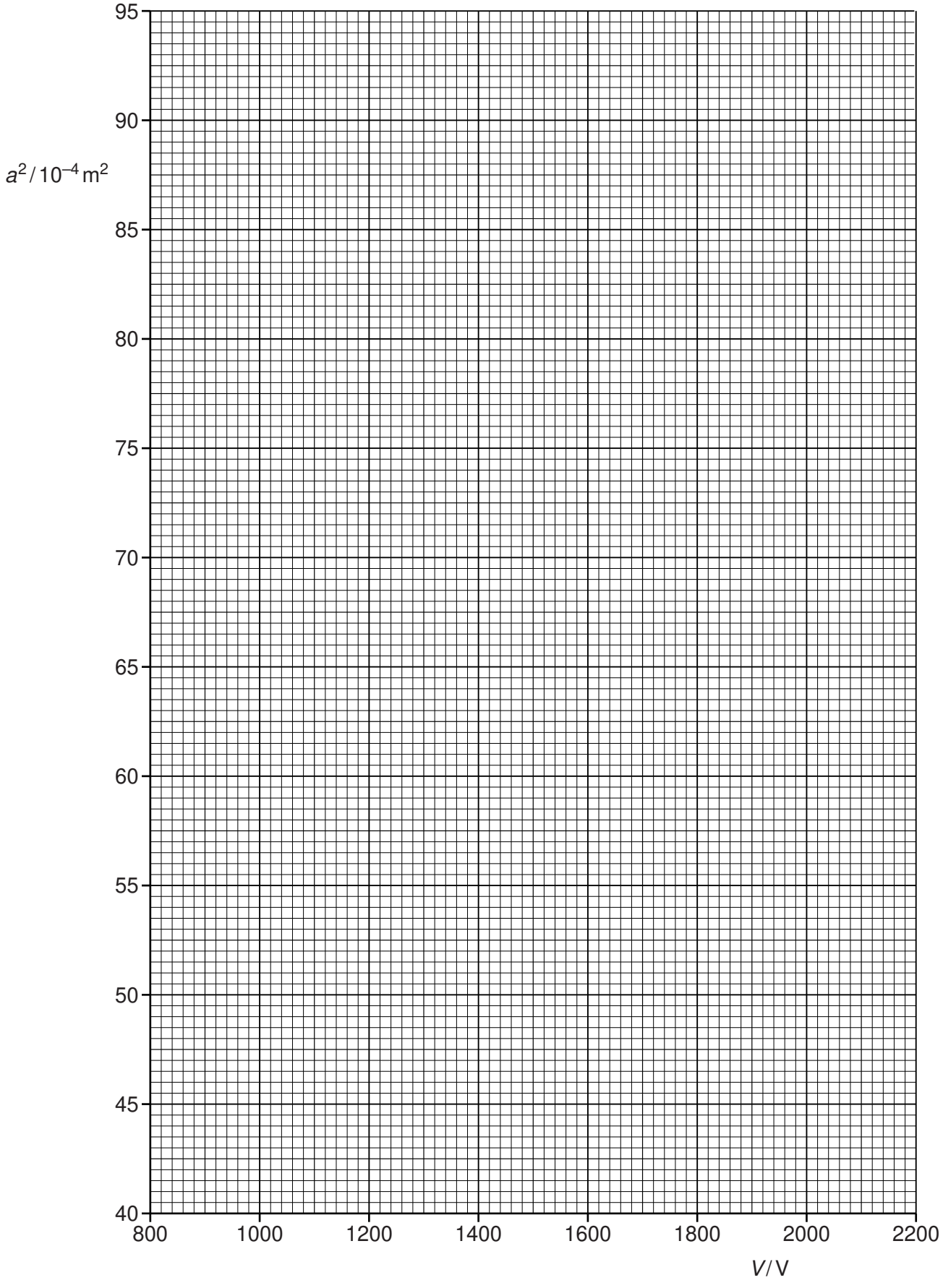

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(d) (i) Using your answer to **(c)(iii)**, determine a value for E. Include an appropriate unit in your answer.

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Data: $b = (4.0 \pm 0.1) \times 10^{-2}$ m

E = ...[2]

(ii) Determine the percentage uncertainty in your value of E.

percentage uncertainty = ...% [1]

(e) Using your answers to **(d)**, determine a value for V to give a distance $a = 5.0 \pm 0.1$ cm. Include the absolute uncertainty in your answer.

V = ...V [2]

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