Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0123456789

PHYSICS **9702/05**

Paper 5 Planning, Analysis and Evaluation **For Examination from 2016**

SPECIMEN PAPER

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 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 **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.

CAMBRIDGE International Examinations

1 Two students are having a discussion about an experiment in which the air inside a bell jar is gradually removed. The sound of a ringing bell inside the jar is heard to decrease in intensity during this process.

One student suggests that the frequency f of a sound wave and the pressure p are related by the equation

$$f = kp^2$$

where k is a constant.

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

- the procedure to be followed,
- the measurements to be taken,
- the control of variables,
- the analysis of the data,
- the safety precautions to be taken.

[15]

Diagram

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[Total: 15]

2 In the early part of the twentieth century, experiments were carried out to measure the range R and energy E of α-particles in air using a number of different radioactive nuclides in the thorium series.

It is suggested that R and E are related by the equation

$$R = cE^{\frac{3}{2}}$$

where c is a constant.

(a) A graph is plotted of R^2 on the y-axis against E^3 on the x-axis. Determine an expression for the gradient in terms of c.

gradient = ... [1]

(b) Values of R and E for a set of nuclides are given in Fig. 2.1.

$R / 10^{-2}$ m	E / MeV		
4.00 ± 0.05	5.38		
4.35 ± 0.05	5.68		
4.80 ± 0.05	6.05		
5.05 ± 0.05	6.28		
5.70 ± 0.05	6.77		

Fig. 2.1

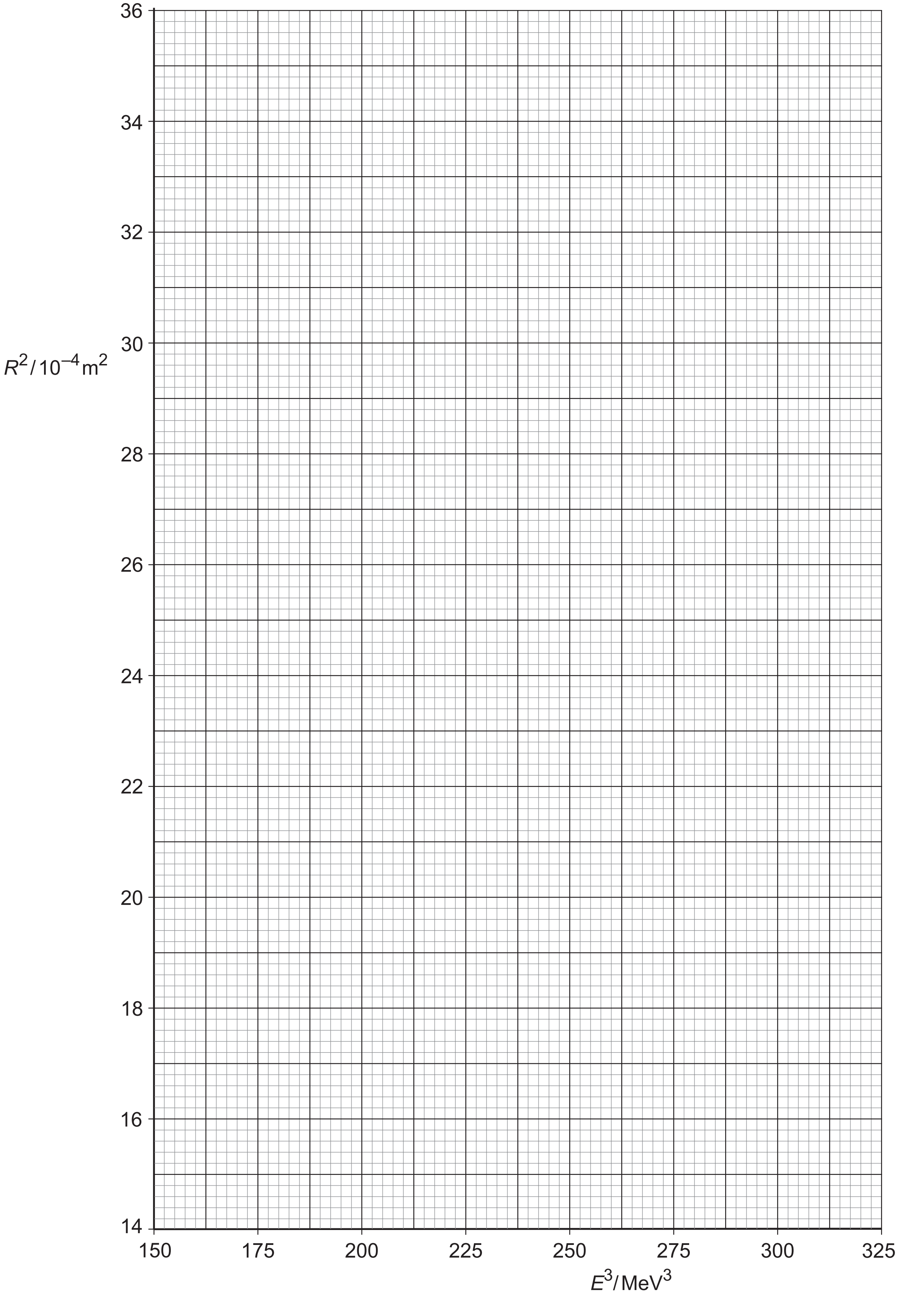
Calculate and record values of $R^2 / 10^{-4}\,m^2$ and E^3 / MeV^3 in Fig. 2.1. Include the absolute uncertainties in R^2. [3]

(c) **(i)** Plot a graph of $R^2 / 10^{-4}\,m^2$ against E^3 / MeV^3. Include error bars for R^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]



36
34
32
30
R^2 / 10^{-4} m^2
28
26
24
22
20
18
16
14
150
175
200
225
250
275
300
325
E^3 / MeV^3

(d) Using your answer to **(c)(iii)**, determine the value of *c*. Include the absolute uncertainty in your value and an appropriate unit.

c = ... [3]

(e) The experiment is repeated for a different nuclide.
The range measured is 5.95 ± 0.05 cm.

(i) Using the relationship given and your answer to **(d)**, determine the corresponding value of *E*.

E = ... MeV [1]

(ii) Determine the percentage uncertainty in *E*.

percentage uncertainty = ... % [1]

[Total: 15]