

Centre Number	Candidate Number	Name
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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Advanced Level

**PHYSICS** **9702/05**

Paper 5 Planning, Analysis and Evaluation 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 in the spaces provided on the Question Paper.  
You may use a pencil for any diagrams, graphs or rough working.  
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **both** questions.  
The number of marks is given in brackets [ ] at the end of each question or part question.  
You may lose marks if you do not show your working or if you do not use appropriate units.

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1	
2	
<b>Total</b>	

- 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 diminish 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 find out whether the student is correct. You should draw a diagram showing the arrangement of your equipment. In your account, you should pay particular attention to

- (a) the procedure to be followed,
- (b) the measurements that would be taken,
- (c) how the frequency of the sound would be measured using a cathode-ray oscilloscope,
- (d) the control of variables,
- (e) how the data would be analysed,
- (f) any safety precautions that you would take.

[15]





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- 2 In the early part of the twentieth century, experiments were carried out to measure the range and energies of  $\alpha$ -particles in air using a number of different radioactive nuclides in the thorium series.

Data relating to the range  $R$  and the energy  $E$  is given in the table below.

nuclide	$R / \text{cm}$	$E / \text{MeV}$		
${}^{228}_{90}\text{Th}$	$4.00 \pm 0.05$	5.38		
${}^{228}_{90}\text{Th}$	$4.35 \pm 0.05$	5.68		
${}^{228}_{90}\text{Th}$	$4.80 \pm 0.05$	6.05		
${}^{220}_{86}\text{Em}$	$5.05 \pm 0.05$	6.28		
${}^{216}_{84}\text{Po}$	$5.70 \pm 0.05$	6.77		

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

$$R = cE^{3/2}$$

where  $c$  is a constant.

- (a) Explain why plotting a graph of  $R^2$  against  $E^3$  would enable you to confirm whether the relationship between  $R$  and  $E$  is valid for the data in the table.

.....  
..... [1]

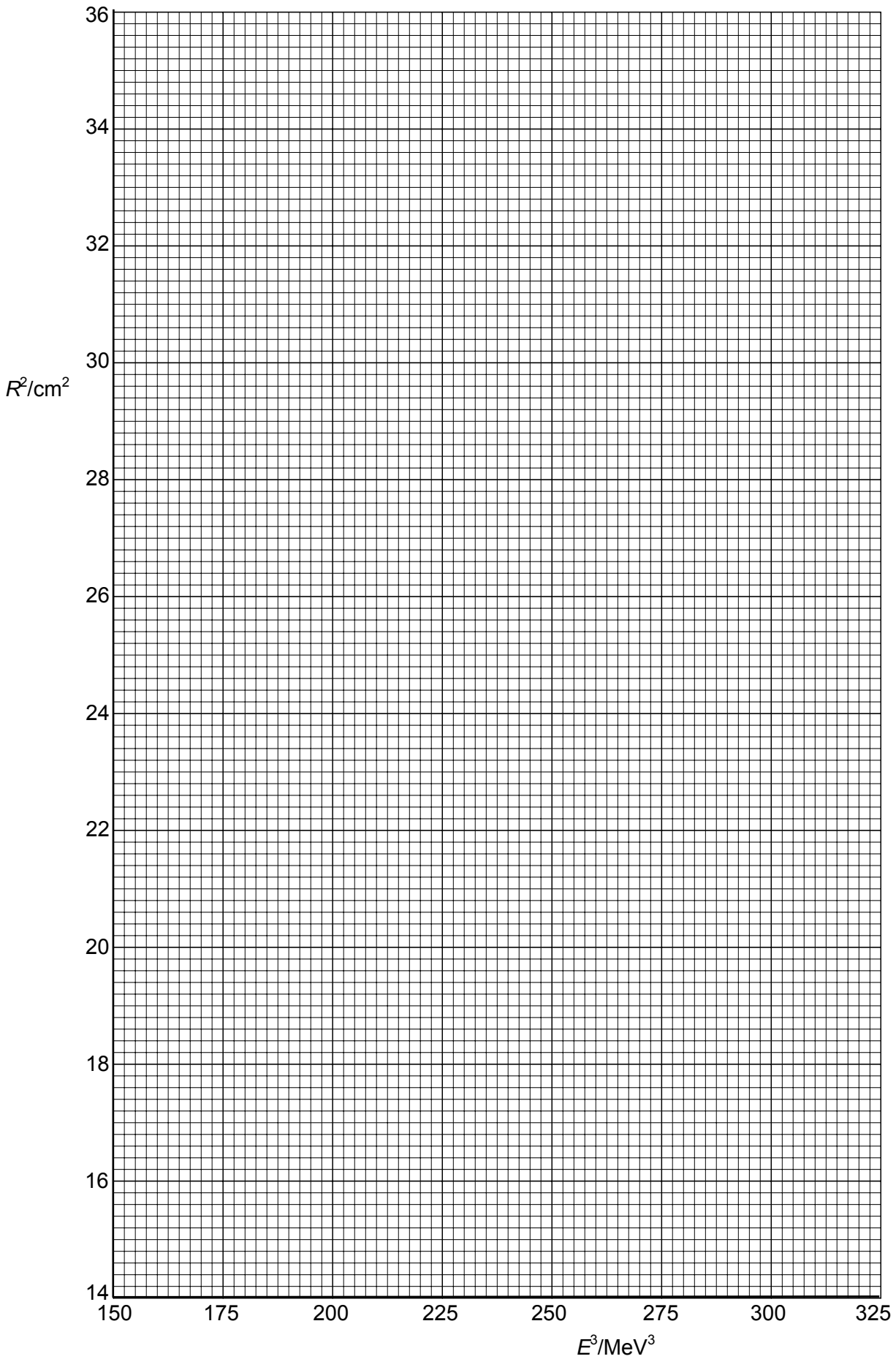
- (b) Calculate and record values of  $R^2$  and  $E^3$  in the table. Include the absolute errors in  $R^2$ . [3]

- (c) (i) Plot a graph of  $R^2$  ( $y$ -axis) against  $E^3$  ( $x$ -axis). Include error bars for  $R^2$ . [2]

- (ii) Draw the line of best fit. [1]

- (iii) Determine the gradient of the line. Include the error in your answer.

gradient = ..... [3]




(d) Determine the value of  $c$ . Include the error and the unit in your answer.

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Use

$c =$  ..... [5]


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