UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

5028818814

PHYSICS **9702/05**

Paper 5 Planning, Analysis and Evaluation **May/June 2008**

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 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 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 two questions in this paper carry equal marks.

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1	
2	
Total	

This document consists of **8** printed pages.

UNIVERSITY of CAMBRIDGE International Examinations

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1 A student wishes to measure the resistivity of glass. A teacher suggests that its resistivity is of the order of $10^6\,\Omega\,\text{m}$ which is very large.

Resistivity ρ is defined by the equation

$$\rho = \frac{RA}{l}$$

where R is resistance, A is cross-sectional area and l is the length of the material.

The student is given a number of sheets of glass of the same thickness and of different areas.

Design a laboratory experiment to determine the resistivity of glass. 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) how the glass would be connected to the circuit,

(c) the measurements that would be taken,

(d) the control of variables,

(e) how the data would be analysed,

(f) any safety precautions that you would take. [15]

Diagram

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2 A radioactive source was placed facing a Geiger-Müller tube. An experiment was carried out to investigate how the count rate registered by the tube varied with the thickness of a lead absorber placed between the source and the tube.

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The equipment was set up as shown in Fig. 2.1.

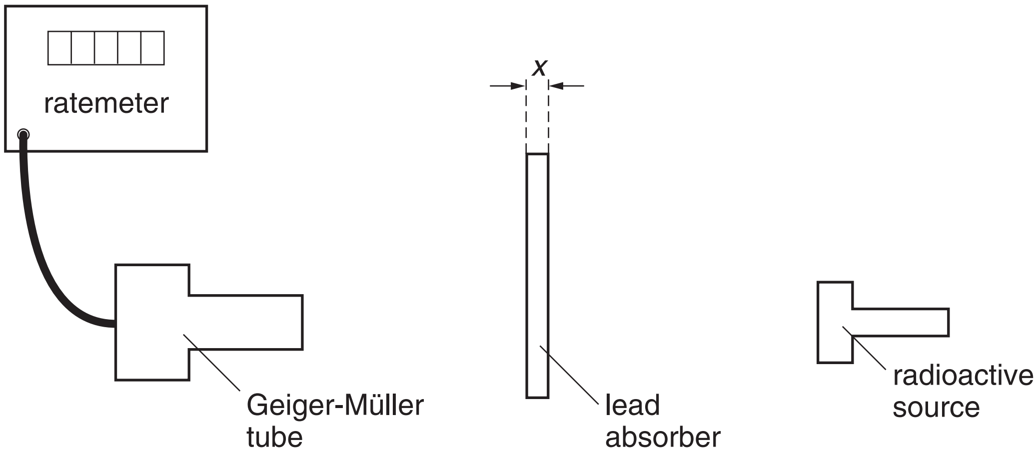

Fig. 2.1

The count rate R reaching the Geiger-Müller tube from the source was recorded for different thicknesses x of the lead absorbers.

Values of x and R are given in Fig. 2.2.

x / m	R / s^{-1}	
0.0050	750 ± 20	
0.0100	580 ± 20	
0.0150	430 ± 20	
0.0200	330 ± 20	
0.0250	250 ± 20	
0.0300	190 ± 20	

Fig. 2.2

It is suggested that R and x are related by the formula

$$R = R_0 e^{-\rho\eta x}$$

where R_0 is the count rate with no absorbers, ρ is the density of lead and η is a quantity called the mass absorption coefficient.

(a) If a graph of ln R against x were plotted, what quantities in the above equation would the gradient and y-intercept represent?

gradient = ...

y-intercept = ... [1]

(b) Calculate and record values of ln R in the table. Include in the table the absolute errors in ln R. [3]

(c) **(i)** Plot a graph of ln R on the y-axis against x on the x-axis. Include error bars for ln R. [2]

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

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

gradient = ... [2]

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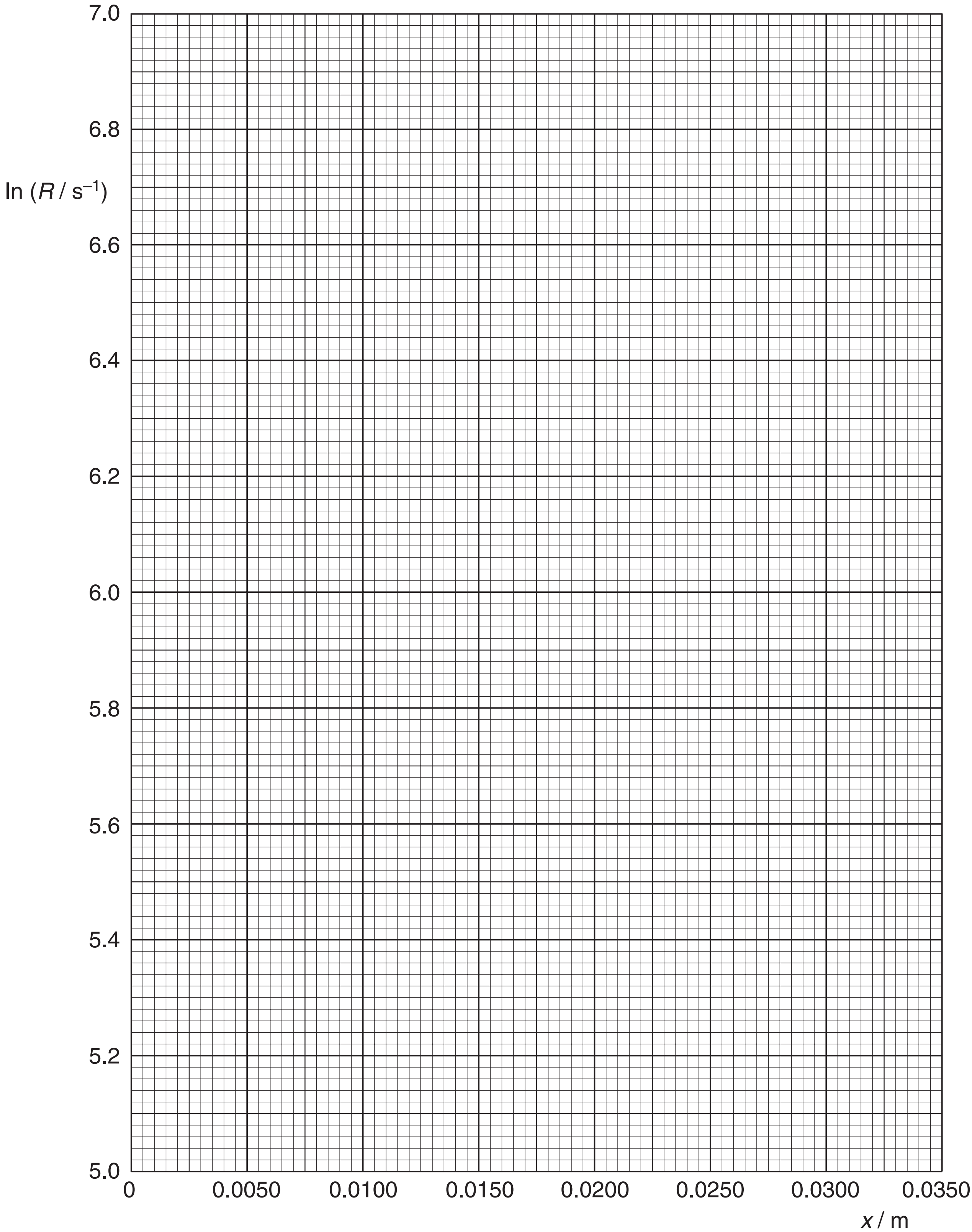

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(d) The density of lead is given as 11 300 kg m^{-3}. Using the answer to **(c)(iii)** determine the value of η. Include the error in your value. Include an appropriate unit.

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η = ... [3]

(e) Use your answer from **(d)** to determine the thickness of lead required to reduce R to 10% of R_0. Include the error in your value.

x = ... m [2]