UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

PHYSICS **9702/51**

Paper 5 Planning, Analysis and Evaluation **October/November 2009**

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 **all** 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 number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

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

1 The volume of air in a bottle affects its resonant frequency.

For Examiner's Use

It is suggested that the resonant frequency f is related to the volume V by the equation

$$f^2 = \frac{k}{V}$$

where k is a constant.

Design a laboratory experiment to determine whether this equation 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 to be taken,

(c) the control of variables,

(d) how to analyse the data,

(e) the safety precautions to be taken. [15]

Diagram

For Examiner's Use

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For Examiner's Use

2 An experiment is carried out to investigate how the resistance R of a thermistor varies with temperature T.

For Examiner's Use

An ohmmeter is used to measure R. The equipment is set up as shown in Fig. 2.1.

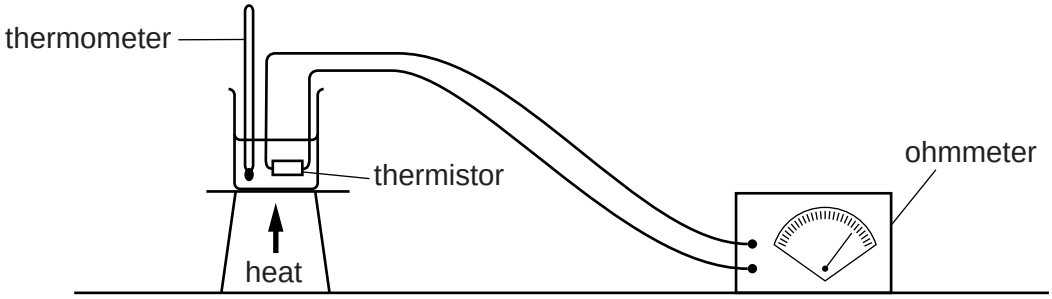

Fig. 2.1

Question 2 continues on page 6.

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

$$R = \frac{T^h}{g}$$

where g and h are constants.

(a) A graph is plotted with lg R on the y-axis and lg T on the x-axis. Express the gradient and y-intercept in terms of g and h.

gradient = ...

y-intercept = ...
[1]

(b) Values of T and R are given in Fig. 2.2.

T/K	R/Ω	lg (T/K)	lg (R/Ω)
293	990 ± 10		
303	860 ± 10		
313	760 ± 10		
323	680 ± 10		
333	610 ± 10		

Fig. 2.2

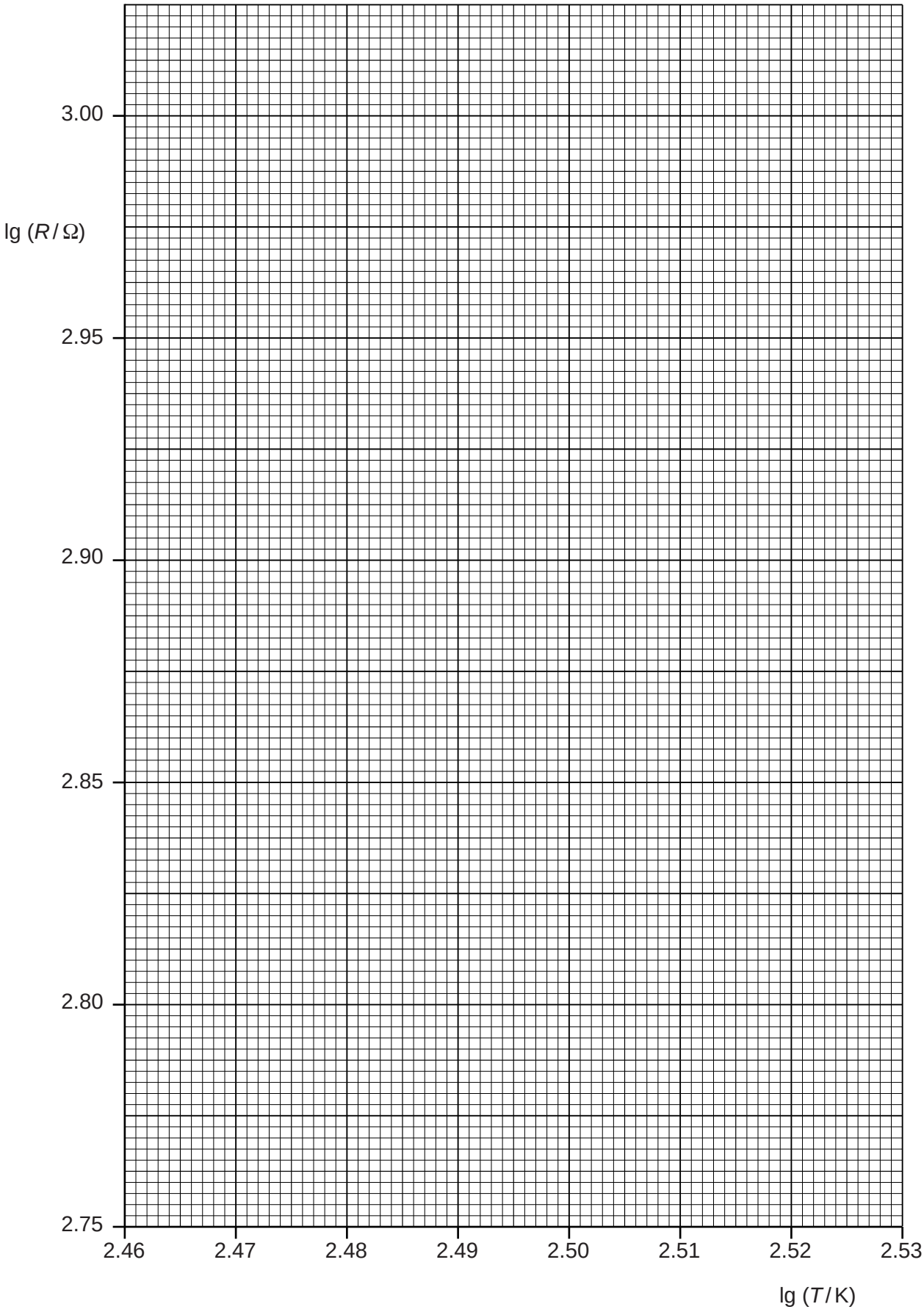
Calculate and record values of lg (T/K) and lg (R/Ω) in Fig. 2.2. Include the absolute errors in lg (R/Ω). [3]

(c) **(i)** Plot a graph of lg (R/Ω) against lg (T/K). Include error bars for lg (R/Ω). [2]

(ii) Draw the 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 error in your answer.

gradient = ... [2]



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(iv) Determine the *y*-intercept of the line of best fit. Include the error in your answer.

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y-intercept = ... [2]

(d) Using your answers to **(c)(iii)** and **(c)(iv)**, determine the values of *g* and *h*. Include the error in your values. You need not be concerned with the units of *g* and *h*.

g = ...

h = ...
[3]