THIS IS A LEGACY SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

ADVANCED GCE

PHYSICS A

2826/03/TEST

Practical Examination 2 (Part B – Practical Test)

Candidates answer on the question paper

OCR Supplied Materials:
None

Other Materials Required:
- Candidate's Plan (Part A of the Practical Examination)
- Electronic Calculator
- Ruler (cm/mm)

Friday 30 January 2009
Morning

Duration: 1 hour 30 minutes

CUP/T58363

2826603

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- In the Practical Test you will be assessed on the Experimental and Investigative Skills:
  Skill I: Implementing
  Skill A: Analysing evidence and drawing conclusions
  Skill E: Evaluating evidence and procedures.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- You will awarded marks for the quality of written communication where this is indicated in the question.
- This document consists of **12** pages. Any blank pages are indicated.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
Planning	**16**	
1	**28**	
2	**16**	
TOTAL	**60**	

Answer **all** the questions.

It is recommended that you spend about one hour on question 1.

1 In this question you will be investigating the characteristics of a thermistor.

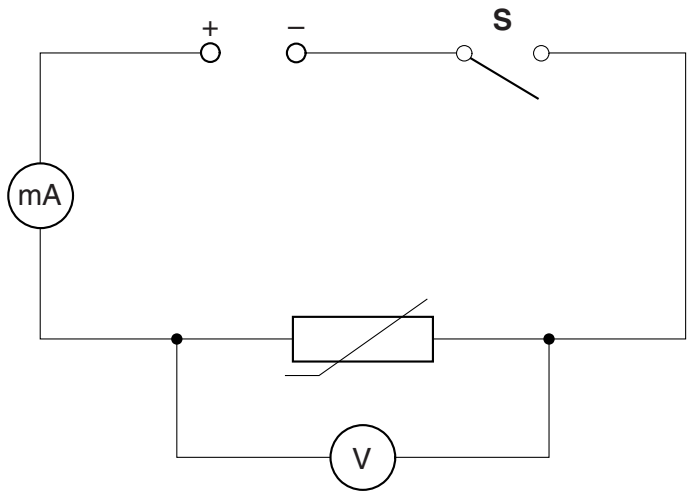


Fig. 1.1

(a) Connect the circuit as shown in Fig. 1.1. The thermistor and its leads should be attached to the bulb of a thermometer using a small rubber band. Immerse the thermistor and the bulb of the thermometer in a beaker of water. Arrange the beaker so that the water can be heated. The thermometer and the leads of the thermistor should be secured above the beaker by a clamp and stand. You are also provided with a rod for stirring.

(b) **(i)** Record the value I of the current through the thermistor, and the potential difference V across the thermistor.

I = ... mA V = ... V

(ii) Record the temperature θ of the water.

θ = ... °C

(iii) Use $R = \frac{V}{I}$ to calculate the resistance R of the thermistor at this temperature.

R = ... Ω **[2]**

(c) Estimate the percentage uncertainty in your value of *R*.

percentage uncertainty = ... **[3]**

(d) Heat the water, and repeat the procedure in **(b)** so that you have resistance readings for six values of θ ranging from room temperature to about 80 °C. Include in your table values for the thermodynamic temperature T (= θ + 273), $\frac{1}{T}$, and ln(R/Ω).

[8]

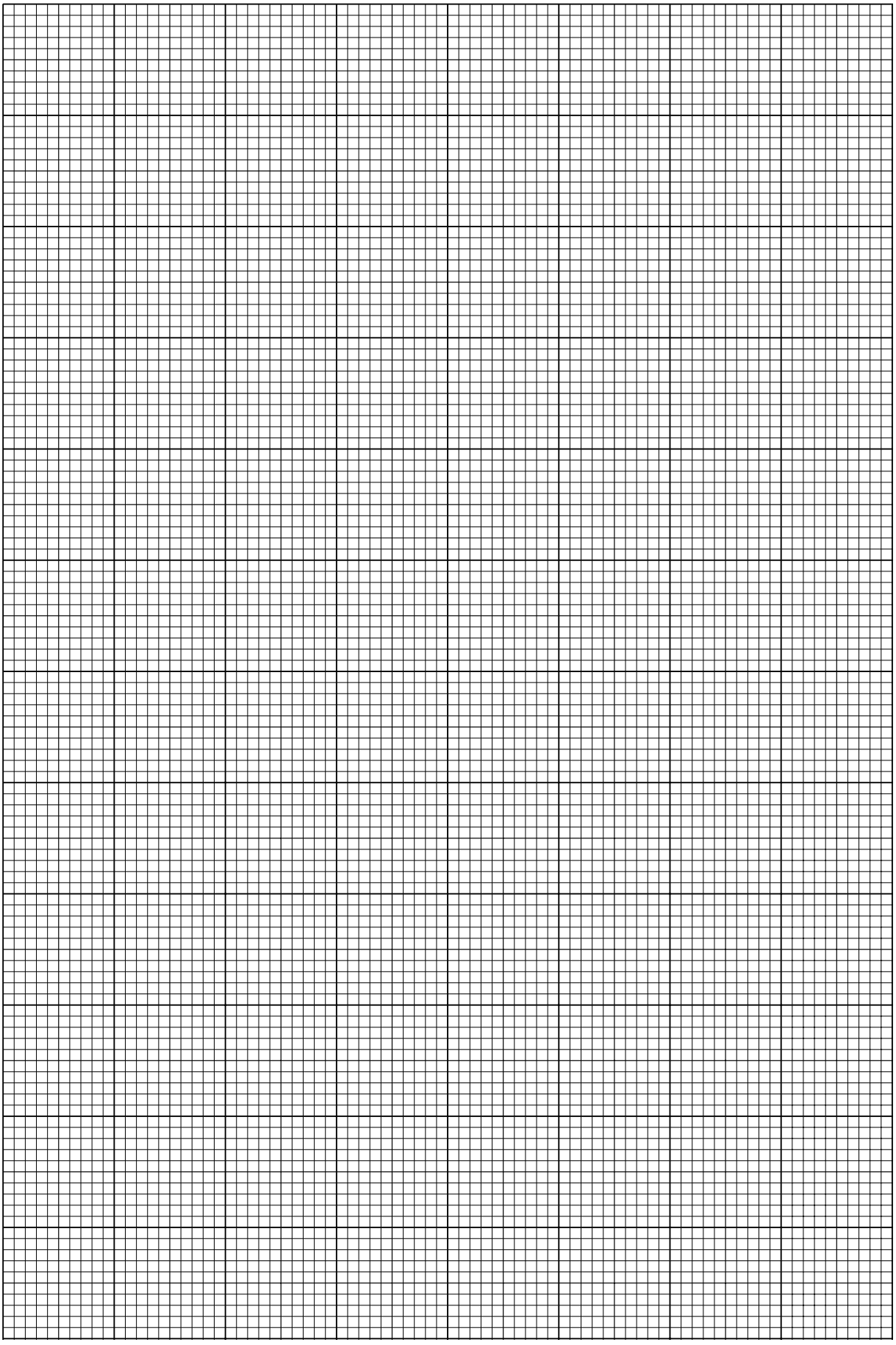
(e) (i) Plot a graph of ln(R/Ω) (y-axis) against $\frac{1}{T}$ (x-axis). Draw the line of best fit. **[4]**

(ii) Determine the gradient and y-intercept of this line. You need not be concerned with the units of these quantities.

gradient = ...

y-intercept = ...

[3]



(f) Theory suggests that

$$R = A\,e^{\frac{B}{T}}$$

where A and B are constants. From your answers to **(e)**, obtain values for A and B, showing your working. Give the units for these quantities.

A = ... unit .....

B = ... unit .....

[5]

(g) The sensitivity of the thermistor may be defined as the resistance change per degree of temperature change. Estimate the average sensitivity of the thermistor for your experiment. Is the sensitivity greatest for low temperatures, high temperatures, or roughly the same across the temperature range?

sensitivity = ... $\Omega\,K^{-1}$

.....

.....

..... **[3]**

[Total: 28]

It is recommended that you spend about 30 minutes on this question.

Approximately half of this time should be spent on the evaluation section in part (d).

2 In this experiment you will investigate the torsional oscillations of a mass attached to a spring suspended from a clamp. Fig. 2.1 shows a plan view of the mass undergoing torsional oscillations, with the mass twisting backwards and forwards.

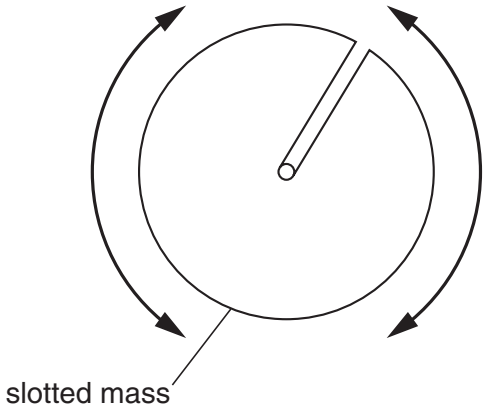


Fig. 2.1

(a) Suspend the spring so that it hangs vertically from the clamp. Attach the 300 g mass on to the spring. Use the G-clamp to hold the stand firmly to the bench. Twist the mass through about 360° and carefully release it to perform torsional oscillations, as seen in Fig. 2.1.

(i) Make and record measurements in order to determine the period T_1 of the torsional oscillations.

T_1 = ... s **[2]**

(ii) Justify the number of significant figures you have given for T_1.

.....

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

(b) Now increase the mass to 600 g. Repeat **(a)(i)** to give a new value T_2 for the period of torsional oscillations.

T_2 = ... s **[1]**

(c) For vertical oscillations of a mass m on a spring, the period T is proportional to $\sqrt{m}$. Do the results of your experiment show that the period of torsional oscillations follows the same rule? Justify your answer.

.....

.....

.....

..... **[3]**

(d) In this section, **two** marks are available for the quality of written communication.

Write an evaluation of the procedure which you have followed to investigate the torsional oscillations of a mass suspended from a spring.

Marks are given here for:

- explaining the limitations of the procedure, and the problems encountered
- suggesting, with reasons, ways in which the experiment could be improved.

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Quality of Written Communication **[2]**

[Total: 16]

END OF QUESTION PAPER

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