OCR
RECOGNISING ACHIEVEMENT

ADVANCED GCE UNIT

2826/03/TEST

PHYSICS A

Practical Examination 2 (Part B – Practical Test)

THURSDAY 1 FEBRUARY 2007

Afternoon

Time: 1 hour 30 minutes

Additional materials:
Candidate's Plan (Part A of the Practical Examination)
Electronic Calculator

Candidate Name

Centre Number

Candidate Number

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre Number and Candidate number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.

INFORMATION FOR CANDIDATES

- 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 be awarded marks for the quality of written communication where this is indicated in the question.

For Examiner's Use		
Qu.	Max.	Mark
Planning	16	
1	28	
2	16	
Total	60	

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Answer **all** the questions.

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

1 In this question, you will investigate the effect of load on the extension of two rubber bands suspended in parallel. You will use the results of your experiment to find a value for the stress in the rubber at a certain load. Take the value of g as $9.8\,\text{N kg}^{-1}$.

(a) Hang the two rubber bands over the rod of a clamp fixed to a stand. Suspend a mass holder of mass 100 g from the other end of the rubber bands, as in Fig. 1.1.

The clamp stand should be secured to the bench top using a G-clamp. The extension of the rubber bands is to be measured with a vertically clamped metre rule (with zero at the top). Readings should be taken from the base of the mass holder.

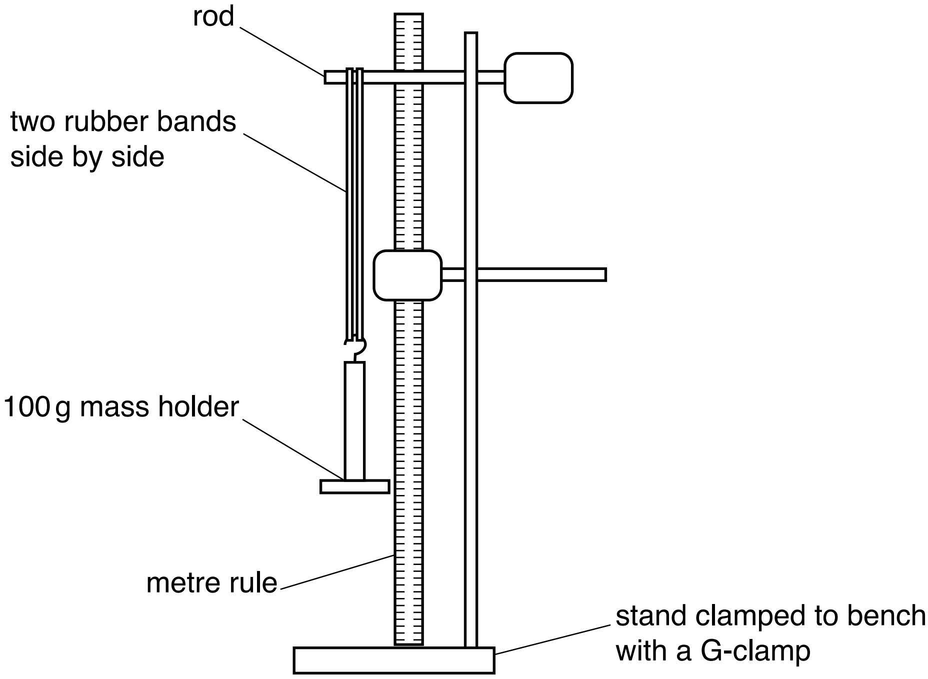

Fig 1.1

(b) **(i)** Read the scale of the metre rule at the base of the 100 g mass holder. Record this reading as y_0.

y_0 = ... mm

(ii) Now stretch the rubber by adding a mass m of 100 g to give a total mass of 200 g. Record this reading as y.

y = ... mm

Hence calculate the extension x caused by the added mass of 100 g.

x = ... mm

[2]

(c) Increase the value of the **added mass** *m*. Repeat the procedure in **(b)(ii)**, until you have six results in the range 100 g $\leqslant m \leqslant$ 900 g. Include in your table of results all six values of lg(*m*/g) and lg(*x*/mm). You are not required to repeat the readings.

[9]

(d) **(i)** Plot a graph of lg(*m*/g) (y-axis) against lg(*x*/mm) (x-axis). Draw the line of best fit. [4]

(ii) Determine the gradient of this line.

gradient = ... [2]

[Turn over

(e) It is suggested that m and x are related by a simple power law of the form

$$m = kx^n$$

where n and k are constants.

Use this equation and your answer from **(d)(ii)** to determine the value for n.

n = ... [2]

(f) **(i)** Use a micrometer screw gauge to measure the width b and thickness d of the rubber from which the band is made.

b = ... mm

d = ... mm [1]

(ii) Hence determine the **total** original cross-sectional area A of the four unstretched lengths of rubber.

A = ...m^2 [2]

(iii) What is the percentage uncertainty in the width b?

percentage uncertainty = ... % [2]

(iv) Calculate the tensile stress in the rubber when a total mass of 100 g is suspended from it, stating an assumption you have made. Give the unit for your answer.

stress = ... unit...............[4]

[Total: 28]

It is recommended that you spend about 30 minutes on question 2.

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

2 You will investigate how the rate of cooling in air of the thermometer provided varies with the difference between the temperature given by the thermometer and the room temperature.

(a) The supervisor will give you a value for the room temperature, θ_R. Record this value.

θ_R = ... °C

(b) The bulb of the thermometer is in the boiling water. At least 10 cm is immersed. It has been left for at least two minutes so that the reading is steady at, or close to, 100 °C.

Quickly remove the thermometer from the water and hold it close to a stop clock. Start the stop clock when the temperature is at 60 °C and, without stopping the clock, make a note of the times at which the temperature θ reaches 55 °C, 50 °C, 45 °C and 40 °C. Record the times in a table.

θ/°C
60
55
50
45
40

[1]

(c) **(i)** Determine the time t_1 taken for the temperature to fall from 55 °C to 50 °C.

t_1 = ... s

(ii) Calculate the average rate of fall of temperature R_1 between 55 °C and 50 °C.

R_1 = ... °C s^{-1} [1]

(d) Justify the number of significant figures you have given for R_1.

....

....

....[1]

(e) Calculate the average rate R_2 at which the temperature is falling between 45 °C and 40 °C.

R_2 = ... °C s^{-1} [1]

(f) It is suggested that the rate of cooling is directly proportional to the temperature difference between the thermometer and the surroundings, i.e. the excess temperature. Do the results of your experiment support this suggestion? Justify your answer.

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....[3]

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

Write an evaluation of the procedure you have followed to investigate the relationship governing the rate of cooling of a thermometer and the excess temperature.

Marks are given for

- explaining the limitations of the procedure and the problems encountered
- suggesting how the experiment could be improved, giving your reasons.

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....[7]

Quality of Written Communication [2]

[Total: 16]

END OF QUESTION PAPER

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