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:
- Candidate's Plan (Part A of the Practical Examination)

Other Materials Required:
- Electronic calculator

Wednesday 3 February 2010
Afternoon

Duration: 1 hour 30 minutes

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

- 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.
- 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**.
- 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.
- 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**	

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Answer **all** the questions.

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

1 In this question you will set up a circuit involving a capacitor **C** and a resistor **R**. You will use this circuit to measure the time taken for the discharge current to halve for different values of the resistance *R* of the resistor.

(a) Set up the circuit shown in Fig. 1.1. The resistor **R** should be a single 47 kΩ resistor. You must ensure that the terminal marked + on the capacitor is connected to the positive terminal of the power supply unit. Your supervisor **must** check the circuit before you continue. **[2]**

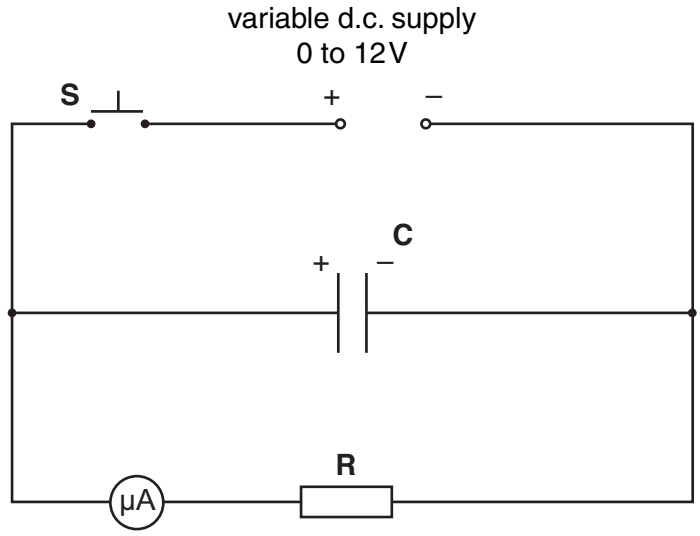


Fig. 1.1

(b) **(i)** Close switch **S**.

(ii) Adjust the output of the power supply so that the microammeter reads 80 μA.

(iii) Open the switch and at the same time start a stopwatch.

(iv) Measure and record the time $t_{\frac{1}{2}}$ for the current to halve.

$t_{\frac{1}{2}}$ = ... s **[1]**

(v) Reduce the output of the power supply to zero.

(c) Estimate the percentage uncertainty in $t_{\frac{1}{2}}$.

percentage uncertainty = ...% **[2]**

(d) Change the value of R by using a combination of two or three of the 47 kΩ resistors provided and repeat **(b)** until you have seven sets of readings of $t_{\frac{1}{2}}$ and R. Your readings should **not** contain the value $R = 0$.

[**Note:** For resistances in series $R_T = R_1 + R_2 + \ldots$;

for resistances in parallel $1/R_T = 1/R_1 + 1/R_2 + \ldots .$]

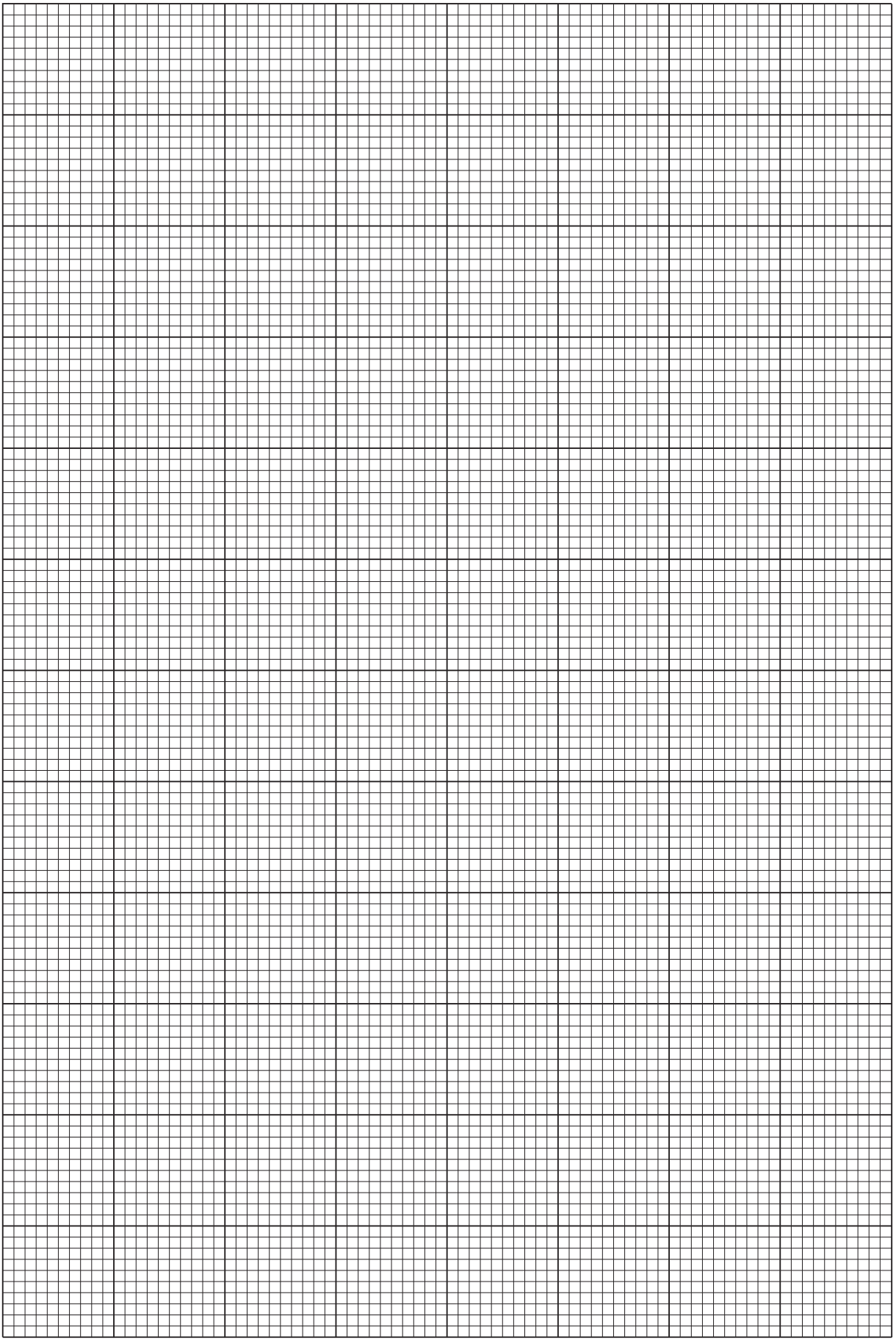
[9]

(e) (i) Plot a graph of $t_{\frac{1}{2}}$ (y-axis) against R (x-axis). **[5]**

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

gradient = ...**[2]**

y-intercept = ...**[1]**



(f) Time t and resistance R are related by the formula $I = I_0 e^{\frac{-t}{CR}}$
where I = current at time t
I_0 = initial current
C = capacitance of capacitor.

Using this formula show that $t_{\frac{1}{2}} = CR \ln 2$.

[2]

(g) Use your answers from **(e)(ii)** and **(f)** to determine a value for C. Include an appropriate unit for your value.

C = …….. unit ……...**[4]**

[Total: 28]

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TURN OVER FOR QUESTION 2

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 suspended metre rule.

A metre rule has been suspended horizontally from another metre rule by two vertical threads. The vertical separation of the rules is about 50 cm.

(a) (i) Adjust the separation *d* of the threads, if necessary, so that *d* is 20.0 cm, ensuring that the threads are equidistant from the ends of the rules. The threads should be parallel and vertical. The arrangement is shown in Fig. 2.1.

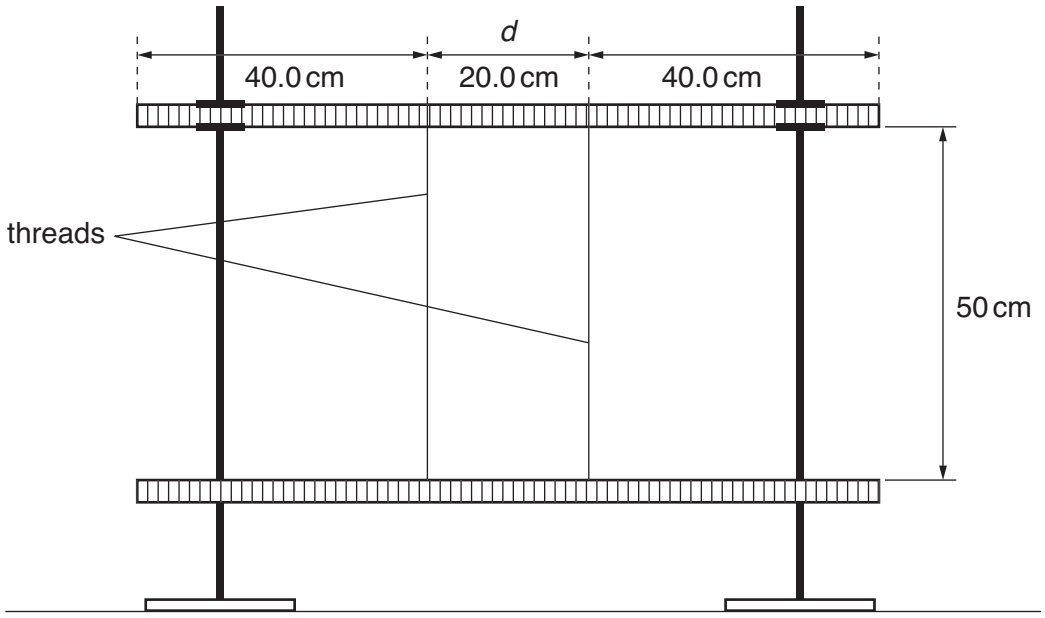

Fig. 2.1 side view

(ii) Displace the ends of the lower rule slightly so that it performs small torsional oscillations about a vertical axis through the centre of the rule as shown in Fig. 2.2.

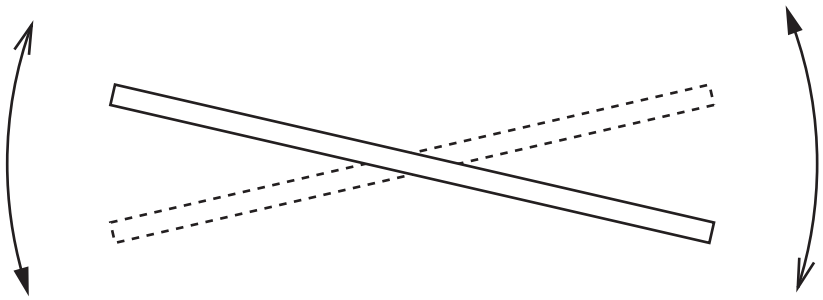

Fig. 2.2 plan view

(iii) Make and record measurements in order to determine the period T of these oscillations.

T = ... s **[1]**

(iv) Justify the number of significant figures that you have given for T.

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

(b) Increase the value of d to 40.0 cm, ensuring that the threads are still equidistant from the ends of the rule. Repeat parts **(a)(ii)** and **(a)(iii)** to give a new value for the period of torsional oscillation of the rule.

T = ... s **[2]**

(c) It is suggested that T is inversely proportional to d. Do the results of your experiment support this suggestion? Justify your answer.

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.....**[2]**

(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 suspended metre rule.

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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