OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

PHYSICS A 2826/03/TEST

Practical Test (Part B)

Wednesday **30 JANUARY 2002** Morning 1 hour 30 minutes

Additional materials:
Electronic Calculator
Candidate's Plan (Part A of the Practical Test)
Candidates answer on the question paper.

Candidate Name	Centre Number	Candidate Number

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** questions.
- Write your answers in the spaces on the question paper.

INFORMATION FOR CANDIDATES

- In this part of 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
- You are advised to spend the first few minutes reading through the whole paper before starting to answer any questions.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

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

This question paper consists of 9 printed pages and 3 blank pages.

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

1 All commercial capacitors have a working voltage. Exceeding this voltage will damage the capacitor and may be dangerous. One way of increasing the effective working voltage is to use several capacitors connected in series with one another. In this experiment you will discharge a series arrangement of capacitors through a fixed resistor, and measure the potential difference across the arrangement of capacitors 15 seconds after the discharge starts. You will repeat this experiment with different numbers of capacitors in the series arrangement.

(a) Set up the circuit shown in Fig. 1.1 using a single capacitor C. The working voltage of this capacitor is 10 V. Ensure that the positive terminal of this capacitor is connected to the positive terminal of the power supply. R is a fixed resistor.

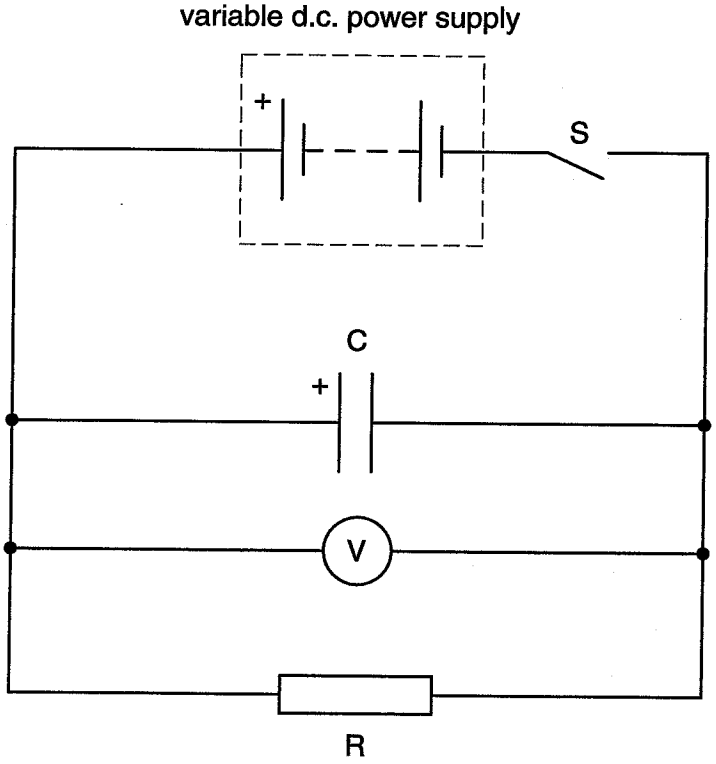


Fig. 1.1

(b) (i) Close switch S and adjust the output of the power supply until the voltmeter just reaches full scale deflection.

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

(iii) Measure and record the potential difference V across the capacitor after a time $t = 15.0$ s.

(iv) Include another capacitor in series with the first one, ensuring that the positive terminals of the capacitors are connected as shown in Fig. 1.2.

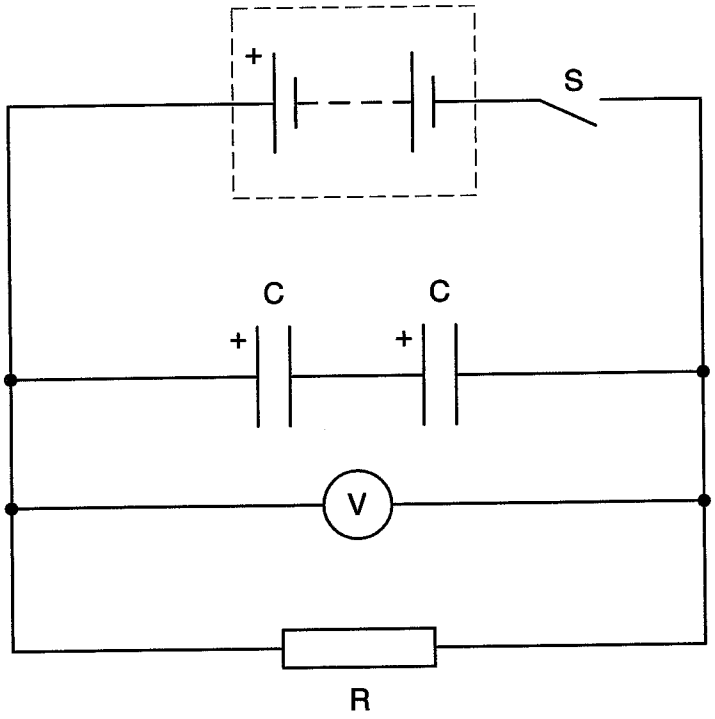


Fig. 1.2

(v) Repeat **(i)**, **(ii)**, **(iii)** and **(iv)** until you have five sets of readings for V and n, where n is the number of capacitors in the series arrangement.

Include values of ln (V/V) in your table of results.

(c) Suggest how the use of a datalogger may increase the accuracy of the experiment.

(d) V and n are related by the expression

$$V = V_0 e^{-kn}$$

where V_0 is the initial potential difference across the arrangement and k is a constant.

(i) Plot a graph of ln (V/V) (y-axis) against n (x-axis) and draw the line of best fit.

(ii) Determine the gradient of the line.

(iii) State the value of k.

(e) A series arrangement of ten capacitors could be used in the circuit of **Fig. 1.2** with an initial potential difference of 100 V. Use the results of your experiment to calculate a value for V, the potential difference 15 seconds after the switch is opened, in this case.

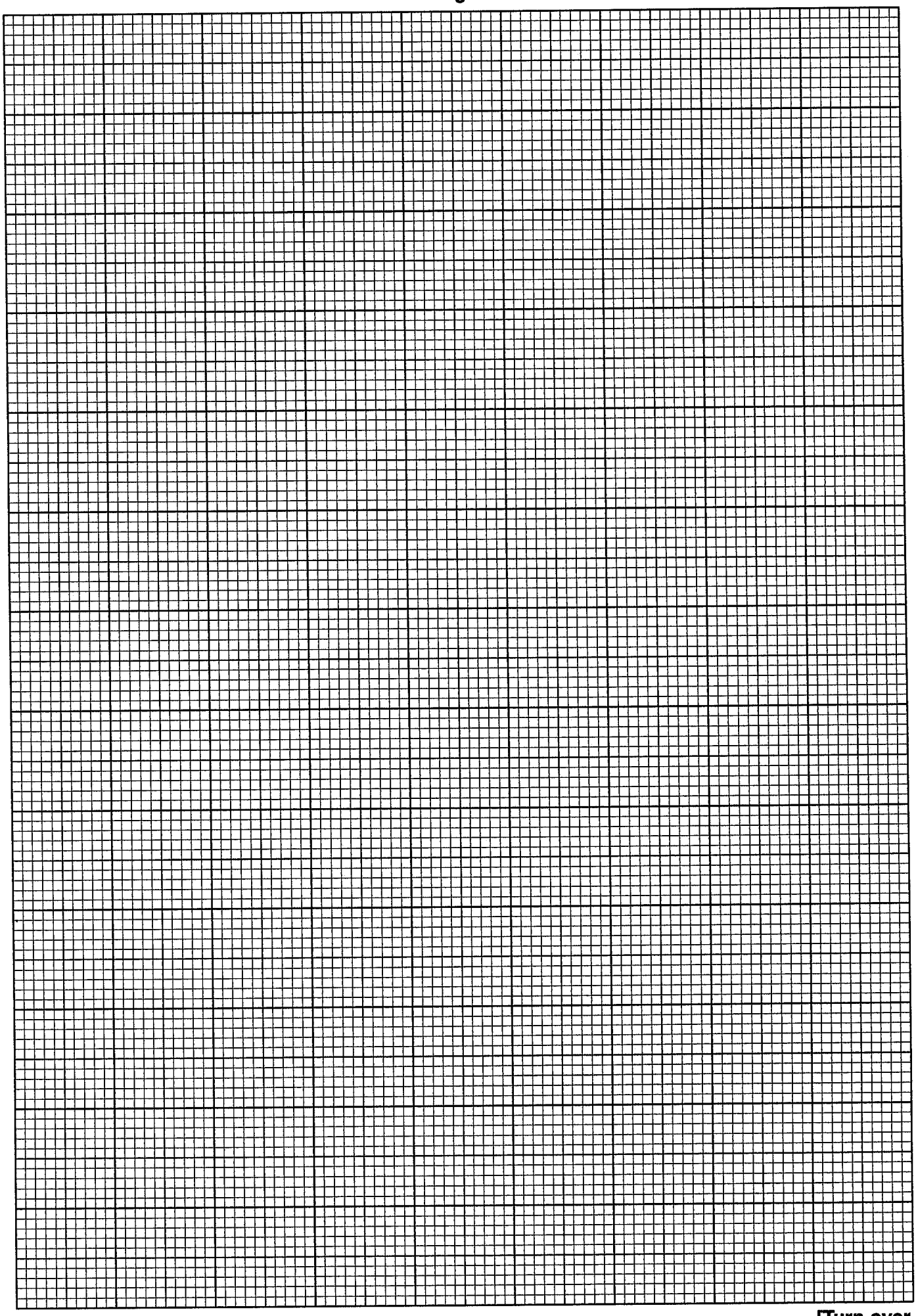
Measurements and Calculations

For Examiner's Use

M

R

A



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

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

2 There are many situations in everyday life that involve energy transfer from one oscillating system to another. In this experiment you will be required to investigate the energy transfer from one oscillating pendulum to another pendulum connected to it.

You are provided with a metre rule which has been clamped horizontally. You should not disturb the rule from its position. Two pendulum bobs A and B are suspended 50.0 cm below the clamped rule. The separation of the points of suspension of the pendulums should be 60.0 cm as shown in Fig. 2.1.

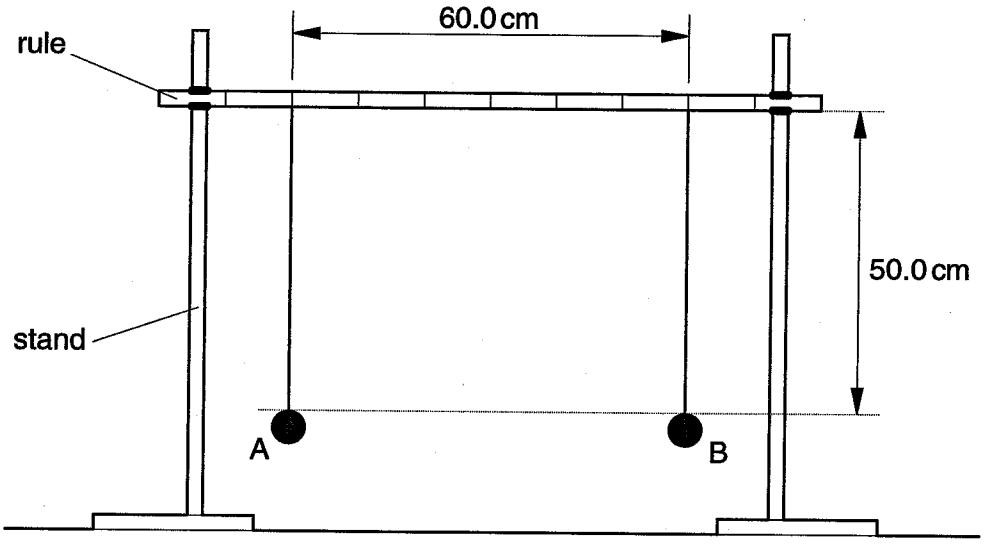

Fig. 2.1

(a) Link the two pendulums together with twine so that the distance PQ is 50.0 cm. The horizontal twine PQ should be a distance *d* vertically below the metre rule, where *d* is initially 30.0 cm. The arrangement is shown in Fig. 2.2.

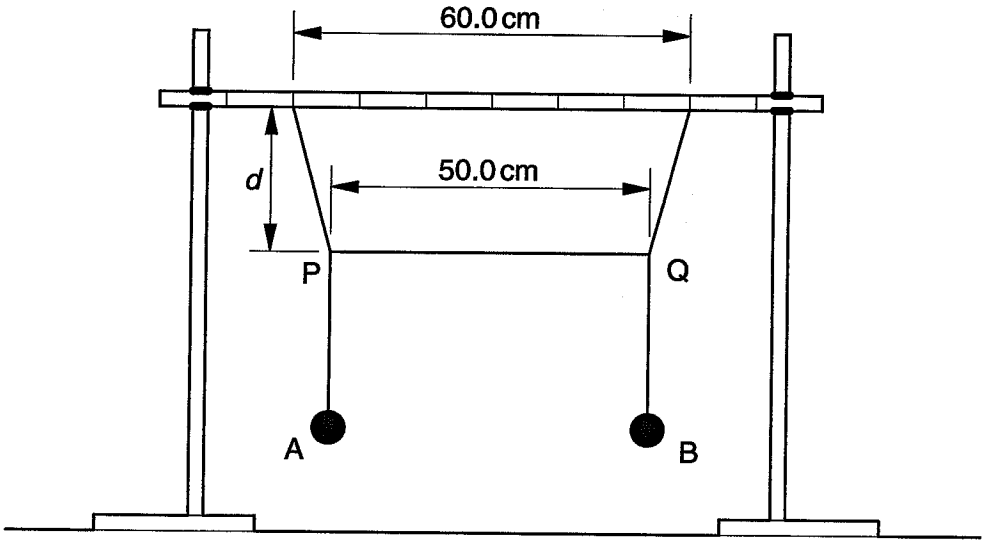

Fig. 2.2

(b) Place your open hand under pendulum bob A so that it just rests on your palm. Gently pull pendulum bob B a few centimetres (e.g. about 5 cm) in a direction perpendicular to the plane containing the pendulums (see Fig. 2.3). Then release B. When B is oscillating smoothly, lower your hand from A so that it is initially at rest. Note that energy is gradually transferred from B to A, until B comes momentarily to rest (or oscillates with minimum amplitude).

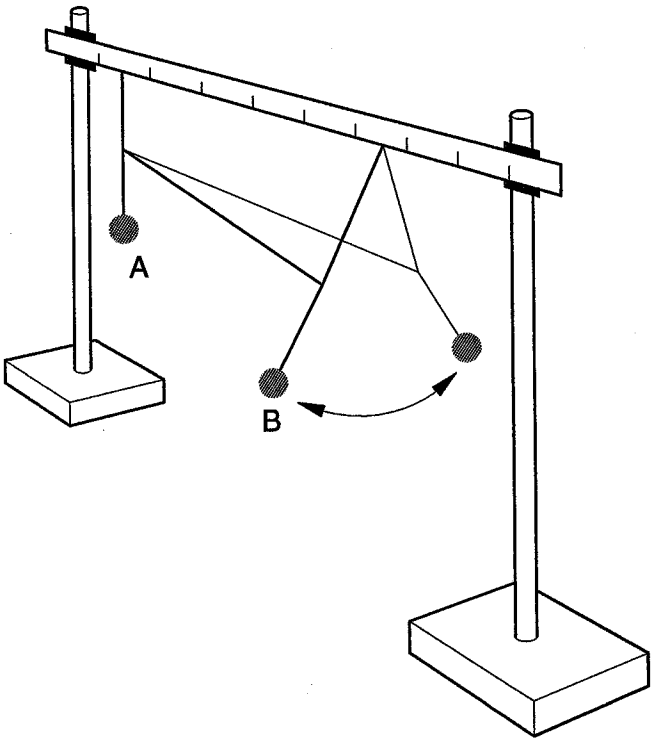

Fig. 2.3

(c) **(i)** Repeat the procedure outlined in part **(b)**, and measure the time t for B to come to rest after A is released.

(ii) Estimate the percentage uncertainty in this time.

(d) Adjust the positions of P and Q so that $d = 15.0$ cm and repeat **(c) (i)**.

(e) It is suggested that the time t taken for all of the kinetic energy to be transferred from B to A is inversely proportional to the distance d. Do the results of your experiment support this suggestion? Justify your answer.

(f) Evaluation exercise. (*In this part question two marks are awarded for quality of written communication).*

Write an evaluation of the procedure which you have followed to investigate how the time t taken for the energy to be transferred from B to A is related to the distance d. You should include some of the limitations of your procedure and suggest ways in which the experiment may be improved, giving reasons for your suggestions.

Measurements and Calculations

For Examiner's Use

Evaluation

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