



Cambridge International AS & A Level

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PHYSICS

9702/52

Paper 5 Planning, Analysis and Evaluation

May/June 2025

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 30.
- The number of marks for each question or part question is shown in brackets [].

This document has 8 pages.



- 1 A thin solid disc of radius r and thickness z is attached to a thin axle. String is wrapped around the axle, as shown in Fig. 1.1.

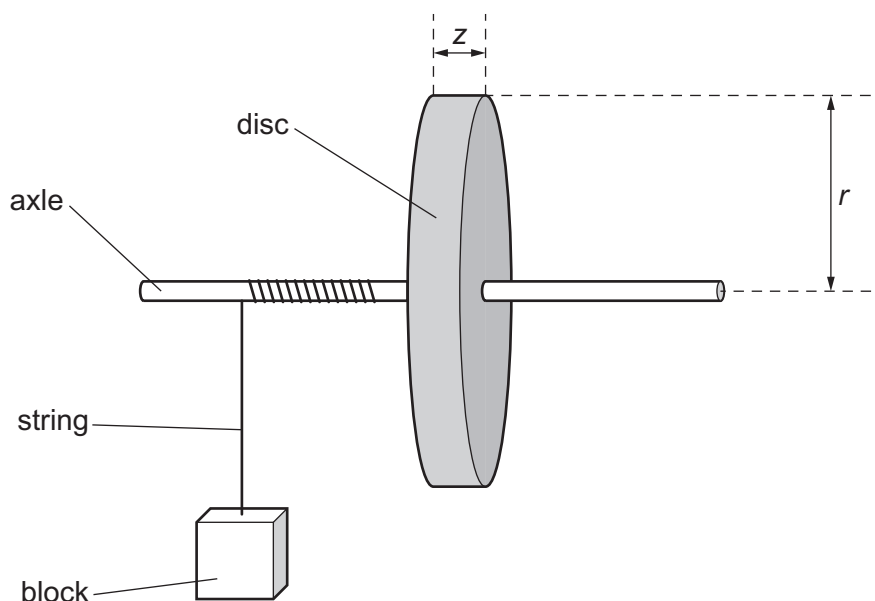


Fig. 1.1

A block of mass m is attached to the string.

The block is released from rest and falls downwards. The block has speed v when it has fallen through a distance h from the point of release. The value of v is determined using **one** light gate connected to a timer.

It is suggested that v is related to m by the relationship

$$\frac{h}{v^2} = \frac{\pi r^2 z}{2PQm} + \frac{1}{P}$$

where P and Q are constants.

Plan a laboratory experiment to test the relationship between v and m .

Draw a diagram showing the arrangement of your equipment.

Explain how the results could be used to determine values for P and Q .

In your plan you should include:

- the procedure to be followed
- the measurements to be taken
- the control of variables
- the analysis of the data
- any safety precautions to be taken.





Diagram

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..... [15]

- 2 A student investigates a circuit containing capacitors. The circuit is connected with a capacitor of capacitance A , as shown in Fig. 2.1.

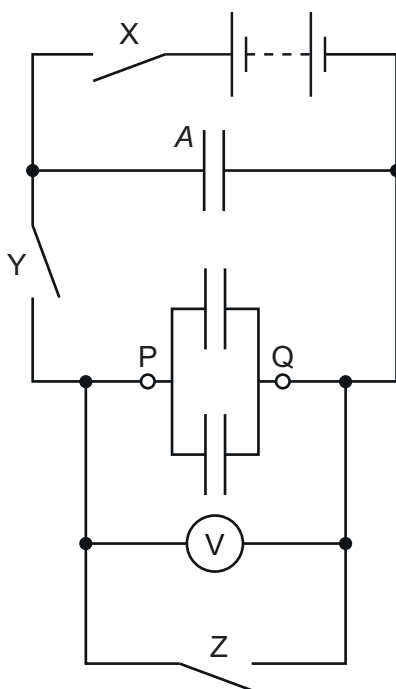


Fig. 2.1

Two capacitors, each of capacitance C , are connected in parallel between P and Q.

Initially, switch X and switch Z are closed and switch Y is open.

Switches X and Z are opened. Switch Y is then closed. The maximum potential difference between P and Q is measured using the voltmeter. This procedure is repeated and the mean maximum potential difference V between P and Q is determined.

The experiment is then repeated by changing the number n of capacitors, each of capacitance C , connected in parallel between P and Q.

It is suggested that V and n are related by the equation

$$EA = V(nC + A)$$

where E is the electromotive force (e.m.f.) of the battery.

- (a) A graph is plotted of $\frac{1}{V}$ on the y -axis against n on the x -axis.

Determine expressions for the gradient and y -intercept.

gradient =

y -intercept =

[1]





- (b) Values of n and the two measured values of the maximum potential difference V_1 and V_2 are given in Table 2.1.

Table 2.1

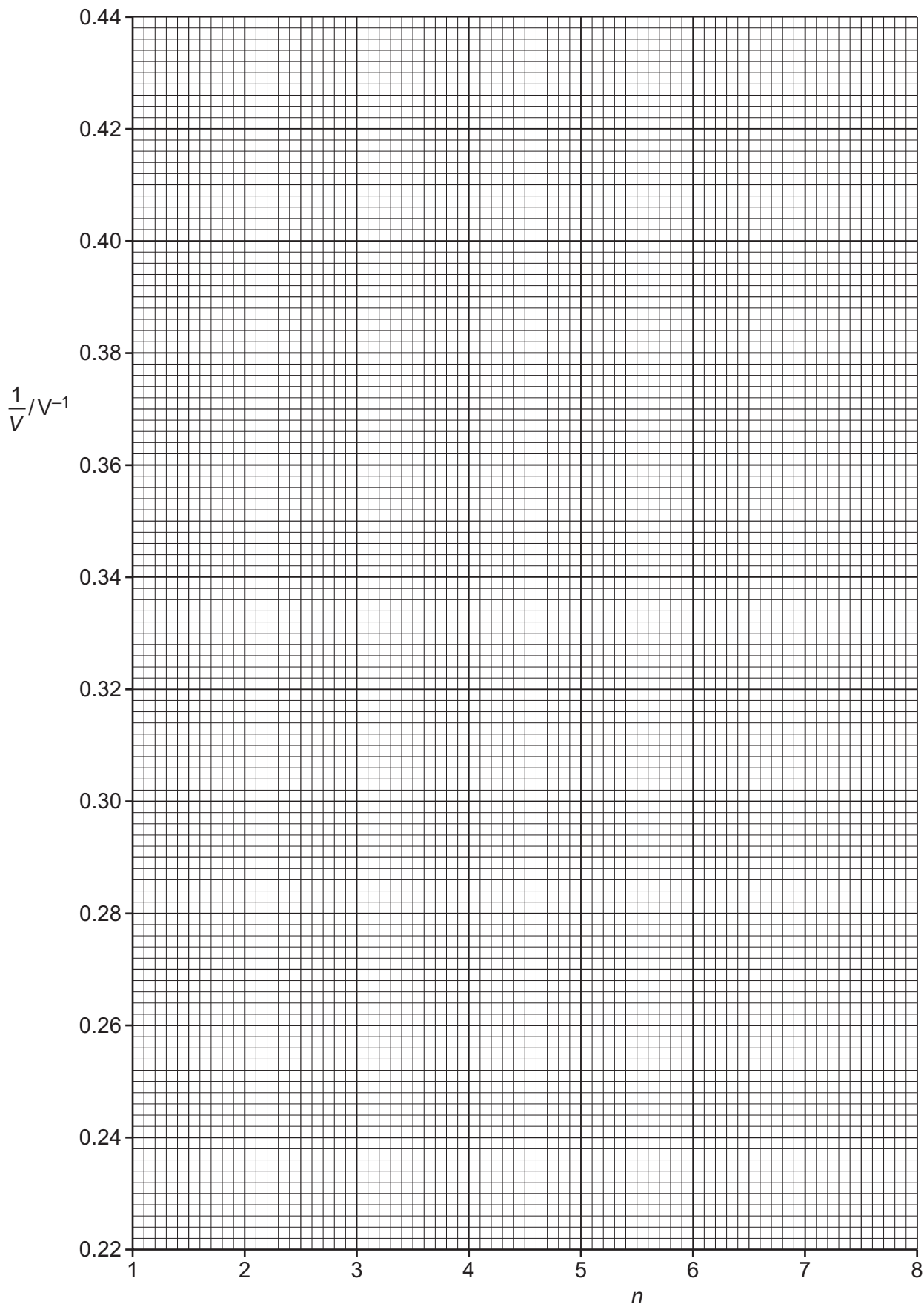
n	V_1/V	V_2/V	V/V	$\frac{1}{V}/V^{-1}$
2	4.30	4.20		
3	3.65	3.75		
4	3.30	3.20		
5	2.85	2.95		
6	2.65	2.55		
7	2.30	2.40		

Calculate and record values of V/V and $\frac{1}{V}/V^{-1}$ in Table 2.1. Include the absolute uncertainties in V and $\frac{1}{V}$. [2]

- (c) (i) Plot a graph of $\frac{1}{V}/V^{-1}$ against n . Include error bars for $\frac{1}{V}$. [2]
- (ii) Draw the straight line of best fit and a worst acceptable straight line on your graph. Label both lines. [2]
- (iii) Determine the gradient of the line of best fit. Include the absolute uncertainty in your answer.

gradient = [2]







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

y -intercept = [2]

- (d) (i) Using your answers to (a), (c)(iii) and (c)(iv), determine the values of E and C . Include appropriate units.

Data: $A = (2.2 \pm 0.2) \text{ mF}$

$E = \dots\dots\dots$

$C = \dots\dots\dots$ [2]

- (ii) Determine the percentage uncertainty in your value of C .

percentage uncertainty =% [1]

- (e) The experiment is repeated with 10 capacitors, each of capacitance C , connected in parallel between P and Q. Determine the maximum potential difference V between P and Q.

$V = \dots\dots\dots V$ [1]

[Total: 15]

