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PHYSICS

0625/63

Paper 6 Alternative to Practical

May/June 2025

1 hour

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 40.
- The number of marks for each question or part question is shown in brackets [].

This document has **16** pages. Any blank pages are indicated.

- 1 A student investigates the forces supporting a metre ruler to determine the weight of the metre ruler.

He uses the apparatus shown in Fig. 1.1. The scale of the metre ruler faces upwards.

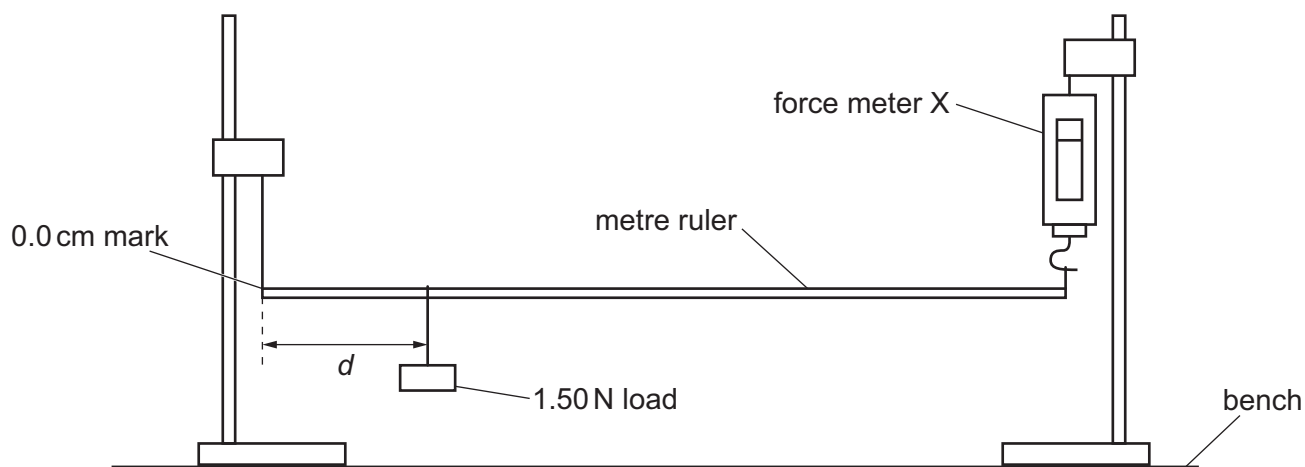


Fig. 1.1

- (a) The student ensures that the metre ruler is horizontal.

Briefly describe how to check that the ruler is horizontal. You may draw a diagram.

.....

.....

..... [1]

- (b) (i) The student adjusts distance d between the 0.0 cm mark and the 1.50 N load, as shown in Fig. 1.1. He moves the thread supporting the 1.50 N load so that it is at the mark on the metre ruler shown in Fig. 1.2.

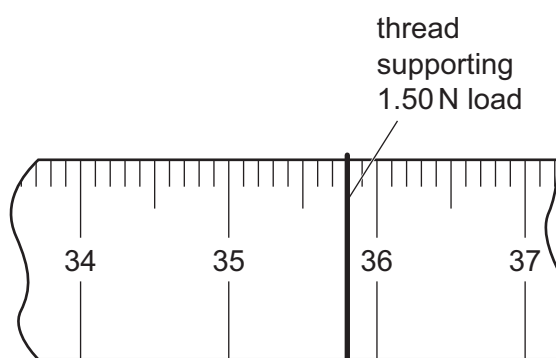


Fig. 1.2



The metre ruler is **not** drawn to scale.

Record the distance d indicated on Fig. 1.2.

$d = \dots\dots\dots$ cm [1]

(ii) The reading on force meter X is shown in Fig. 1.3.

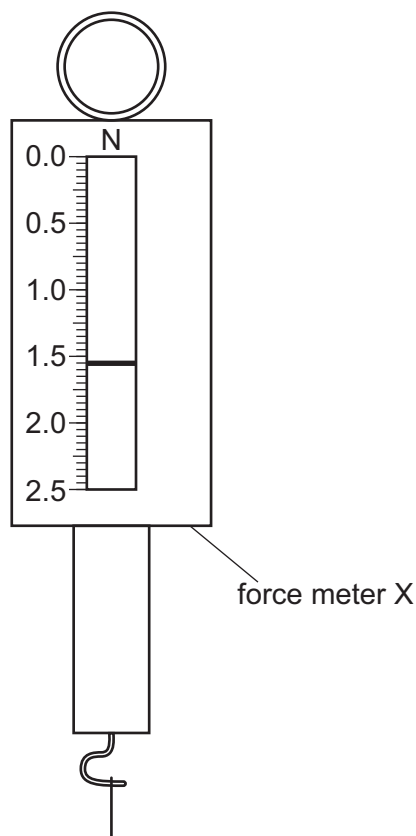


Fig. 1.3

Record F_X , the reading on force meter X shown in Fig. 1.3.

$F_X = \dots\dots\dots$ N [1]



- (c) The student moves the 1.50 N load to distances $d = 10.0$ cm, 30.0 cm, 50.0 cm, 70.0 cm and 90.0 cm. For each distance d , he reads the value F_X on force meter X.

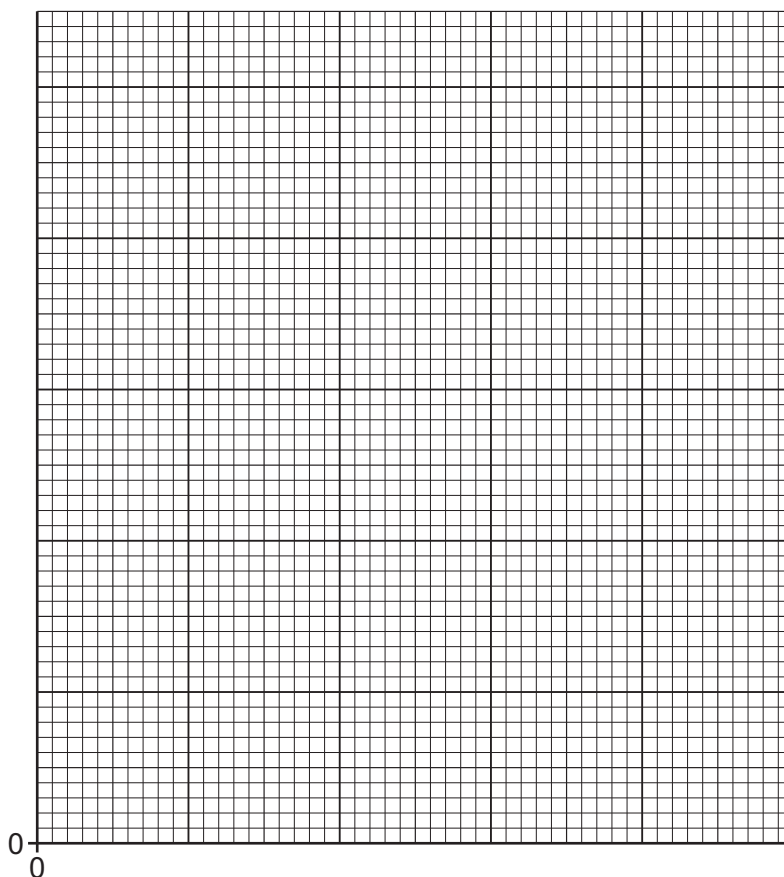
His readings are shown in Table 1.1.

Table 1.1

d/cm	F_X/N
10.0	1.17
30.0	1.40
50.0	1.82
70.0	2.15
90.0	2.35

Plot a graph of F_X/N (y -axis) against d/cm (x -axis). Start the axes at the origin (0, 0).

Draw a best-fit straight line.



[4]



- (d) From your graph, determine F_0 , the value of F_x when $d = 0.0$ cm.

$$F_0 = \dots\dots\dots$$

Calculate the weight W_R of the metre ruler, using the equation $W_R = 2 \times F_0$.

$$W_R = \dots\dots\dots \text{ N}$$

[2]

- (e) State and explain whether your plots made it easy to choose the best-fit line. Justify your answer with reference to your plots.

statement

explanation

.....

.....

[1]

- (f) Another student does the experiment with the same equipment. He reads values of F_x which are all higher than those in Table 1.1 by 0.05 N.

Suggest **one** reason for this difference. Assume that the values in Table 1.1 are accurate.

.....

.....

.....

[1]

[Total: 11]



- 2 A student investigates the cooling of hot water in a beaker.

She uses the apparatus shown in Fig. 2.1.

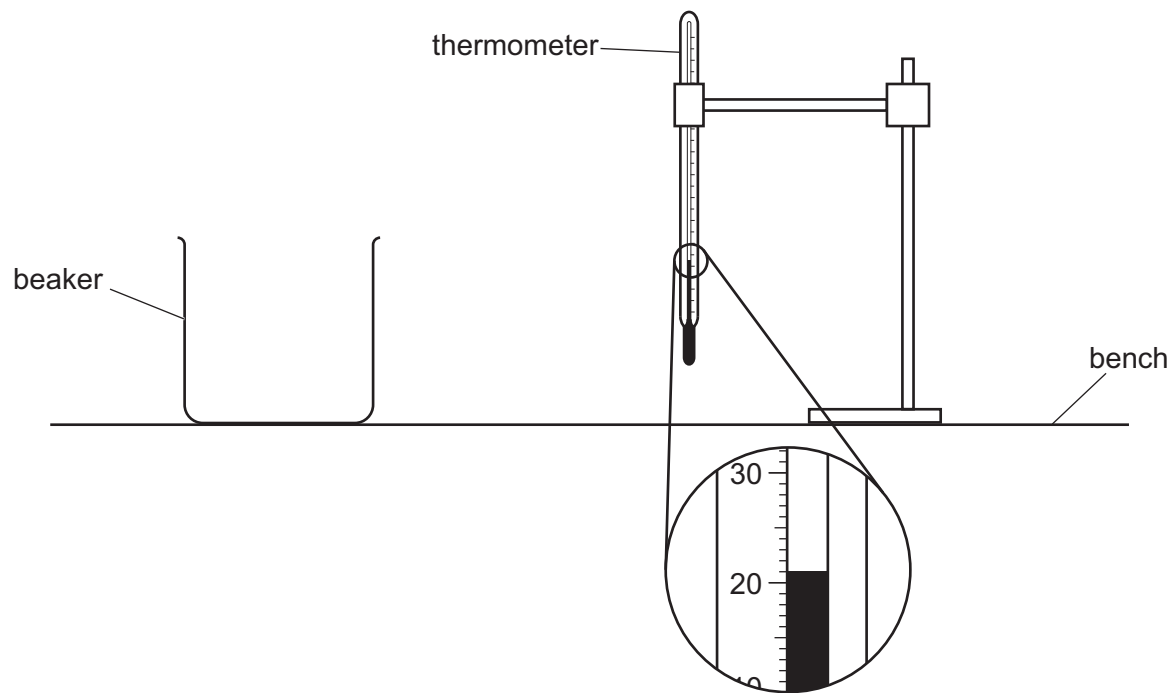


Fig. 2.1

- (a) Record room temperature θ_R shown on the thermometer in Fig. 2.1.

$$\theta_R = \dots\dots\dots [1]$$

- (b) The student pours hot water into the beaker and records the initial temperature θ in Table 2.1. She then records the temperature θ every 30 s. Her values are shown in Table 2.1.

Describe **one** technique that you use to ensure that temperature readings in this type of experiment are as accurate as possible.

.....
 [1]



Table 2.1

t/s	$\theta/^\circ\text{C}$
0	93.0
30	90.5
60	88.5
90	87.0
120	85.5
150	84.0
180	83.0
210	82.0
240	81.5
270	81.0

- (c) Estimate what the temperature θ_{300} is at 300 s. Use the readings from Table 2.1 to guide you.

$$\theta_{300} = \dots\dots\dots ^\circ\text{C} \quad [1]$$

- (d) (i) Calculate the average cooling rate x_1 during the first 90 s of the experiment. Use the readings from Table 2.1 and the equation:

$$x_1 = \frac{\theta_0 - \theta_{90}}{T}$$

where $T = 90\text{ s}$ and θ_0 and θ_{90} are the temperatures at $t = 0$ and $t = 90\text{ s}$.
Include the unit for the cooling rate.

$$x_1 = \dots\dots\dots [1]$$

- (ii) Calculate the average cooling rate x_2 during the middle 90 s of the experiment. Use the readings from Table 2.1 and the equation:

$$x_2 = \frac{\theta_{90} - \theta_{180}}{T}$$

where $T = 90\text{ s}$ and θ_{90} and θ_{180} are the temperatures at $t = 90\text{ s}$ and $t = 180\text{ s}$.

$$x_2 = \dots\dots\dots [1]$$

- (iii) Calculate the average cooling rate x_3 during the last 90 s of the experiment. Use the readings from Table 2.1 and the equation:

$$x_3 = \frac{\theta_{180} - \theta_{270}}{T}$$

where $T = 90\text{ s}$ and θ_{180} and θ_{270} are the temperatures at $t = 180\text{ s}$ and $t = 270\text{ s}$.

$$x_3 = \dots\dots\dots [1]$$





- (e) (i) Use your results from (d) to describe the overall pattern of the rate of cooling of the water in the experiment. Justify your answer by reference to your results.

.....

 [1]

- (ii) Estimate the final temperature θ_F of the water after several hours.

$\theta_F =$ [1]

- (f) (i) Another student does the same experiment. He starts with the hot water at a lower initial temperature.

Suggest how his cooling rates are likely to compare with those in (b). Use your results to explain your answer.

suggestion

.....

explanation

.....

.....

[2]

- (ii) State **one** variable, other than the initial water temperature, that the student needs to control.

.....

..... [1]

[Total: 11]





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- 3 A student investigates circuits containing different combinations of resistors.

Circuit A is shown in Fig. 3.1. Circuit A is **not** complete.

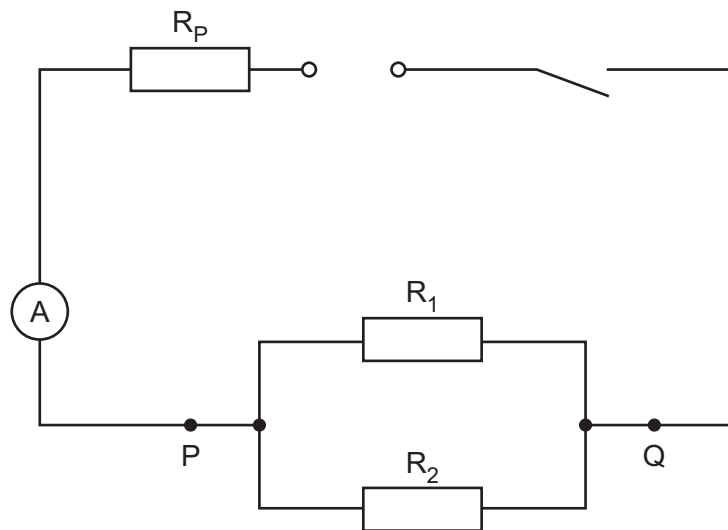


Fig. 3.1

- (a) On Fig. 3.1, complete the circuit to show a voltmeter connected to measure the potential difference (p.d.) across the terminals P and Q. [1]
- (b) The student measures the potential difference V across the parallel combination of resistors R_1 and R_2 and measures the current I in the circuit.

His readings are shown in Fig. 3.2 and Fig. 3.3.

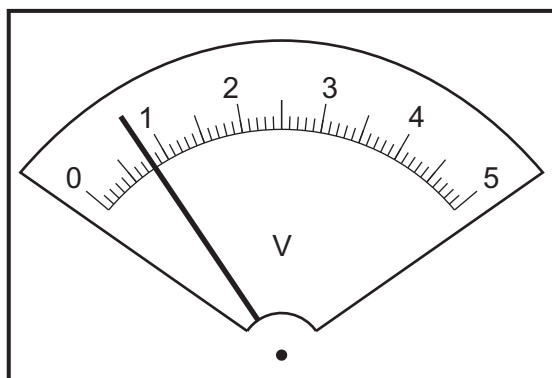


Fig. 3.2

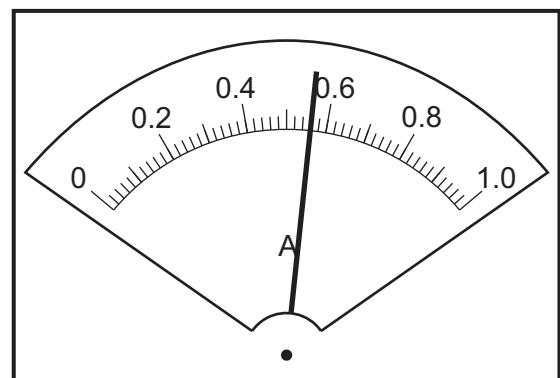


Fig. 3.3

- (i) Read, and record in the first line of Table 3.1, the values of V and I shown on the meters in Fig. 3.2 and Fig. 3.3. [2]

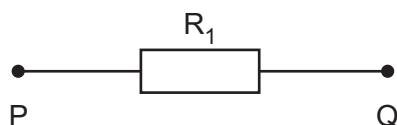


Table 3.1

	V/V	I/A	R/Ω
circuit A			
circuit B	1.4	0.46	
circuit C	1.8	0.29	

The student rearranges the resistors between terminals P and Q, as shown in Fig. 3.4, to form circuit B and circuit C. The new values of V and I are shown in Table 3.1.

Circuit B



Circuit C

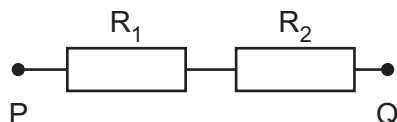


Fig. 3.4

- (ii) For each circuit, calculate and record in Table 3.1 a resistance R . Use the values of V and I in Table 3.1 and the equation:

$$R = \frac{V}{I}.$$

[1]

- (c) (i) Calculate resistance R_A . Use the value of R from circuit A and the equation:

$$R_A = 2R.$$

$$R_A = \dots\dots\dots \Omega$$

Record resistance R_B . R_B is equal to the value of R from circuit B.

$$R_B = \dots\dots\dots \Omega$$

Calculate resistance R_C . Use the value of R from circuit C and the equation:

$$R_C = \frac{R}{2}.$$

$$R_C = \dots\dots\dots \Omega$$

[2]





- (ii) A student suggests that R_A , R_B and R_C should all be equal.

State whether your results support this suggestion. Justify your statement with reference to values from your results.

statement

justification

.....

.....

[2]

- (d) The circuits use a 3 V power supply.

Briefly explain why resistor R_P , shown in Fig. 3.1, must remain in place throughout the experiment.

R_P has a resistance of $4.0\ \Omega$. Use Fig. 3.3 and the values in Table 3.1 to support your answer.

.....

.....

..... [1]

- (e) A student determines the resistance of R_1 . He uses a variable resistor in circuit B to control the current and draws a graph of V against I .

- (i) Draw the circuit symbol for a variable resistor.

[1]

- (ii) Briefly explain **one** advantage of using a variable resistor to control the current.

.....

.....

..... [1]

[Total: 11]





4 A student investigates the refraction of light.

Refraction is the change in direction of a ray of light when passing into a transparent substance, as shown in Fig. 4.1.

Plan an experiment which enables him to investigate how the concentration of a gel affects the angle at which light is refracted when passing from air into the gel.

A transparent gel block can be made by dissolving gel powder in hot water in a mould and allowing it to cool. Changing the amount of powder will change the concentration.

Concentration is measured in g/cm^3 .

The apparatus available includes:

- samples of gel made at different concentrations and labelled with those concentrations
- a ray-lamp which produces a narrow ray of light.

In your plan:

- list any additional apparatus needed
- explain briefly how to do the experiment, including the measurements to take
- state the key variable to keep constant
- draw a table, or tables, with column headings, to show how to display the readings (you are **not** required to enter any readings in the table)
- explain how to use the readings to reach a conclusion.

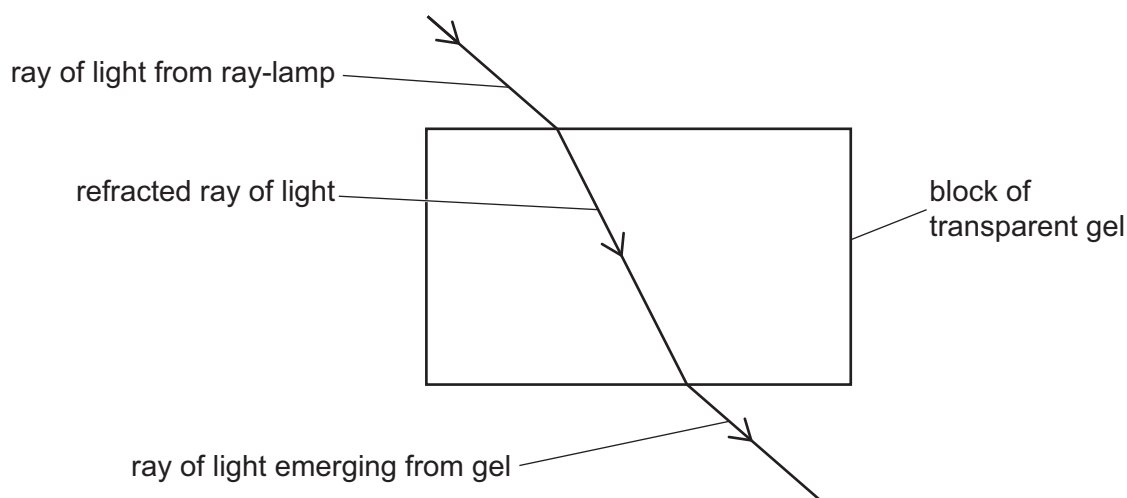


Fig. 4.1





[7]





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