



CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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0625/53

May/June 2024

1 hour 15 minutes

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential 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.

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

For Examiner's Use	
1	
2	
3	
4	
Total	

This document has **12** pages. Any blank pages are indicated.

- 1 In this experiment, you will determine the density of modelling clay by two methods.

Refer to Fig. 1.1.

Method 1

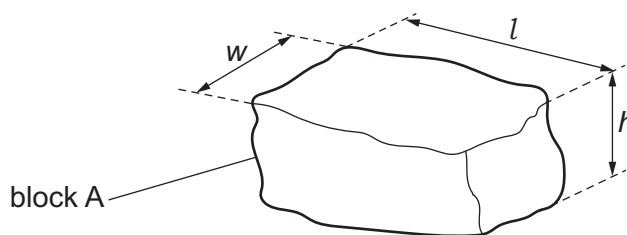


Fig. 1.1

- (a) (i) Measure the length l , width w and height h of block A. Record your values in centimetres to the nearest millimetre.

$l =$ cm

$w =$ cm

$h =$ cm
[1]

- (ii) Calculate the volume V_A of block A. Use your measurements from (a)(i) and the equation $V_A = l \times w \times h$.

$V_A =$ cm³ [1]

- (b) Suggest a possible source of inaccuracy in measuring the dimensions of the block.

Describe how the accuracy of these measurements can be improved.

You are **not** required to do this improved investigation.

suggestion

.....

improvement

.....

[2]

- (c) Measure the mass m_A of block A. Use the top-pan balance.

$m_A =$ g [1]

- (d) Calculate a value ρ_A for the density of the modelling clay. Use your results from (a)(ii) and (c) and the equation $\rho_A = \frac{m_A}{V_A}$. Include the unit for the density.

$\rho_A = \dots\dots\dots$ [2]

Method 2

- (e) Measure the weight W_B of block B, as shown in Fig. 1.2.

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

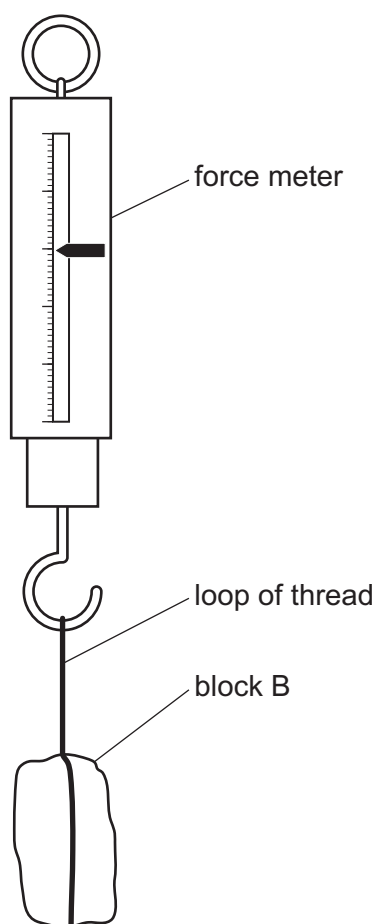


Fig. 1.2

- (f) (i) Pour approximately 60 cm^3 of water into the measuring cylinder.

Measure and record the actual volume V_1 of the water in the measuring cylinder.

$$V_1 = \dots\dots\dots \text{ cm}^3$$

Remove the loop of thread from the force meter and lower block B carefully into the water in the measuring cylinder, as shown in Fig. 1.3.

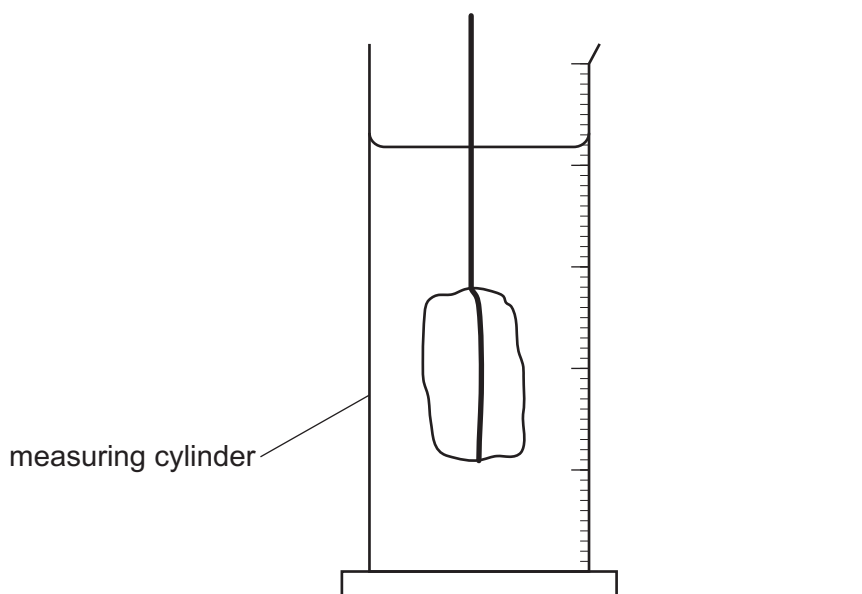


Fig. 1.3

Measure and record the new reading V_2 of the measuring cylinder.

$$V_2 = \dots\dots\dots \text{ cm}^3$$

[1]

- (ii) Draw an arrow on Fig. 1.4 to show the correct line of sight to obtain the value for the volume of water in the measuring cylinder.

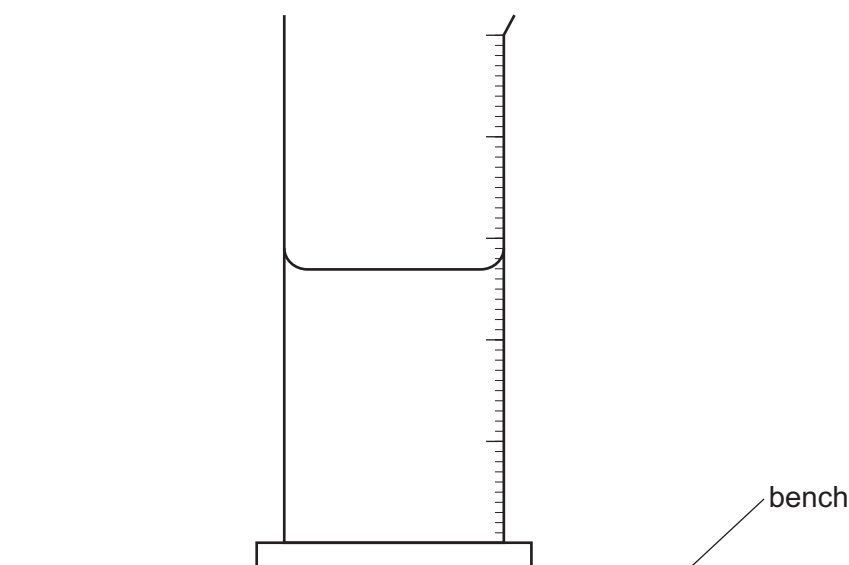


Fig. 1.4

[1]

- (g) Calculate another value ρ_B for the density of modelling clay. Use your readings from (e) and (f) and the equation $\rho_B = \frac{W_B \times k}{(V_2 - V_1)}$, where $k = 100 \text{ g/N}$.

$\rho_B = \dots\dots\dots$ [1]

[Total: 11]

- 2 In this experiment, you will investigate how the volume of water affects the rate at which hot water in a beaker cools.

Refer to Fig. 2.1.

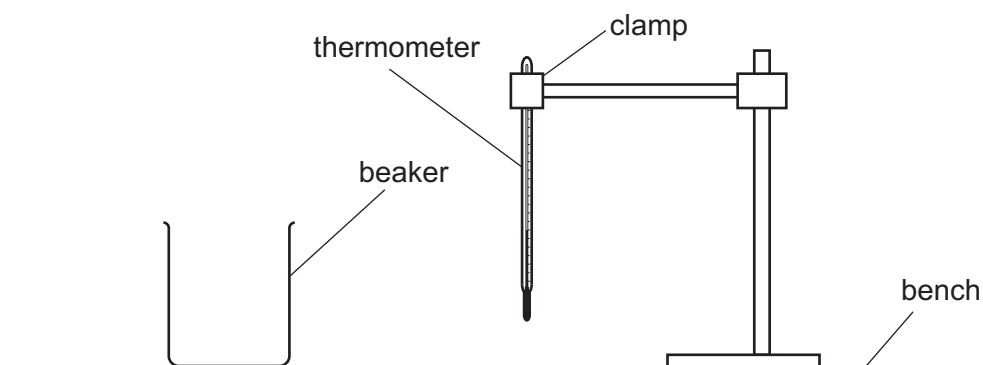


Fig. 2.1

- (a) Pour 200 cm^3 of hot water into the beaker. Use the graduations on the beaker as a guide. Place the thermometer in the water.

In the first row of Table 2.1, record the temperature θ of the water at time $t = 0$ and immediately start the stop-watch.

Record the temperature θ of the water at times $t = 30\text{ s}$, 60 s , 90 s , 120 s , 150 s and 180 s .

Remove the thermometer from the beaker and pour out the water. [1]

- (b) (i) Repeat (a), using only 75 cm^3 of hot water. [2]

- (ii) Add units to the column headings in Table 2.1.

Table 2.1

	beaker with 200 cm^3 of hot water	beaker with 75 cm^3 of hot water
$t/$	$\theta/$	$\theta/$
0		
30		
60		
90		
120		
150		
180		

[1]

- (c) Write a conclusion stating how the volume of hot water affects the rate of cooling of the water. Justify your answer by reference to your results.

.....

.....

.....

..... [2]

- (d) (i) Using your values for 75 cm^3 of water, calculate the average cooling rate x_1 for the first 90 s of the experiment. Use your 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.

$$x_1 = \dots\dots\dots [2]$$

- (ii) Using your values for 75 cm^3 of water, calculate the average cooling rate x_2 for the last 90 s of the experiment. Use your 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) A student states that it is important to start the two experiments in (a) and (b) with water at the same initial temperature.

Explain whether your values for x_1 and x_2 support this statement.

.....

.....

..... [1]

- (e) Another student repeats the experiment.

State **one** variable, other than initial water temperature, that she should control to obtain readings that are as close as possible to those in Table 2.1.

.....

..... [1]

3 In this experiment, you will determine the focal length of a converging lens.

Refer to Fig. 3.1.

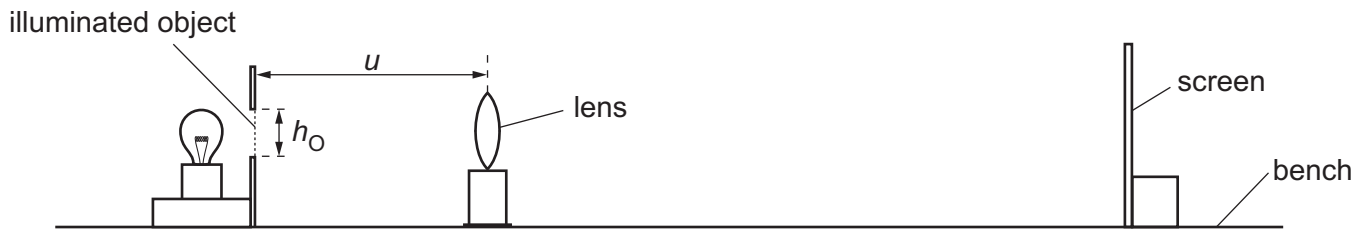


Fig. 3.1

(a) Set up the apparatus as shown in Fig. 3.1.

- (i) Measure the height h_O of the illuminated object. Fig. 3.1 shows the height to measure on the illuminated object provided.

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

- (ii) Place the lens a distance $u = 20.0$ cm from the illuminated object.
Place the screen near the lens.
Switch on the lamp.
Move the screen until a focused image of the illuminated object is seen on the screen.

Measure, and record in Table 3.1, the height h_I of the image on the screen.

Repeat the procedure for $u = 25.0$ cm, 30.0 cm, 35.0 cm and 40.0 cm.

Switch off the lamp.

Table 3.1

u/cm	h_I/cm	W
20.0		
25.0		
30.0		
35.0		
40.0		

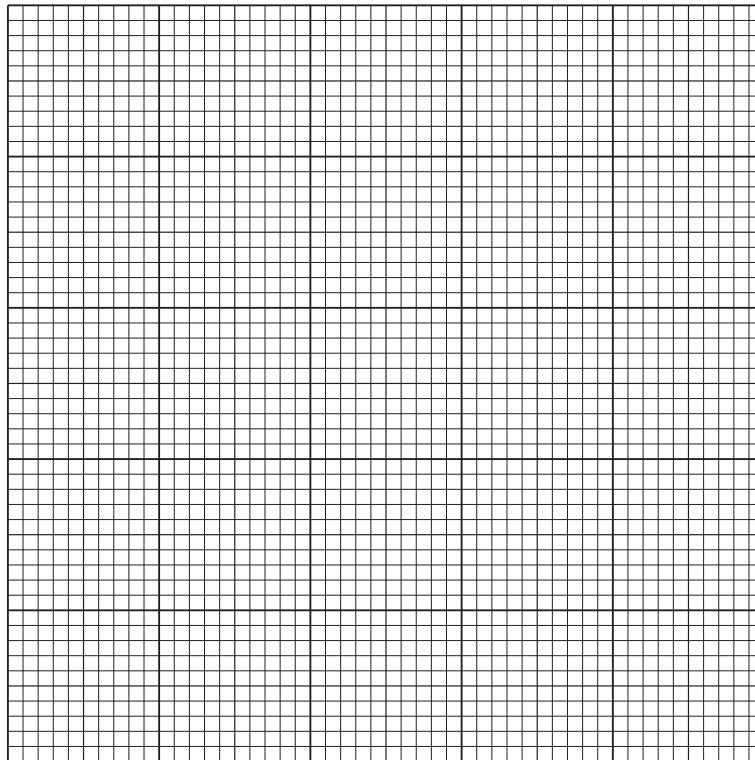
[1]

- (iii) Describe a technique for obtaining an image that is as sharp as possible.

.....

 [1]

- (b) For each distance u , calculate, and record in Table 3.1, a value W . Use your results from (a) and the equation $W = \frac{h_O}{h_I}$. [1]
- (c) Plot a graph of u/cm (y-axis) against W (x-axis). You do **not** need to start your axes at the origin (0,0). Draw the best-fit line.



[4]

- (d) (i) Determine the gradient G of the line. Show clearly on the graph how you obtained the necessary information.

$G = \dots\dots\dots$ [1]

- (ii) The focal length f of the lens is numerically equal to the gradient G .

Record a value of f for this experiment.

$f = \dots\dots\dots \text{ cm}$ [1]

- (e) A student decides to continue the experiment using larger values of u .

Explain why this produces less accurate values for W .

.....

.....

..... [1]

- 4 A student investigates the relationship between the diameter of a wire and the electrical resistance of the wire.

Plan an experiment which enables him to investigate how the diameter of a wire affects the resistance of the wire.

Resistance R is calculated from the equation $R = \frac{V}{I}$

where V is the potential difference (p.d.) across the wire and I is the current in the wire.

You are **not** required to do this experiment.

The apparatus available includes wires of different known diameters.

In your plan:

- list any additional apparatus needed
- complete Fig. 4.1 to show a circuit suitable for measuring the resistance of a wire
- explain briefly how to do the experiment, including the measurements to take so that the resistance can be determined
- state the key variables 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.

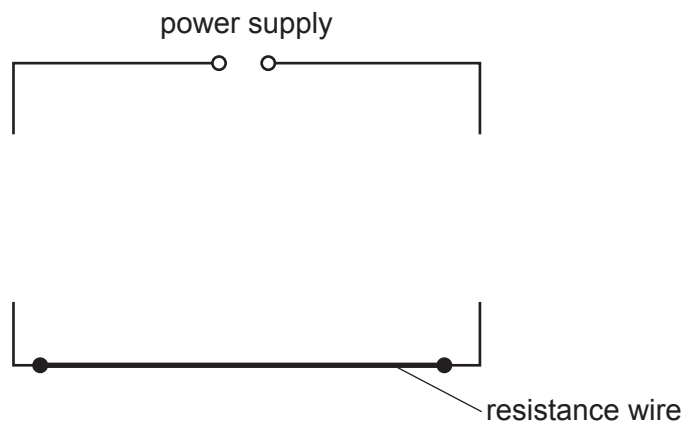


Fig. 4.1

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