



CANDIDATE
NAME

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CENTRE
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CANDIDATE
NUMBER

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0625/63

May/June 2024

1 hour

No additional materials are needed.

- 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 [].

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

- 1 A student determines the density of modelling clay by two methods.

Method 1

He uses the block of modelling clay shown in Fig. 1.1.

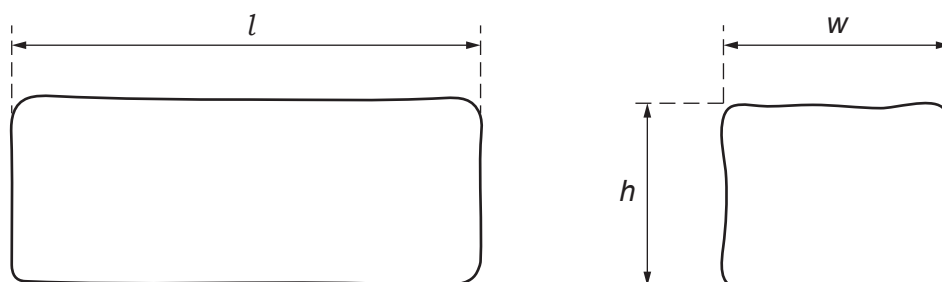


Fig. 1.1

- (a) (i) Measure the dimensions of the block of modelling clay shown in Fig. 1.1. Record the values in centimetres to the nearest millimetre.

$l =$ cm

$w =$ cm

$h =$ cm
[1]

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

$V_A =$ cm^3 [1]

- (b) Suggest why the value of V_A is only an approximation of the volume of the block.

Describe how the accuracy of V_A can be improved.

suggestion

.....

improvement

.....

.....

[2]

(c) Record the mass m_A of the block shown on the top-pan balance in Fig. 1.2.

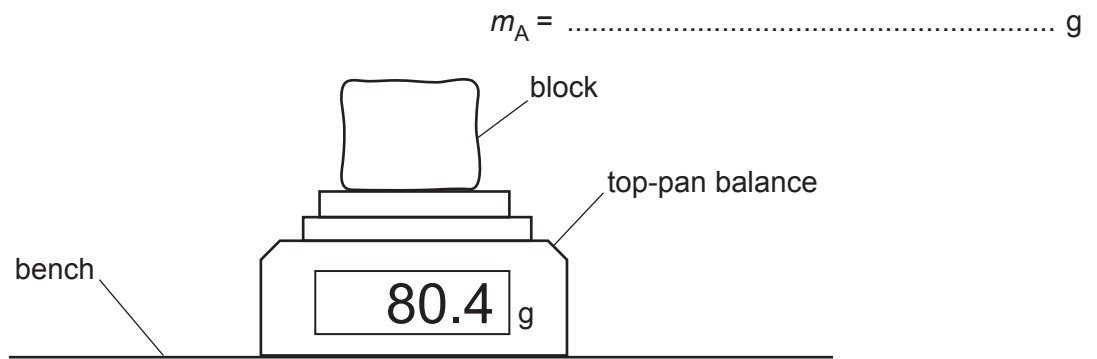


Fig. 1.2

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

(d) The student then uses a smaller block of modelling clay.

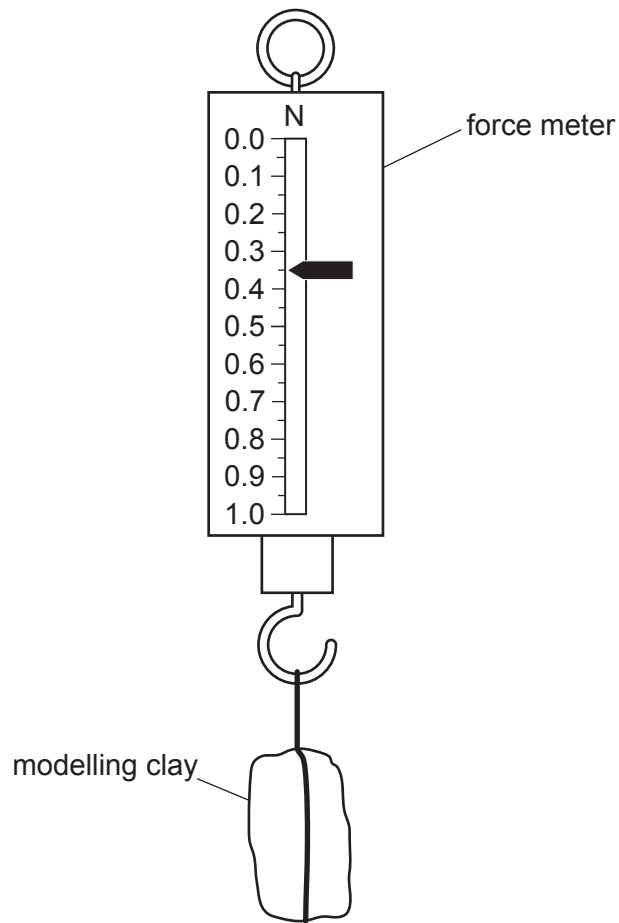


Fig. 1.3

Record the weight W_B of the block of modelling clay shown in Fig. 1.3.

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

(e) (i) The student pours water into a measuring cylinder.

Record the volume V_1 of the water in the measuring cylinder shown in Fig. 1.4.

$V_1 = \dots\dots\dots$ cm³ [1]

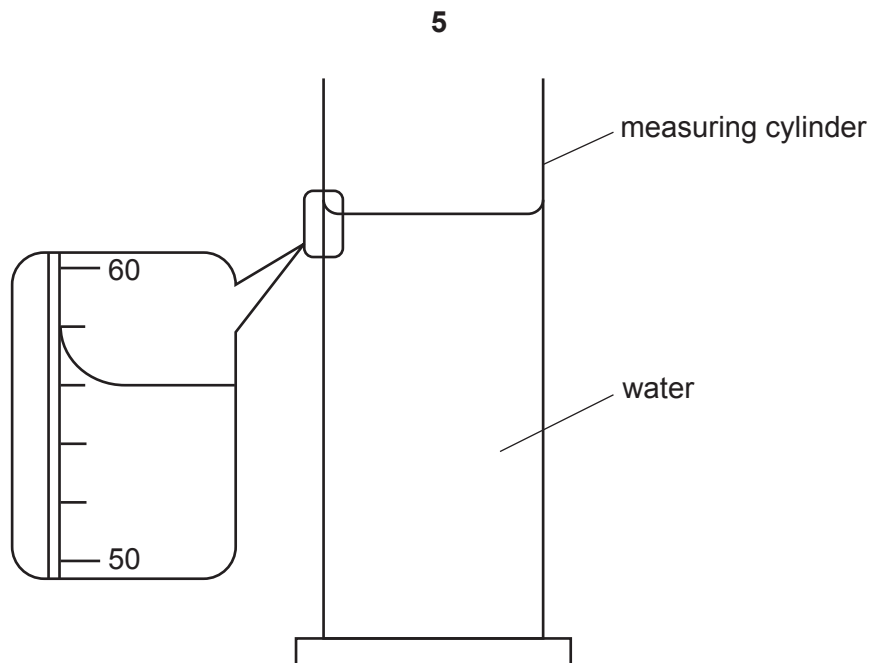


Fig. 1.4

- (ii) Describe briefly how a measuring cylinder is read to obtain a value for the volume of water.

.....

.....

..... [1]

- (f) (i) The student lowers the modelling clay into the water, as shown in Fig. 1.5.

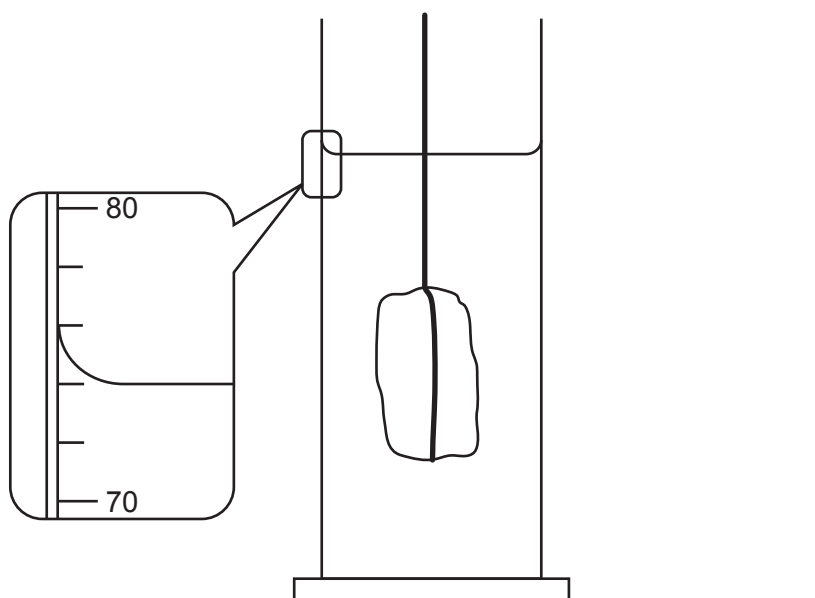


Fig. 1.5

Record the new reading V_2 of the measuring cylinder.

$V_2 =$ cm^3

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

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

- (ii)** Suggest which of ρ_A and ρ_B is likely to be the more accurate value.

Justify your answer by referring to method 1 and method 2.

.....

 [1]

[Total: 11]

- 2 A student investigates how the volume of water affects the rate at which water in a beaker cools. She uses the apparatus shown in Fig. 2.1.

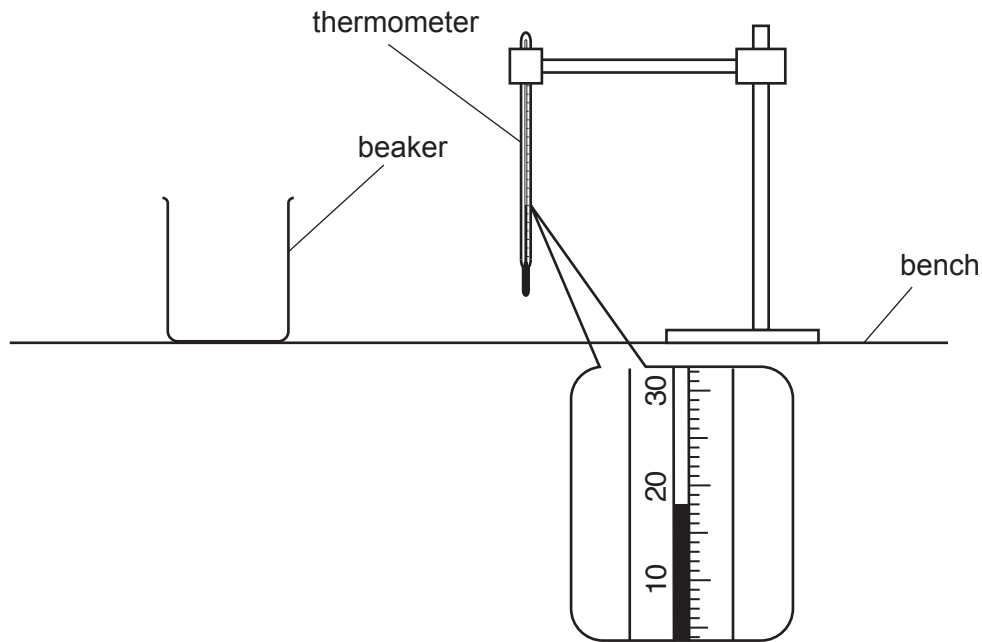


Fig. 2.1

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

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

- (b) The student pours a volume of 200 cm^3 of hot water into the beaker and records the temperature θ of the water at time $t = 0$.

She records the temperature of the water in the beaker every 30 s.

She pours the water out and pours a volume of 75 cm^3 of hot water into the beaker.

The student repeats the temperature measurements for this volume of water.

- (i) Describe **two** precautions that can be taken to ensure that temperature readings in the experiment are as accurate as possible.

1

.....

2

.....

[2]

- (ii) Her readings are shown in Table 2.1.

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
<i>t</i> /	<i>θ</i> /	<i>θ</i> /
0	87.5	85.5
30	85.5	82.0
60	84.0	78.5
90	82.5	75.0
120	81.0	72.0
150	80.0	69.5
180	79.0	67.0

[1]

- (c) Write a conclusion stating how the volume of water affects the rate of cooling of the water.

Justify your answer by reference to the results.

.....

.....

.....

..... [2]

- (d) (i) Using the values for 75 cm^3 of water, calculate the average cooling rate x_1 for 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.

$$x_1 = \dots\dots\dots$$

Using the values for 75 cm^3 of water, calculate the average cooling rate x_2 for the last 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 $t = 180\text{ s}$.

$$x_2 = \dots\dots\dots [2]$$

- (ii) A student states that it is important to start the two experiments in (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 **two** variables, other than initial water temperature, that he should control to obtain readings that are as close as possible to those in Table 2.1.

1
.....
2
..... [2]

[Total: 11]

- 3 A student determines the focal length of a converging lens.

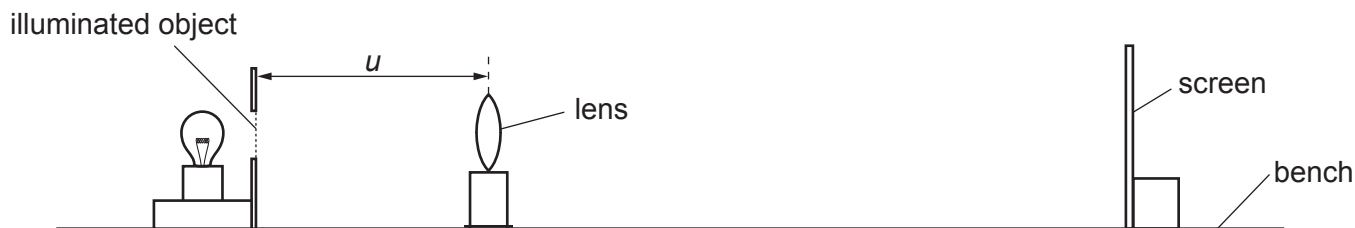


Fig. 3.1

- (a) The student sets up the apparatus as shown in Fig. 3.1.

He sets the distance u between the illuminated object and the lens to 25.0 cm.

He places the screen near the lens and moves the screen until a focused image of the illuminated object is seen on the screen.

Describe a technique for obtaining an image that is as sharp as possible.

.....

 [1]

- (b) The shapes of the illuminated object and the image seen on the screen are shown full size in Fig. 3.2 and Fig. 3.3.

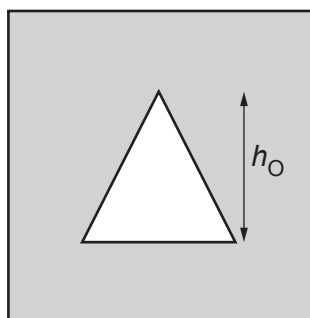


Fig. 3.2

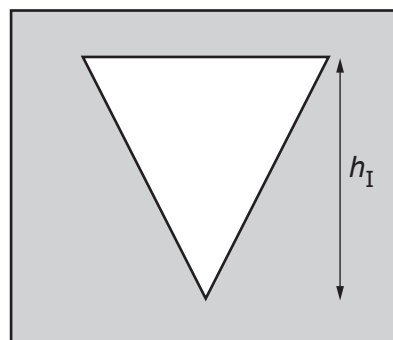


Fig. 3.3

- (i) Measure h_O , the height of the illuminated object, as shown in Fig. 3.2.

$h_O =$ cm

Measure h_I , the height of the image on the screen, as shown in Fig. 3.3.

$h_I =$ cm
 [2]

- (ii) Calculate a value W using your measurements from (b)(i) and the equation $W = \frac{h_O}{h_I}$.

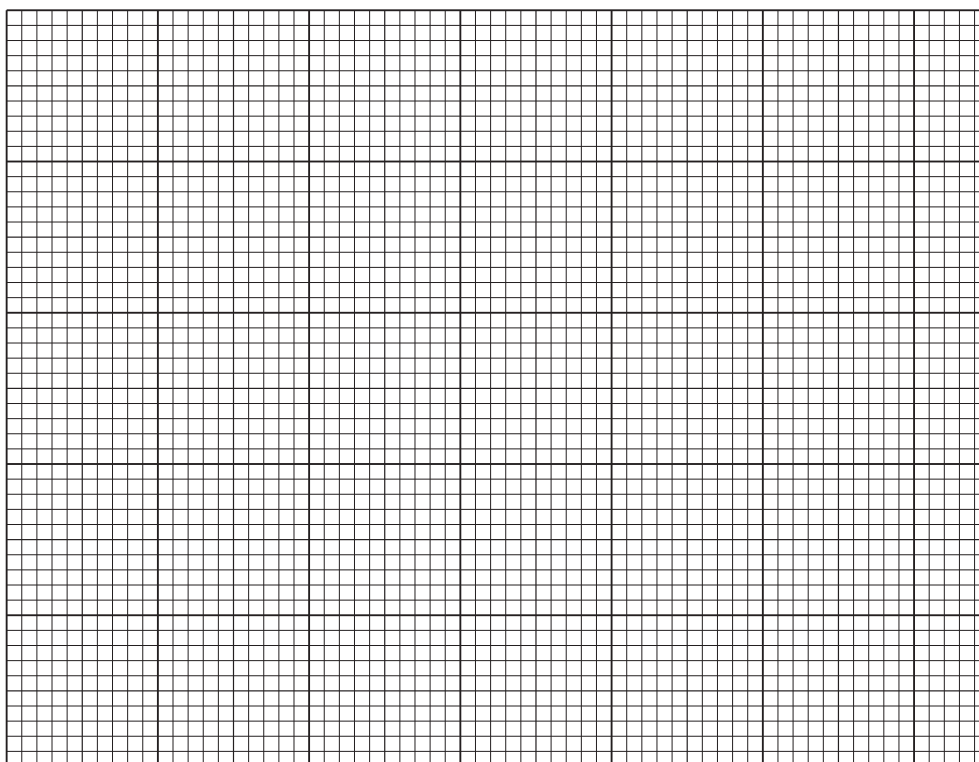
$W =$ [1]

- (c) The student repeats this procedure for $u = 20.0\text{ cm}$, 30.0 cm , 40.0 cm , 50.0 cm and 60.0 cm . His results are shown in Table 3.1.

Table 3.1

u/cm	h_I/cm	W
20.0	5.0	0.4
30.0	2.0	1.0
40.0	1.3	1.6
50.0	0.8	2.4
60.0	0.7	2.9

Plot a graph of u/cm (y -axis) against W (x -axis). Use the results from Table 3.1. 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]

[Total: 11]

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

Plan an experiment which enables her 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.

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.

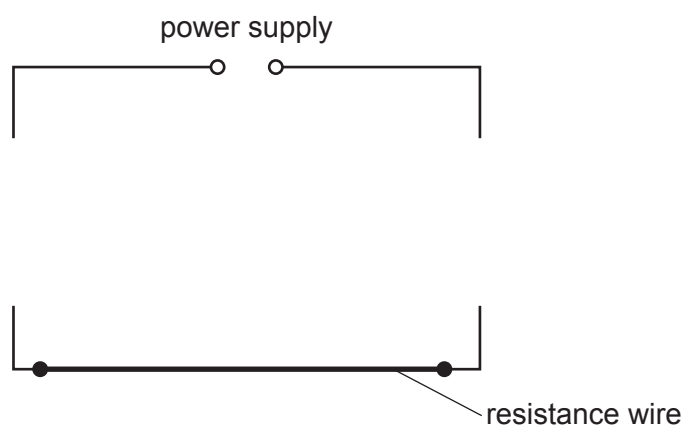


Fig. 4.1

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