Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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9192989554

COMBINED SCIENCE **0653/62**

Paper 6 Alternative to Practical **February/March 2018**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **18** printed pages and **2** blank pages.

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CAMBRIDGE
International Examinations

[Turn over

1 A student investigates the action of the enzyme amylase on starch. The laboratory temperature is 20 °C.

(a) **Method**

Step 1 The student labels two spotting tiles **A** and **B**.

Step 2 She adds two drops of iodine solution to six wells in each of the two spotting tiles, as shown in Fig. 1.1.

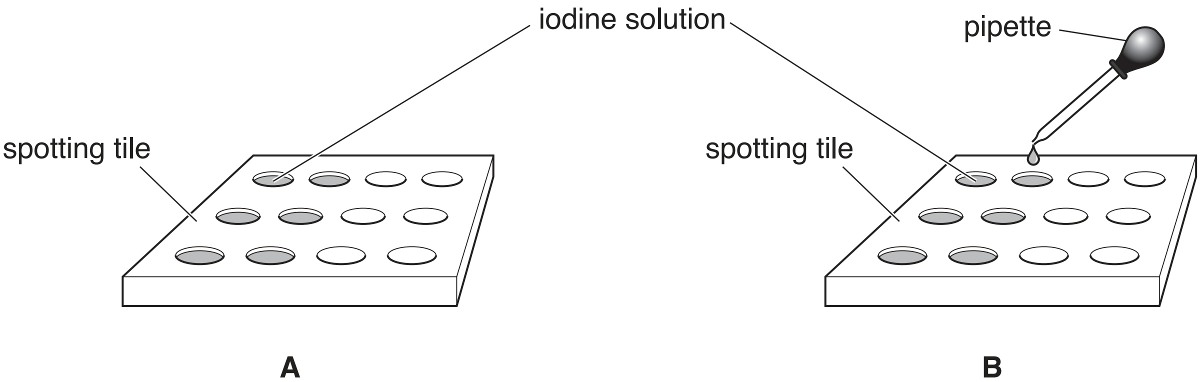


Fig. 1.1

Step 3 She labels two test-tubes **A** and **B**.

Step 4 She measures 5 cm^3 starch solution into each of the test-tubes **A** and **B**.

Step 5 She adds 1 cm^3 enzyme solution to test-tube **A** and mixes.

Step 6 She adds 1 cm^3 water to test-tube **B** and mixes.

Step 7 She places two drops from test-tube **A** into one of the wells in spotting tile **A** containing iodine solution and records in Table 1.1 the colour obtained.

Step 8 She then places two drops from test-tube **B** into one of the wells in spotting tile **B** containing iodine solution and records in Table 1.1 the colour obtained.

Step 9 She repeats steps 7 and 8 using a different well each time at 1 minute intervals for a further 5 minutes.

Table 1.1

time / minutes	colour in spotting tile	
	test-tube **A** (with enzyme)	test-tube **B** (without enzyme)
0	blue-black	blue-black
1	blue-black	blue-black
2	blue-black	blue-black
3	dark brown	blue-black
4	dark brown	blue-black
5	brown	blue-black

(i) Describe and explain the results for test-tube **A** and test-tube **B**.

test-tube **A** ....

....

....

test-tube **B** ....

....

....
[3]

(ii) Predict the results for test-tube **A** if the method had been carried out at 35 °C rather than at 20 °C.

....[1]

(b) Reducing sugar is produced as a result of this enzyme-controlled reaction.

Describe the method that you would use to confirm the presence of reducing sugar in test-tube **A** after 5 minutes.

In your answer you should include the observation for a positive result and explain any safety precautions you would take.

....

....

....

....[4]

(c) **(i)** The student tests the contents of test-tube **A** for the presence of protein and obtains a positive result. Suggest why there is protein present in this test-tube.

....[1]

(ii) The student tests the contents from the well for time = 0 for spotting tile **A** with biuret solution.

Suggest why it might be difficult to make a conclusion from this test.

....[1]

2 A student investigates the effect of varying concentration on the rate of the reaction between hydrochloric acid and calcium carbonate (marble chips).

The student must first make the different concentrations of hydrochloric acid.

He is given hydrochloric acid of concentration 2.0 mol / dm^3 which he uses for one of his reactions. He also uses this solution to make more dilute solutions.

He prepares 20 cm^3 of hydrochloric acid of concentration 1.5 mol / dm^3 by mixing 15 cm^3 of the 2.0 mol / dm^3 hydrochloric acid with 5 cm^3 of water, as shown in Table 2.1.

He prepares 20 cm^3 of hydrochloric acid of concentration 0.75 mol / dm^3 by mixing 7.5 cm^3 of the 2.0 mol / dm^3 hydrochloric acid with 12.5 cm^3 of water, as shown in Table 2.1.

Table 2.1

concentration of hydrochloric acid / (mol / dm^3)	volume of hydrochloric acid of concentration 2.0 mol / dm^3 / cm^3	volume of water / cm^3
2.0	20	0
1.5	15	5
1.0		
0.75	7.5	12.5

(a) Complete Table 2.1 to show the volumes of the 2.0 mol / dm^3 hydrochloric acid and water which must be mixed to make 20 cm^3 of hydrochloric acid of concentration 1.0 mol / dm^3. [1]

He sets up the apparatus as shown in Fig. 2.1.

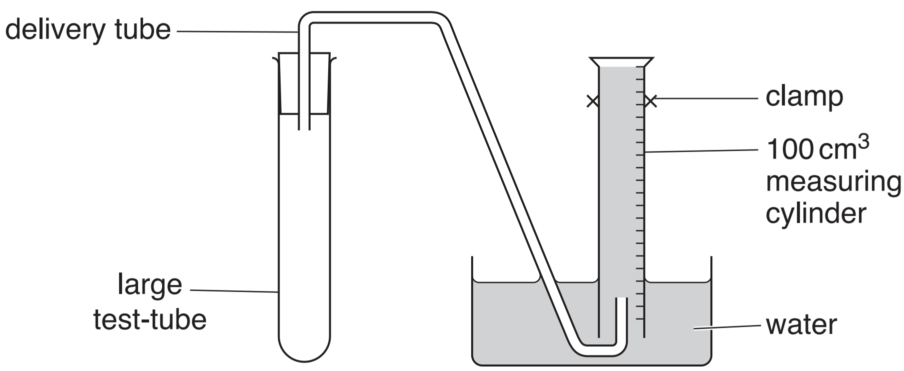


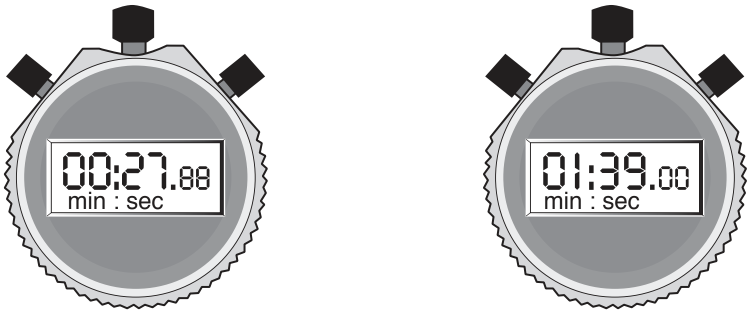
Fig. 2.1

(b)
- He removes the large test-tube from the apparatus.
- He places four marble chips into the large test-tube.
- He adds 20 cm^3 hydrochloric acid of concentration 2.0 mol / dm^3 to the marble chips in the large test-tube.
- He replaces the large test-tube in the apparatus as quickly as possible and starts the stopclock.
- He stops the stopclock when 10 cm^3 of gas have been collected in the measuring cylinder.
- He washes out the large test-tube and discards the marble chips.

He repeats **(b)** for concentrations of hydrochloric acid of 1.5, 1.0 and 0.75 mol / dm^3.

(i) Fig. 2.2 shows the stopclock readings for this experiment using hydrochloric acid of concentrations 2.0 and 0.75 mol / dm^3.

Record in Table 2.2 the time t to the nearest second for each of these readings. [2]



2.0 mol / dm^3 0.75 mol / dm^3

Fig. 2.2

Table 2.2

concentration of acid / (mol / dm^3)	time t to collect 10 cm^3 of gas / s	measure of rate of reaction, $\frac{1}{t}$
2.0		
1.5	45	0.022
1.0	62	0.016
0.75		

(ii) Use Table 2.2 to make a conclusion about the relationship between the concentration of the hydrochloric acid and the time t to collect 10 cm^3 of gas.

....

....

....[1]

(iii) $\frac{1}{t}$ is a measure of the rate of reaction.

Calculate $\frac{1}{t}$ for concentrations 2.0 mol / dm^3 and 0.75 mol / dm^3 of acid in Table 2.2.

Record in Table 2.2 the values of $\frac{1}{t}$ **to 2 significant figures**.

[2]

(iv) 1. Use the values of $\frac{1}{t}$ in Table 2.2 to calculate the ratio of $\frac{1}{t}$ for concentration 2.0 mol / dm^3 to $\frac{1}{t}$ for concentration 1.0 mol / dm^3.

ratio = ...

2. Use the values of $\frac{1}{t}$ in Table 2.2 to calculate the ratio of $\frac{1}{t}$ for concentration 1.5 mol / dm^3 to $\frac{1}{t}$ for concentration 0.75 mol / dm^3.

ratio = ...

3. Use these ratios to state and explain whether halving the concentration of hydrochloric acid always halves the rate of reaction. You should refer to experimental error in your answer.

....

....

....[2]

(c) **(i)** Suggest why hydrochloric acid of concentrations greater than 2.0 mol / dm^3 are not used in this experiment.

....

....[1]

(ii) Suggest one source of inaccuracy in **this procedure**.

....

....[1]

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3 A student measures the electromotive force (voltage) of a power supply.

(a) She sets up the circuit shown in Fig. 3.1 and follows the instructions below.

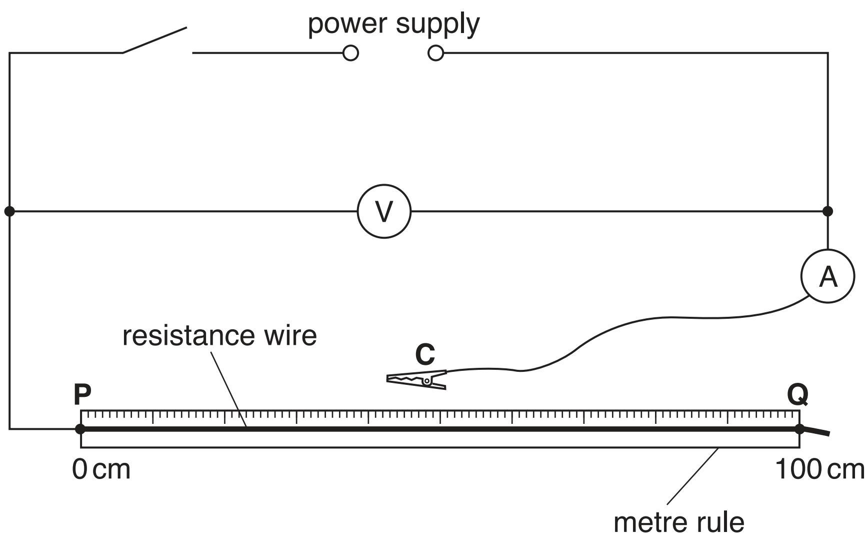


Fig. 3.1

- Connect the crocodile clip **C** to the resistance wire at a distance d = 100.0 cm from the end **P** of the wire.
- Switch on the circuit.
- Record the ammeter and voltmeter readings.
- Switch off the circuit.

The ammeter and voltmeter readings are shown in Fig. 3.2.

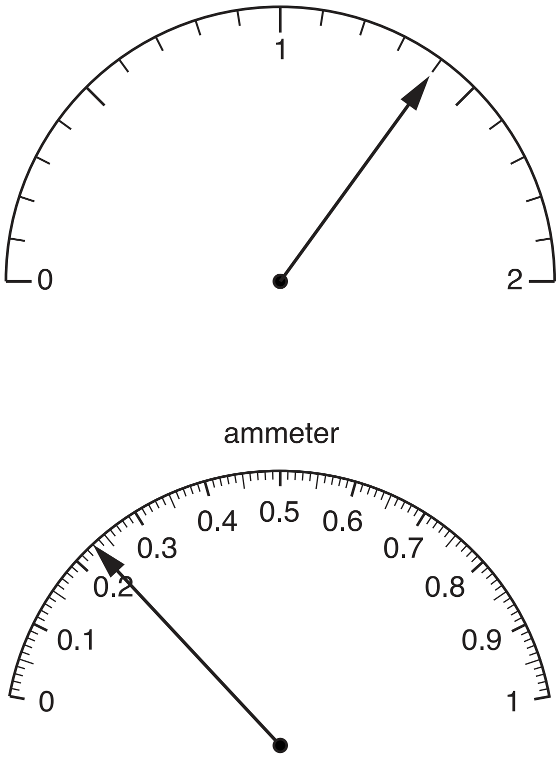


Fig. 3.2

(i) Read and record in Table 3.1 the potential difference V and the current I. Record your answers to an appropriate number of significant figures. [3]

(ii) Add appropriate units to the headings of the columns in Table 3.1. [1]

Table 3.1

d/cm	V/..............	I/..............
100.0	....	....
80.0	1.35	0.28
60.0	1.30	0.36
40.0	1.20	0.50
20.0	1.00	0.83

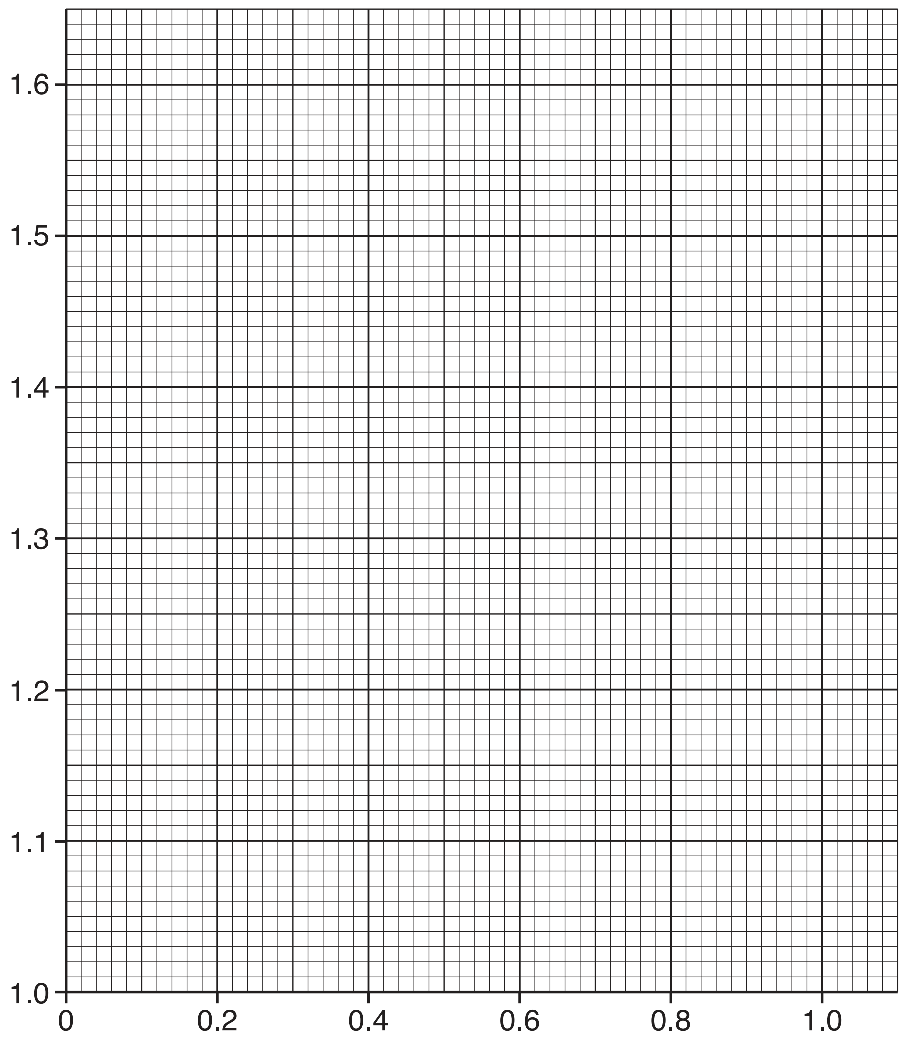
(iii) She repeats the procedure in **(a)** for values of d = 80.0 cm, 60.0 cm, 40.0 cm and 20.0 cm. Her results are shown in Table 3.1.

Explain why the student switches off the circuit between taking readings.

....

....[1]

(b) **(i)** On the grid provided, plot a graph of V (vertical axis) against I. [2]



(ii) Draw the best-fit straight line. [1]

(c) Continue your line until it crosses the vertical (V) axis.

The value of the intercept on the vertical axis is the electromotive force (voltage) of the power supply.

Write down your value in the space below.

electromotive force of power supply = ... V [1]

(d) Explain why, when carrying out this experiment, it is important not to choose values of d less than 10.0 cm.

....

....[1]

4 A student investigates diffusion in large and small organisms by observing the movement of acid into two different sized cubes of jelly.

The jelly used to make the cubes is neutral and colourless. When the student makes the jelly cubes she adds an indicator and also chemical **C** to make the jelly pink. The indicator is pink in alkali and colourless in acid.

(a) **(i)** Explain why the jelly is pink at the start of the investigation.

....[1]

(ii) Suggest the identity of chemical **C**.

....[1]

(b) The student cuts one small cube and one large cube from the jelly. She places the small cube of jelly in a beaker and covers the cube with acid.

Complete Fig. 4.1 to show how she sets up the apparatus. Label your diagram fully. The jelly cube has been drawn for you.

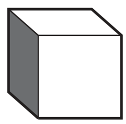


Fig. 4.1

[2]

(c) As the acid moves into the jelly cube, the colour changes from pink to colourless.

She times how long it takes for the small cube to become completely colourless.

She repeats this procedure with the large jelly cube.

The dimensions of the cubes are shown in Table 4.1.

Table 4.1

cube	length of each side / mm	minimum distance moved by the acid / mm	time / seconds
small cube	10		
large cube	20		

Calculate the minimum distance the acid has to move in each cube to decolourise the cube completely. Record these values in Table 4.1.

[1]

(d) The stopclocks in Fig. 4.2 show the times taken for the two cubes to become completely colourless. Read and record these values in Table 4.1. [2]

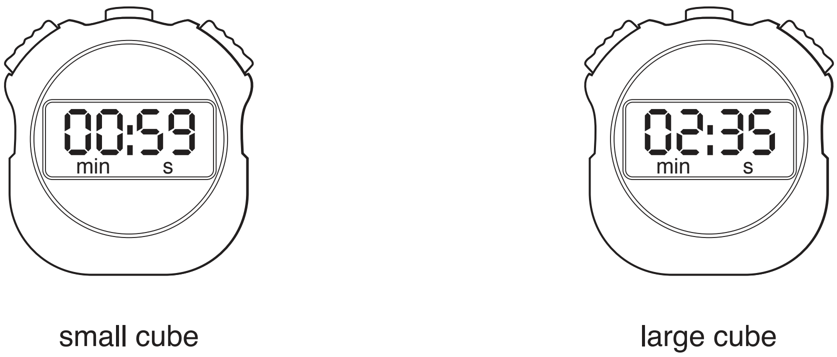


Fig. 4.2

(e) **(i)** Use the data in Table 4.1 to explain the difference in the time taken for each cube to become completely colourless.

....

....[1]

(ii) The teacher suggests that one of the cubes should take twice as long as the other to become completely colourless.

State and explain if the results support this suggestion.

....

....[1]

(iii) Describe one source of error in the experiment.

....

....[1]

5 A student investigates the reaction between **H** and ammonia solution.

H is a solution of a copper salt.

- He places 10 cm^3 of **H** in each of six large test-tubes.
- He adds different volumes of ammonia solution and water to each test-tube, as shown in Table 5.1.
- He shakes each test-tube and leaves the contents to settle for several minutes.
- He measures the height *h* of any precipitate formed in each test-tube by measuring from the bottom of the test-tube to the top of the precipitate.
- Test-tube **4** is shown in Fig. 5.1.

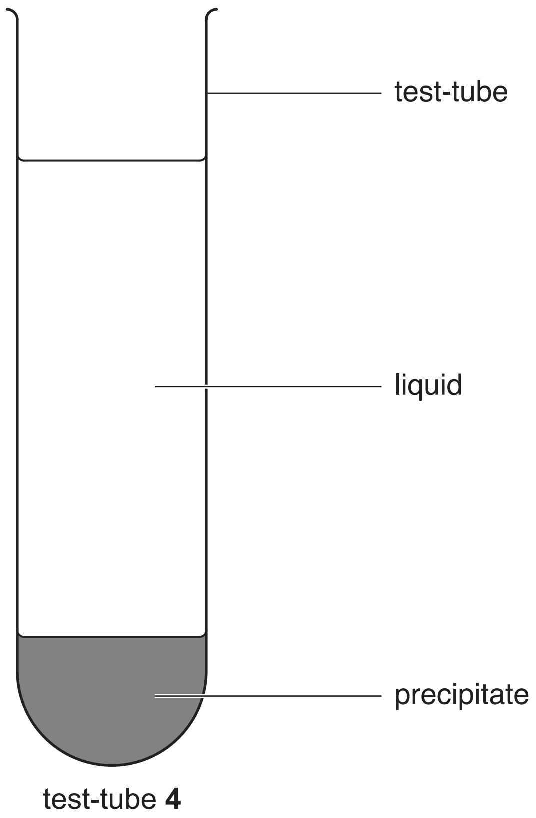


Fig. 5.1

- He records in Table 5.1 the heights *h* to the nearest millimetre.

Table 5.1

test-tube	volume of ammonia solution / cm^3	volume of water / cm^3	height *h* of precipitate / mm
1	5	35	9
2	10	30	17
3	15	25	26
4	20	20	
5	25	15	8
6	30	10	0

(a) **(i)** Measure and record in Table 5.1 the height *h* of the precipitate in test-tube **4** shown in Fig. 5.1.

[1]

(ii) Describe what the student observes in test-tubes **1** and **6**.
Include colours in your answer.

test-tube **1** ....

test-tube **6** ....
[2]

(b) **(i)** Suggest why the amount of water is varied in this experiment.

....

....[1]

(ii) Use Fig. 5.2 to explain why the volume of a precipitate with height h = 20 mm is not twice the volume of a precipitate with height h = 10 mm.

....

....[1]

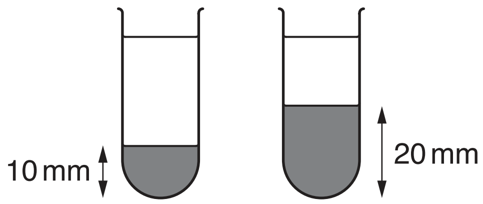


Fig. 5.2 (not to scale)

(c) Use the results in Table 5.1 to describe and explain the relationship between the height *h* of the precipitate and the volume of ammonia solution added.

....

....

....

....[3]

(d) The student repeats the experiment in **(a)** using sodium hydroxide solution instead of ammonia solution to react with the copper salt solution **H**.

As in Table 5.1, the maximum height *h* of precipitate formed is reached in test-tube **3** and is 26 mm.
However, the heights of precipitate in test-tubes **4**, **5** and **6** have the same value as each other.

(i) Explain why the heights *h* of precipitate in test-tubes **4**, **5** and **6** differ from those using ammonia solution, as shown in Table 5.1.

....

....[1]

(ii) Predict the value for the heights *h* of precipitate in test-tubes **4**, **5** and **6**.

h = ...mm [1]

6 A student measures the density of modelling clay by two different methods and compares her answers.

(a) Method 1

She takes a piece of modelling clay and shapes it into a rectangular block. Fig. 6.1 shows the block from two different views.

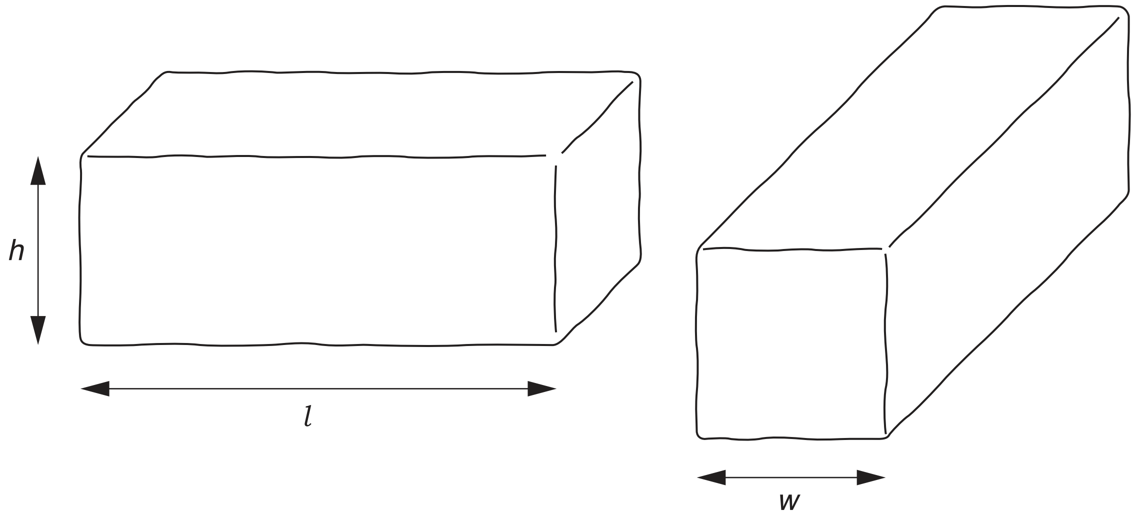


Fig. 6.1

(i) Measure the length l, width w and height h of the block to the nearest 0.1 cm and record your results below.

l = ... cm

w = ... cm

h = ... cm
[2]

(ii) Calculate the volume V_1 of the block by using the equation shown.

$$V_1 = l \times w \times h$$

V_1 = ... cm^3 [1]

(iii) State one source of inaccuracy in the measurement of the volume of the block.

....

....[1]

(iv) The student uses a length of cotton to attach the block of modelling clay to a newton meter, as shown in Fig. 6.2.

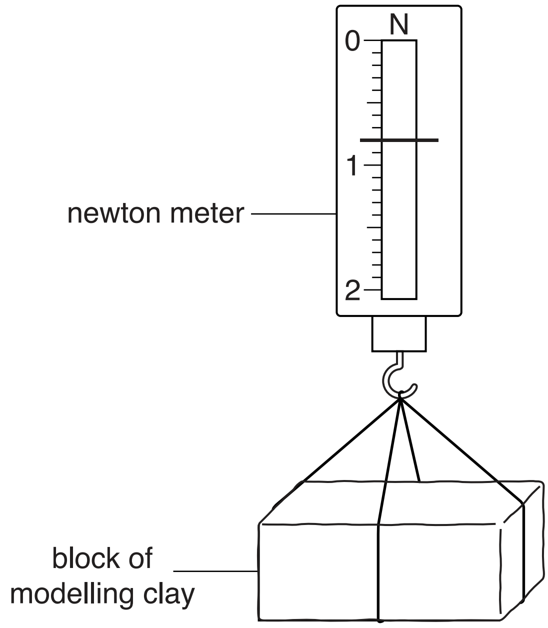


Fig. 6.2

Read the newton meter in Fig. 6.2 and record the weight W of the block of modelling clay.

W = ... N [1]

(v) Use your answers from **(a)(ii)** and **(a)(iv)** to calculate the density d_1 of modelling clay by using the equation shown.

$$d_1 = \frac{100\,W}{V_1}$$

d_1 = ... g/cm^3 [1]

(b) **Method 2**

The student adds 40 cm^3 of water to a measuring cylinder.

She lowers the block carefully into the water.

The new reading V_2 of the measuring cylinder is shown in Fig. 6.3.

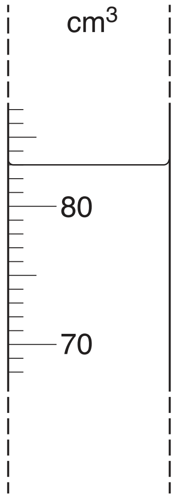


Fig. 6.3

(i) Record the reading V_2 on the measuring cylinder in the space below.

V_2 = ... cm^3 [1]

(ii) Use your answers from **(a)(iv)** and **(b)(i)** to calculate the density d_2 of the modelling clay using the equation shown.

$$d_2 = \frac{100\,W}{V_2 - 40}$$

d_2 = ... g / cm^3 [1]

(c) **(i)** State which method you consider to be the more accurate. Give a reason to support your answer.

....

....

....[1]

(ii) Suggest why the student obtained more accurate results by carrying out the two methods of determining the density of the clay in the order that she did.

....

....[1]

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