



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

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COMBINED SCIENCE

0653/61

Paper 6 Alternative to Practical

May/June 2010

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 a soft pencil for any diagrams, graphs, tables or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
Total	

This document consists of **19** printed pages and **1** blank page.



- 1 One of the characteristics of living things is the ability to detect changes in their surroundings and respond to them. This is important for survival.
- (a) A choice chamber was used to study the responses of woodlice (small invertebrates) to the intensity of light and the amount of moisture in their surroundings. The choice chamber is shown in Fig. 1.1.

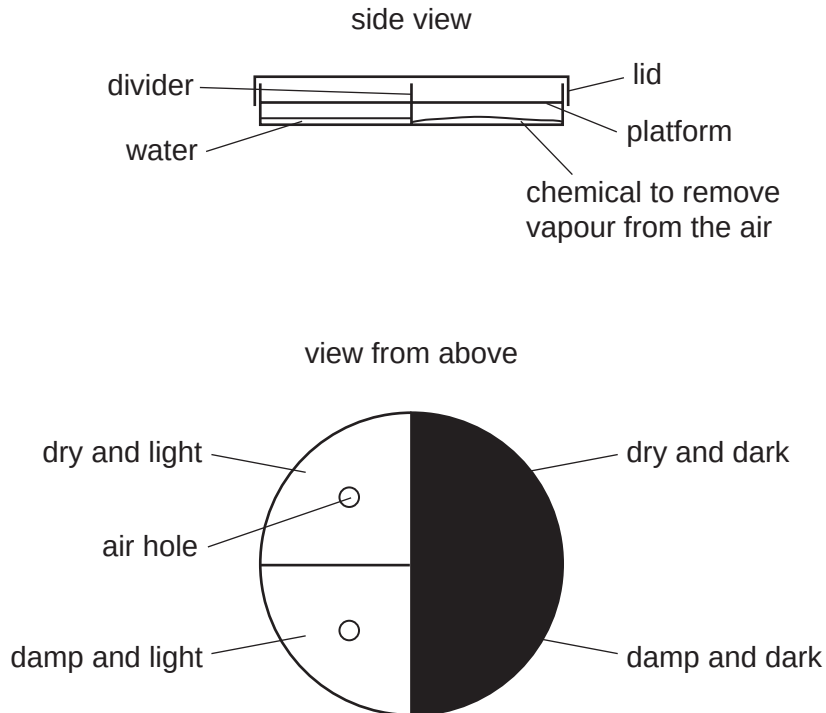


Fig. 1.1

- The divider separated the base of the chamber in half. One side was dry and the other side was damp.
- A platform for the woodlice was made from muslin (a type of net) and this covered the base.
- Half of the lid was covered with light-proof paper. The lid was placed so that four different conditions were produced. The conditions were:
dry and dark,
damp and dark,
dry and light,
damp and light.
- Ten woodlice were placed on the centre of the muslin and left for 15 minutes.
- After this time the number of woodlice in each area was counted.

The experiment was done three times. After each test the lid was removed and the number of woodlice in each area was counted. The platforms when viewed from above are shown in Fig. 1.2.

- (i) Count the number of woodlice in each area of the choice chamber and enter the numbers in Table 1.3. Test **A** has been done for you.

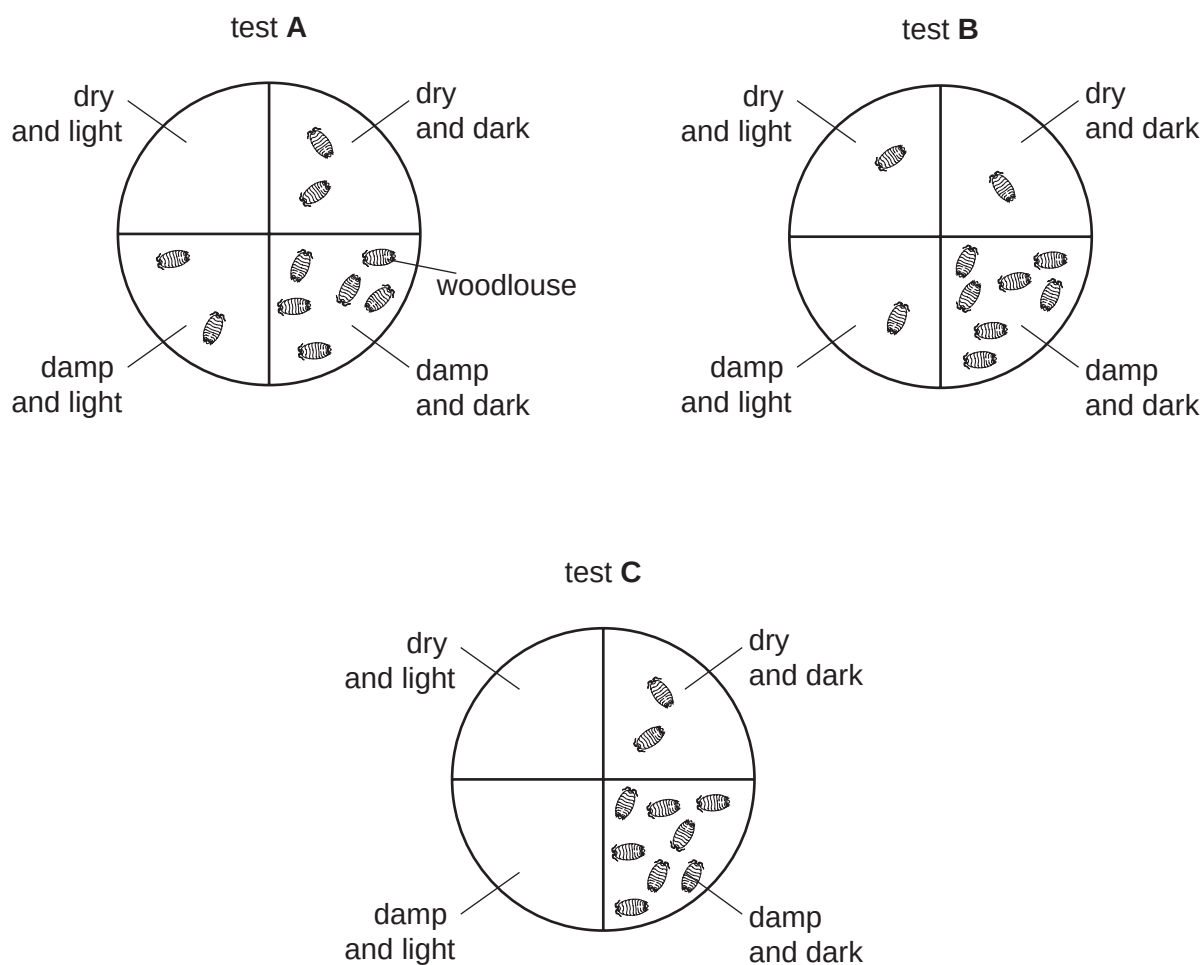


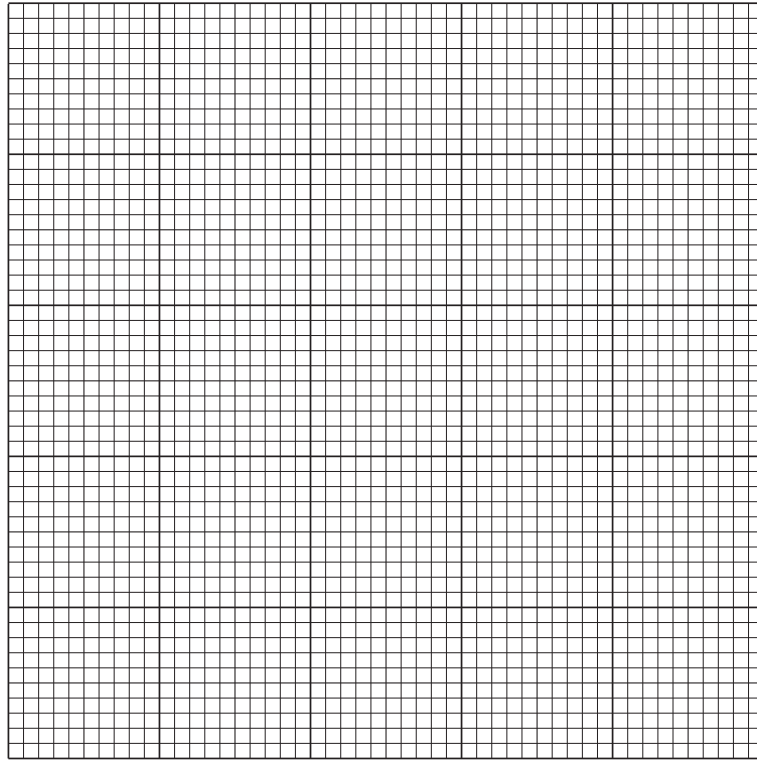
Fig. 1.2

Table 1.3

conditions in each area	number of woodlice counted			average number of woodlice
	test A	test B	test C	
dry and dark	2			
damp and dark	6			
damp and light	2			
dry and light	0			

- (ii) Calculate the average numbers of woodlice in each area and complete the last column of Table 1.3. [2]

- (b) Draw a bar chart to show the average number of woodlice (vertical axis) found in each condition.



[3]

- (c) (i) Which **two** external conditions did the woodlice prefer?

..... and [1]

- (ii) Choose **one** of these conditions and suggest how this may help the woodlice to survive.

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

- 2 A student is investigating the acceleration of a falling mass due to the force of gravity using a ticker-timer. This apparatus is shown in Fig. 2.1.

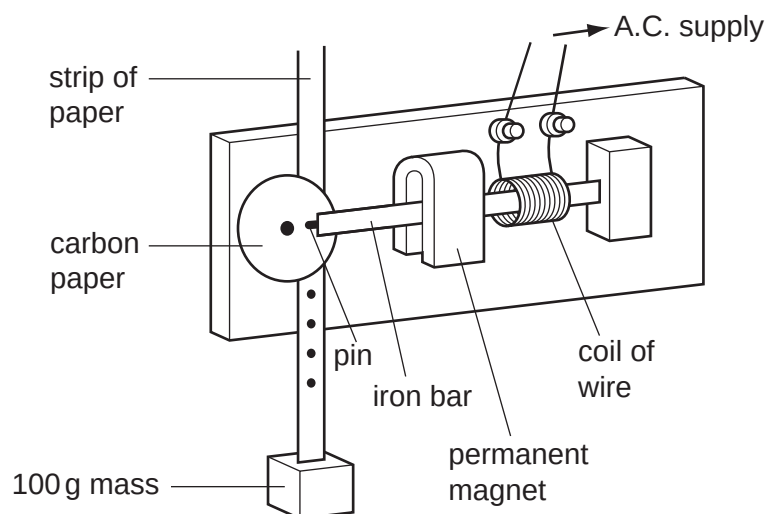


Fig. 2.1

The iron bar is fixed at one end. The bar passes between the poles of a permanent magnet. An alternating current passing through the coil causes the bar to vibrate 50 times per second. At the other end of the bar the pin hits the carbon paper disc making a mark on the paper strip each time the bar vibrates.

- (a) (i) Explain what is meant by an *alternating current*.

.....
 [1]

- (ii) Explain why the alternating current makes the iron bar vibrate.

.....

 [2]

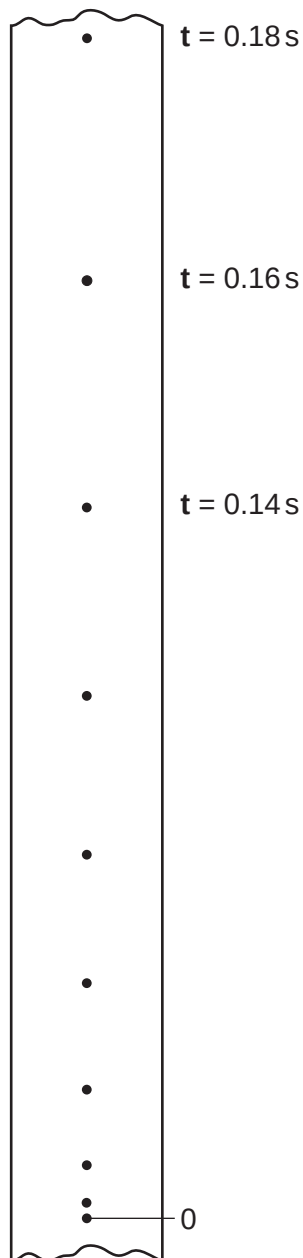


Table 2.3

time / s	distance from point 0 / cm	distance from point 0 / m
0.00	0.0	0.000
0.02	0.2	0.002
0.04	0.7	0.007
0.06	1.7	0.017
0.08	3.1	0.031
0.10	4.8	0.048
0.12	6.9	0.069
0.14		
0.16		
0.18		

Fig. 2.2

A 100 g mass is fixed on the end of the strip of paper. The student allows the mass to fall. It pulls the paper through the ticker-timer as shown in Fig. 2.1. Marks are made on the paper strip.

Part of the paper strip is shown in Fig. 2.2. The student is measuring the distance of each mark from the start, point 0. He has recorded the first six distances in Table 2.3.

(b) (i) Using Fig. 2.2, measure the distances from point 0 to the dots at $t = 0.14\text{ s}$, 0.16 s , and 0.18 s , in centimetres, to the nearest millimetre. Record the distances in Table 2.3. [3]

(ii) Complete Table 2.3 by converting these three distances from centimetres to metres. [1]

- (iii) Use data from Table 2.3 to show that the mass and paper accelerated as the

.....

 [1]

- (c) Calculate **g**, the acceleration due to gravity, by using data from Table 2.3 and the following equation.

$$g = \frac{2 \times \text{distance of fall in metres}}{(\text{time of fall in seconds})^2}$$

$$g = \dots\dots\dots \text{m/s}^2 \quad [2]$$

- 3 The science teacher gives a student the apparatus shown in Fig. 3.1. She also gives three solutions, **X**, **Y** and **Z** of different concentrations of the same acid.

The student must find out which of the three acid solutions is the most concentrated.

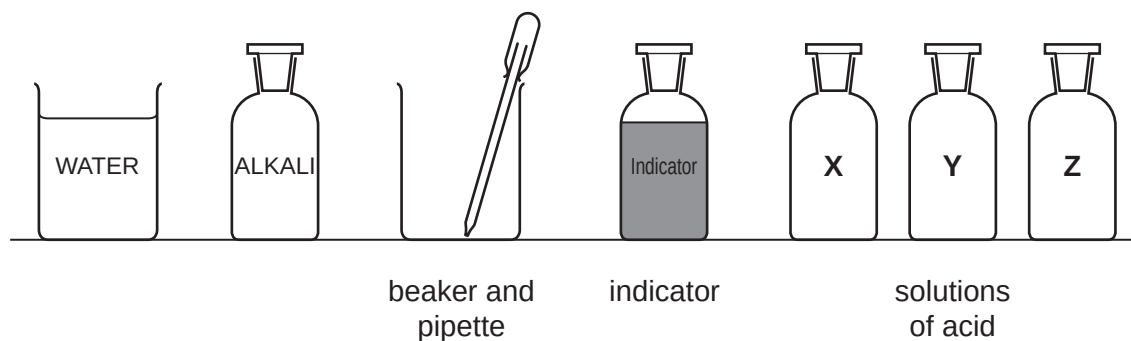


Fig. 3.1

- The student places 5 cm^3 of the acid **X** in the beaker.
- She adds 1 drop of the indicator.
- She adds the alkali, 1 drop at a time, until the indicator changes colour.
- She records the number of drops of alkali added in Table 3.2.
- She repeats the experiment with the acid solutions **Y** and **Z**.

Table 3.2

acid solution	number of drops
X	22
Y	17
Z	8

Table 3.3 below shows the colour of the indicator at different levels of pH.

Table 3.3

colour of indicator	red	orange
pH of solution	5	9

- (a) State the colour of the indicator

in acid, ...

in alkali.

[1]

- (b) (i) Which of the acid solutions, **X**, **Y** or **Z** is the most concentrated?

..... [1]

- (ii) Explain your answer.

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

- (c) Suggest why the beaker of water is needed.

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

- (d) Name an alkali that can be used in this experiment.

..... [1]

The student wants to find out the name of the acid used in the experiment. She places 2 cm^3 of solution **X** in a test-tube and adds aqueous silver nitrate. A white precipitate is formed.

- (e) (i) Name the white precipitate.

..... [1]

- (ii) Name the acid in solution **X**.

..... [1]

- (f) Describe how you could use pieces of magnesium ribbon to find out which of the three solutions is the most concentrated.

.....
.....
.....
.....
..... [3]

- 4 A student did an experiment to find the density of salt solution. He floated a test-tube containing sand, in water and then in the salt solution. This is shown in Fig. 4.1.

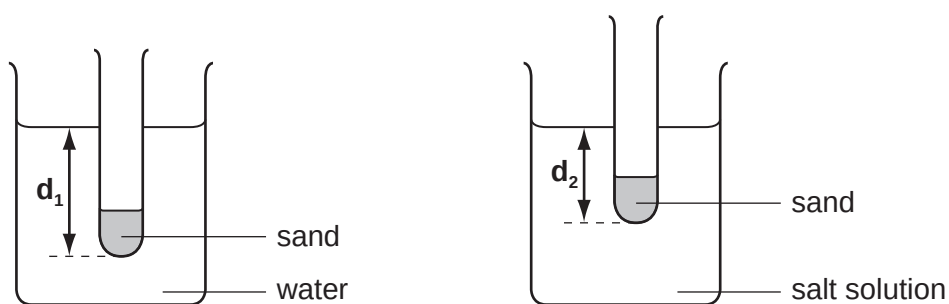


Fig. 4.1

- He placed dry sand in the test-tube and floated it in water. He measured the depth d_1 from the water surface to the bottom of the tube. He recorded this in the first row of Table 4.2, **experiment 1**.
- He placed the same tube in the salt solution and found the depth d_2 . He recorded this in the first row of Table 4.2.
- He emptied some of the sand out of the test-tube and found d_1 and d_2 again, **experiment 2**.
- He emptied out more of the sand and found another set of readings for d_1 and d_2 , **experiment 3**.

Table 4.2

experiment number	depth d_1 in water / millimetres	depth d_2 in salt solution / millimetres
1	104	86
2	85	70
3		

Fig. 4.3 shows the tube floating in water and in salt solution for **experiment 3**. The student has placed a ruler graduated in millimetres next to the tube.

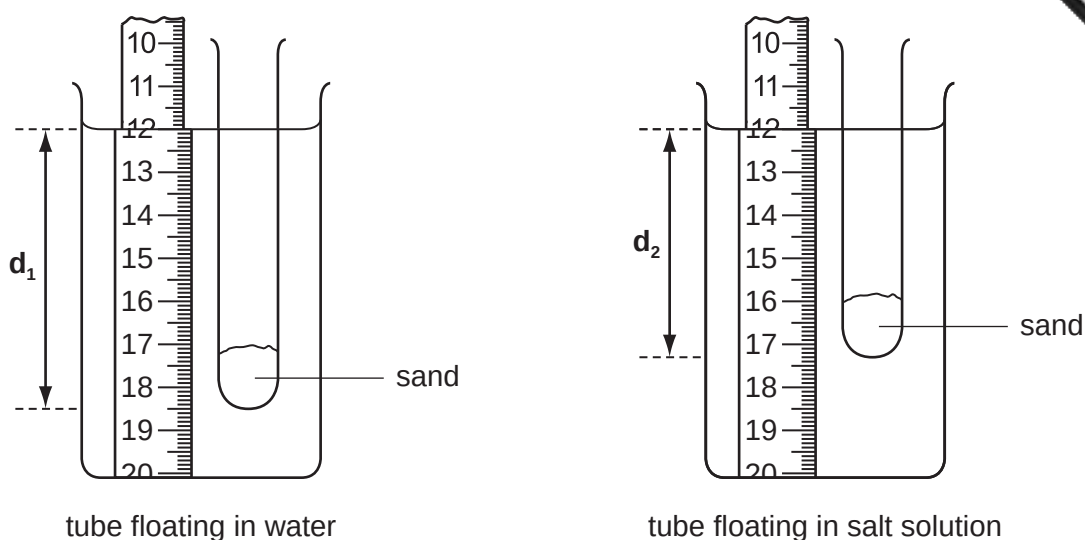


Fig. 4.3

- (a) (i)** Briefly explain why the ruler appears larger when viewed through the side of the beaker.

.....
 [1]

- (ii)** Use the scale of the ruler to calculate the depth d_1 for the tube floating in water.

Record the value in Table 4.2.

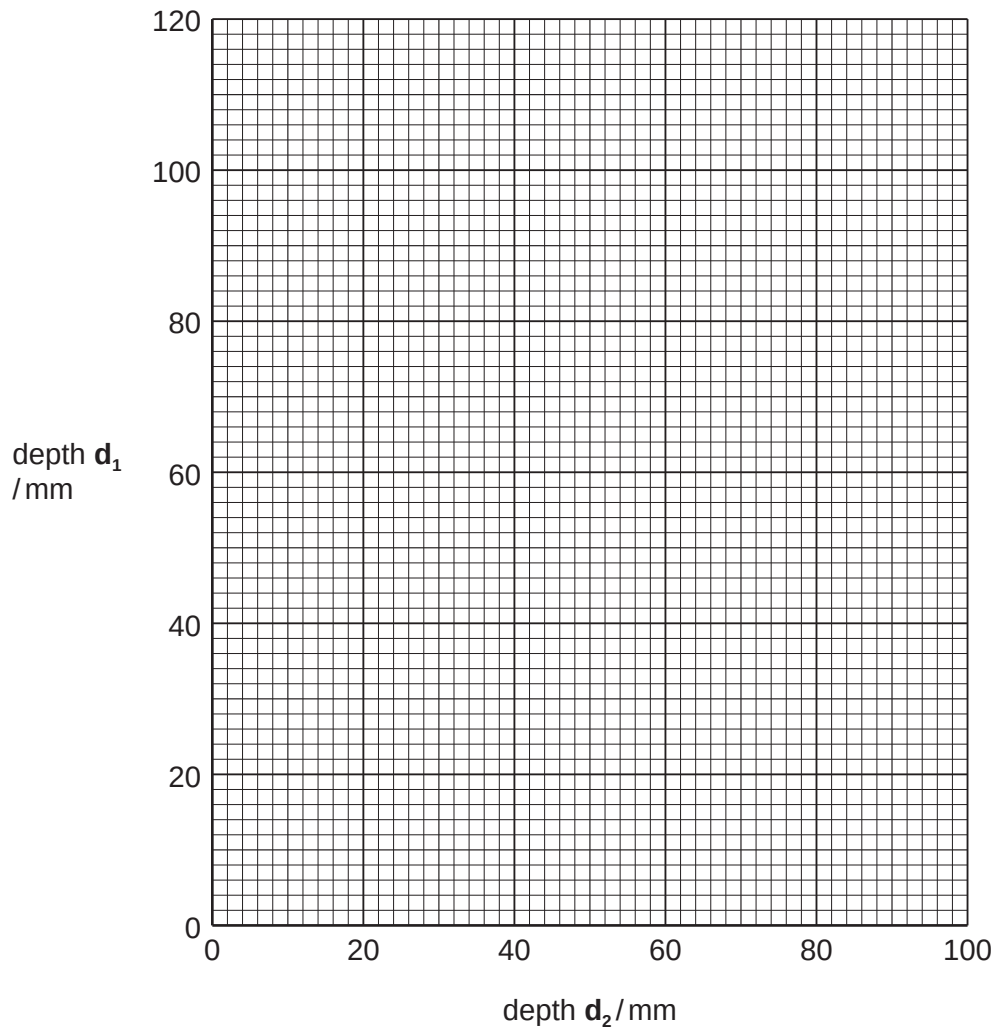
depth d_1 = ... mm [2]

- (iii)** Use the scale of the ruler to calculate the depth d_2 for the tube floating in salt solution.

Record the value in Table 4.2.

depth d_2 = ... mm [1]

- (b) On the grid below, plot the values for d_1 from Table 4.2 (vertical axis) against d_2 (horizontal axis). Draw the best straight line and extend it to pass through the point (0,0).



[2]

- (c) Calculate the gradient of the line, showing on your graph the values you use to do this. The gradient is numerically equal to the density of the salt solution in grams per cubic centimetre.

gradient = ... [2]

- (d) Describe another method for finding the density of a liquid using a pipette or burette, a beaker and a balance.

.....

.....

.....

.....

..... [2]

- 5 Some plants show differences between leaves found in sunny areas of the plant (sun leaves), and leaves found in shaded areas (shade leaves).

(a) A student was supplied with two leaves, labelled **sun leaf** and **shade leaf**. Drawings of the two leaves are shown in Fig. 5.1.

- (i) Measure the maximum length of each leaf, excluding the petiole (stalk). Write your measurements below each diagram.
- (ii)

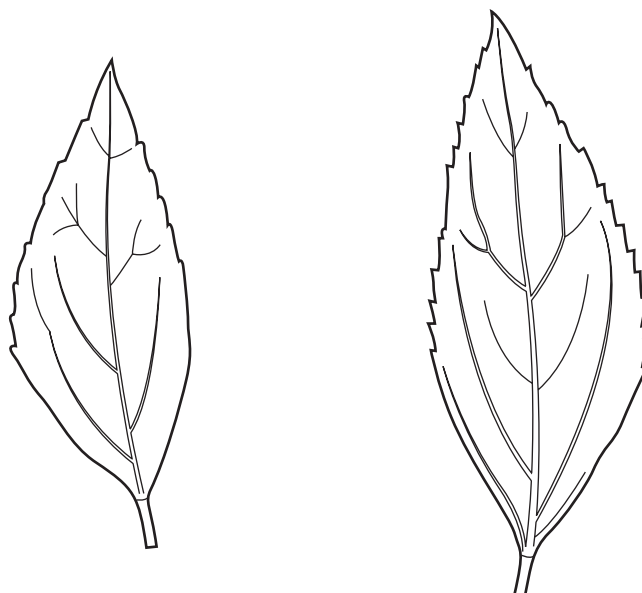


Fig. 5.1

sun leaf

shade leaf

length = ... mm

length = ... mm [2]

- (ii) The leaves clearly have different areas.

One leaf has a larger surface than the other.

Suggest an advantage to the leaf with the larger area.

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

- (b) The diagrams in Fig. 5.2 show cross-sections of a sun leaf and a shade leaf as using a microscope.

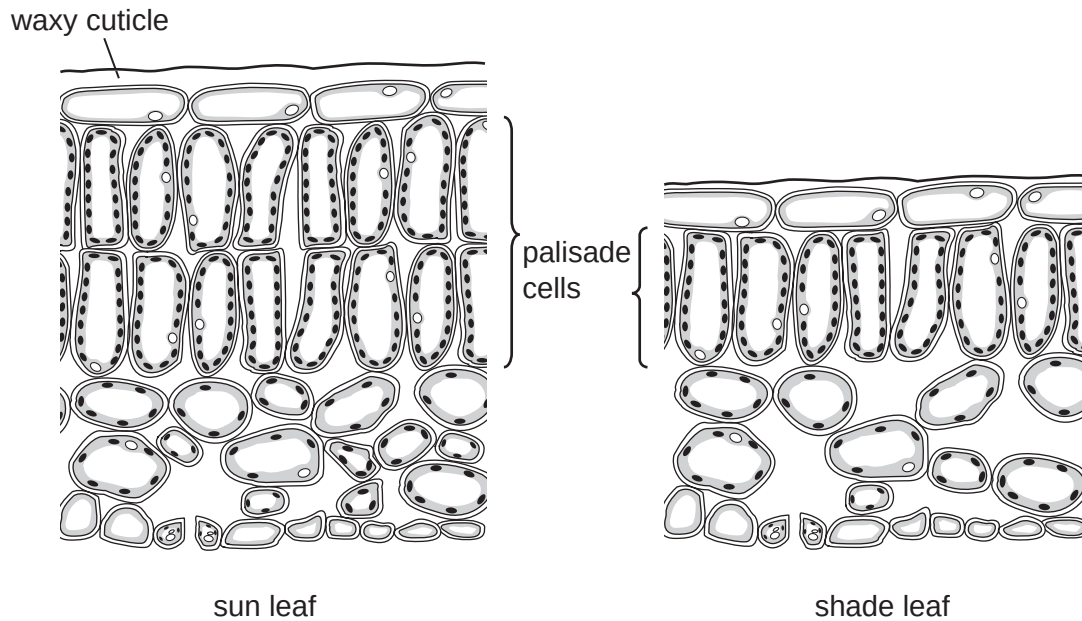


Fig. 5.2

Construct a table to compare these two diagrams. Include the following features; **thickness of leaf, number of palisade cells, size of air spaces.**

[4]

- (c) Choose any **one** feature of the sun leaf in Fig. 5.2 and explain how this feature is a good adaptation for photosynthesis.

feature

explanation

..... [2]

- (d) The sun leaf usually has a thicker cuticle than the shade leaf. The cuticle is a thin, waxy layer covering the leaf. For
Trainer's

Suggest an advantage that this thicker cuticle gives to the sun leaf.

..... [1]

- 6 The science teacher is showing the class an experiment. He makes carbon dioxide, converts it into carbon monoxide. Then he reacts the carbon monoxide with copper(II) oxide.

Fig. 6.1 shows the apparatus.

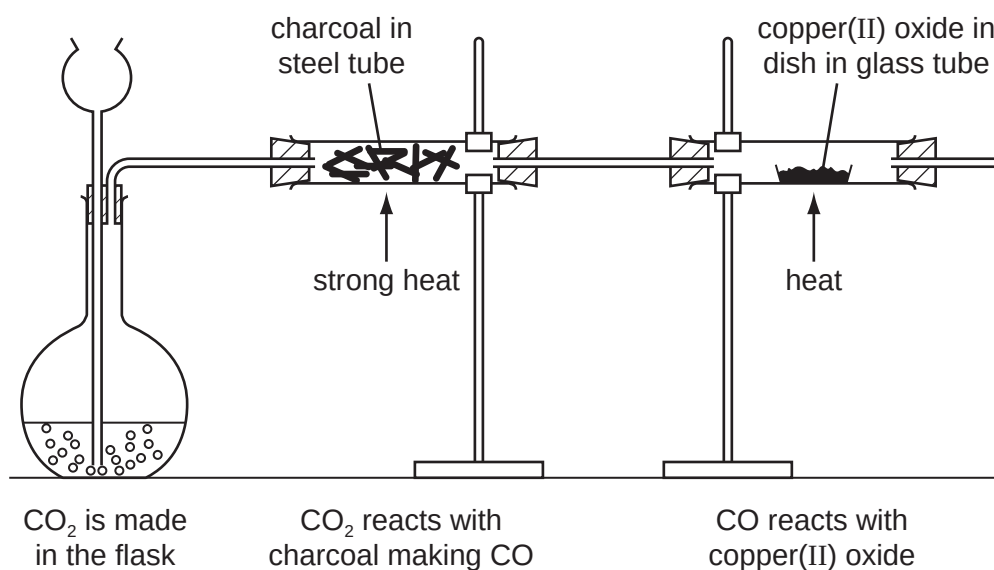


Fig. 6.1

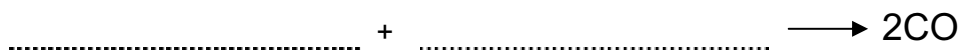
- (a) Name a solid and a liquid that can be placed in the flask to make carbon dioxide.

solid

liquid

[2]

- (b) Complete the symbol equation to show the reaction in the steel tube.



[1]

- (c) When the copper(II) oxide in the glass tube reacts with carbon monoxide it changes from black to reddish-brown. The teacher takes the dish out of the glass tube when it has cooled. He uses the apparatus shown in Fig. 6.2 to find out if the reddish-brown residue in the dish is a metal.

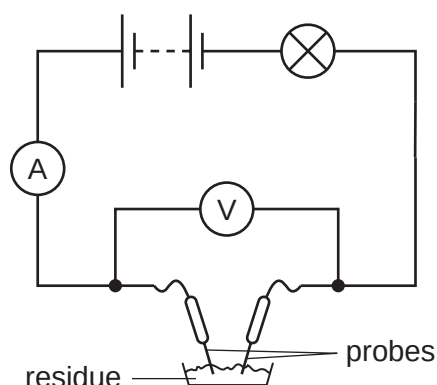


Fig. 6.2

Suggest **two** observations that the class can make, which show that the residue is a metal.

- 1
2 [2]

- (d) Before the experiment began, the teacher weighed the empty dish. Then he weighed it containing the copper(II) oxide. He recorded the masses in Table 6.3.

Table 6.3

mass of empty dish / g	mass of dish + copper(II) oxide / g	mass of dish + reddish-brown residue / g
35.9	43.9	

He weighs the dish containing the reddish-brown residue. Fig. 6.4 shows the balance window.

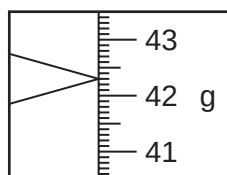


Fig. 6.4

- (i) Read the balance window. Record the mass of the dish containing the reddish-brown residue in Table 6.3. [1]

- (ii) Use the data from Table 6.3 to calculate the mass of the copper(II) oxide that the teacher placed in the dish.

mass of copper(II) oxide = ... g [1]

- (iii) Calculate the loss in mass of the copper(II) oxide when it reacted with carbon monoxide.

loss in mass = ... g [1]

The class decide that oxygen has been removed from the copper(II) oxide.

- (iv) What name is given to this process?

..... [1]

- (e) Suggest a reason why the teacher carried out this experiment in a fume cupboard instead of on the open laboratory bench.

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



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



1 This question is about variation in leaves.

- (a) A student was provided with the 20 leaves shown in Fig. 1.2. Measure the length l of each leaf in millimetres as shown in Fig. 1.1a. If the lamina does not meet the petiole evenly on either side of the leaf use the longer measurement. See Fig. 1.1b.

Enter your measurements in Table 1.1.

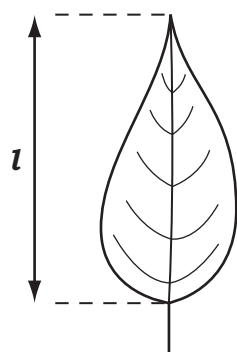


Fig. 1.1a

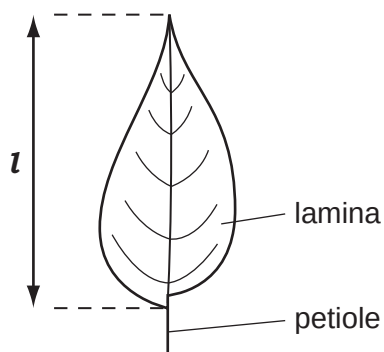


Fig. 1.1b

Table 1.1

length of leaf l / mm			
1		11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	

[2]

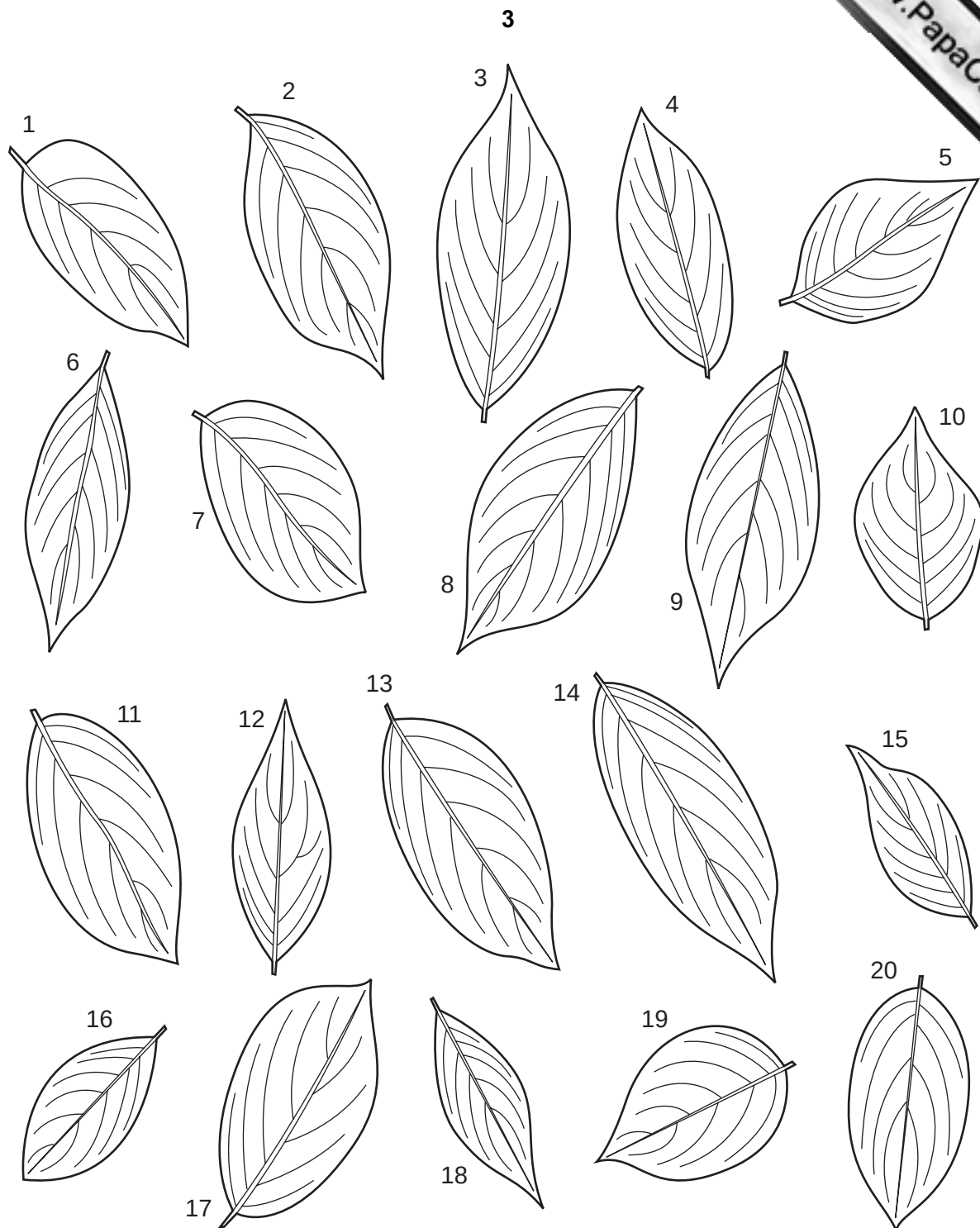


Fig. 1.2

(b) Calculate the average (mean) length of the 20 leaves. Show your working.

average = ... mm

[2]

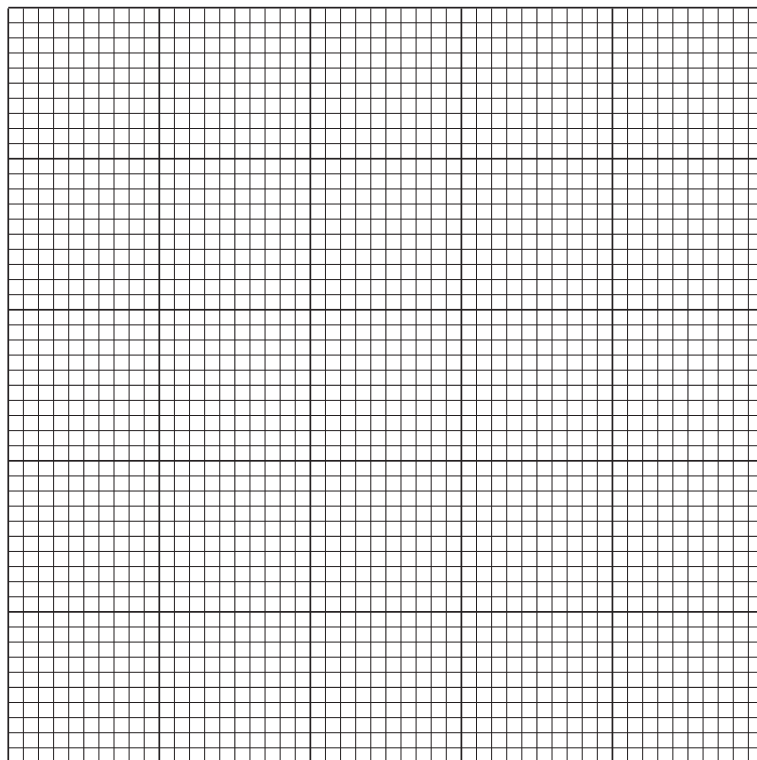
- (c) (i) Enter the number of leaves in each range in Table 1.2 below.

Table 1.2

range / mm	number of leaves in range
30 - 34	
35 - 39	
40 - 44	
45 - 49	
50 - 54	
55 - 59	

[2]

- (ii) Using the information you have entered in Table 1.2 draw a bar chart on the grid provided. Use the **number of leaves in range** as the vertical axis and the **range / mm** as the horizontal axis. Choose suitable scales for your data.



[3]

- (d) The leaves were all of the same species yet they showed variation in length. Suggest a reason for this.

.....
 [1]

- 2 Some science students are making ammonia gas, NH_3 . They are mixing solid calcium hydroxide, $\text{Ca}(\text{OH})_2$ and ammonium chloride, NH_4Cl . Then they are heating the mixture in the apparatus shown in Fig. 2.1.

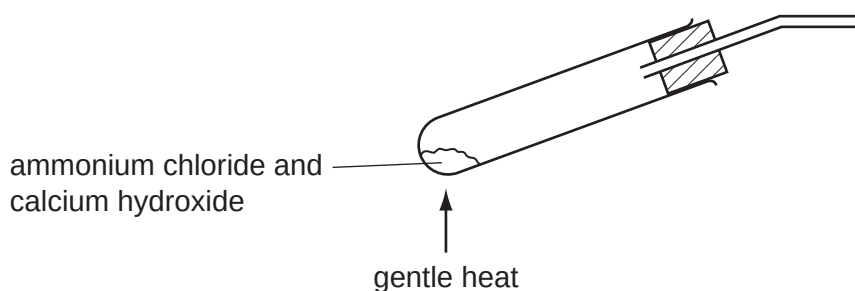


Fig. 2.1

- (a) (i) State the colour of ammonia gas.

..... [1]

- (ii) Water, ammonia and a solid substance are formed when calcium hydroxide reacts with ammonium chloride.

Name the solid substance that is formed. Do not write its formula.

..... [1]

- (b) The students have to decide how to collect the gas that will come out of the delivery tube. The teacher gives them the information shown in Table 2.1.

Table 2.1

name of gas	air	ammonia
density of gas in g / dm^3	1.2	0.7

Three methods of collecting a gas are shown in Fig. 2.2.

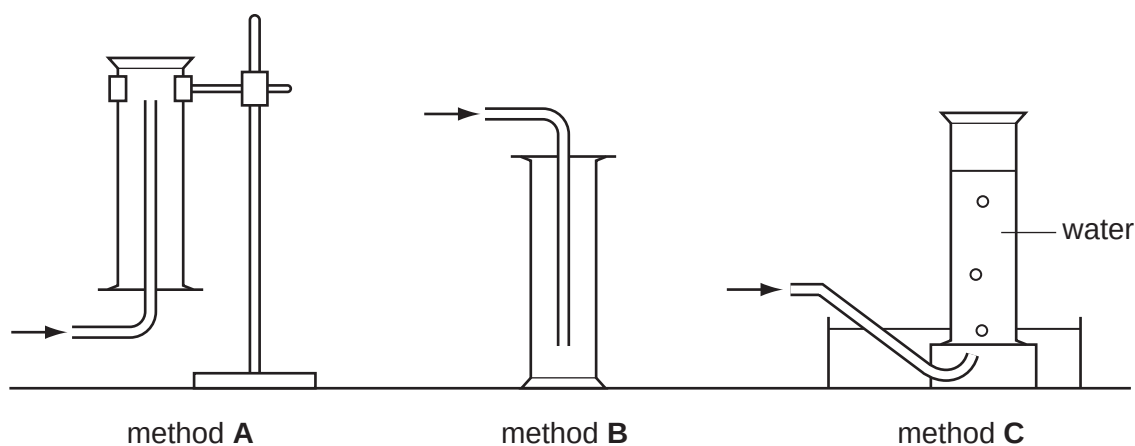


Fig. 2.2

- (i) Study methods **A**, **B** and **C** in Fig. 2.2. Choose the best method of collecting ammonia gas. Use the information in Table 2.1 and your knowledge of properties of ammonia to help you to choose.

The best way to collect ammonia gas is method [1]

- (ii) Choose **one** of the other two methods and complete the sentence below.

Method is **not** a good way to collect ammonia gas

because

.....

..... [1]

- (c) The students have collected some gas-jars of ammonia. They are testing the gas using the tests shown in Table 2.2.

Complete Table 2.2.

Table 2.2

test	result
(i) A few cm ³ of aqueous [1] sulfate is added to the gas.	A white precipitate is formed. After shaking, the precipitate re-dissolves forming a colourless solution.
(ii) A few cm ³ of aqueous copper(II) sulfate is added to the gas.	A precipitate is formed which has a colour. After shaking, the precipitate re-dissolves forming a [2] solution.
(iii) A few drops of litmus is added.	The litmus turns [1]

- (d) The teacher carries out an experiment with the gas-jar of ammonia. He soaks a filter paper in concentrated hydrochloric acid. Then he holds the filter paper at the mouth of the gas-jar of ammonia. This is shown in Fig 2.3.

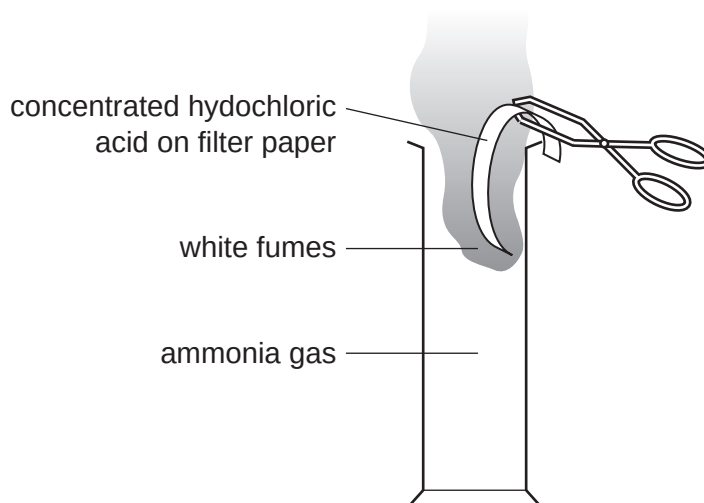


Fig. 2.3

The students see a cloud of white fumes.

Explain how the white fumes are formed.

.....

.....

..... [2]

- 3 A science student is trying to find out how much a liquid expands when it is turned gas. He is using water as the liquid. The apparatus is shown in Fig 3.1.

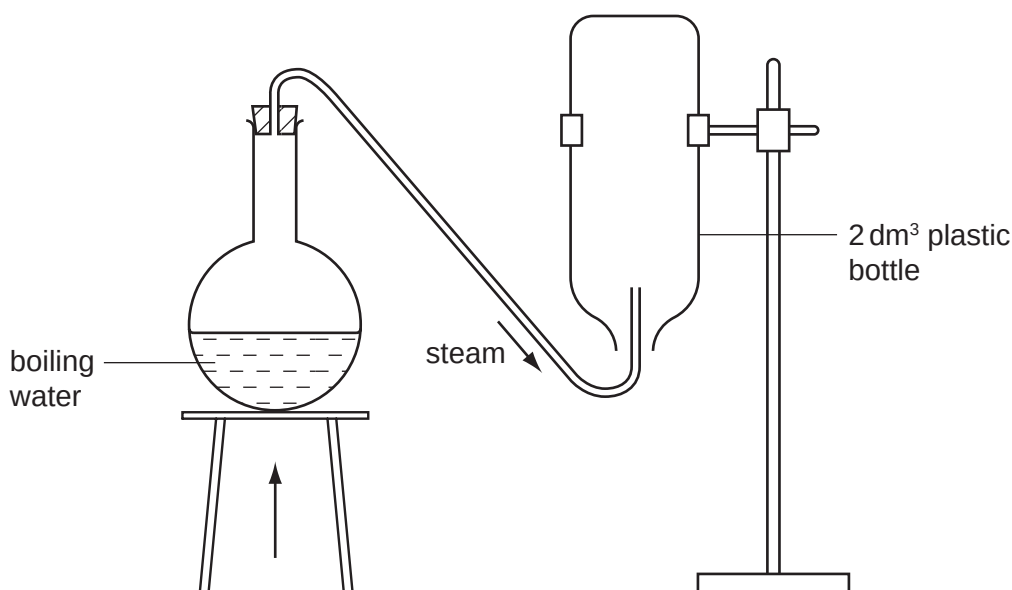


Fig. 3.1

- He weighs a clean, dry plastic 2 dm³ bottle with its lid on and records the mass, m_1 .
- He removes the lid and places the bottle in position as in Fig. 3.1.
- He boils the water and passes steam into the bottle for three or four minutes until the bottle is at 100 °C and no drops of water remain in it. The bottle is now full of steam.
- He quickly removes the bottle from its stand, places it upright and loosely replaces the lid.
- When the bottle has cooled to room temperature he weighs it again and records the mass, m_2 .

The balance windows for the masses, m_1 and m_2 are shown in Fig. 3.2.

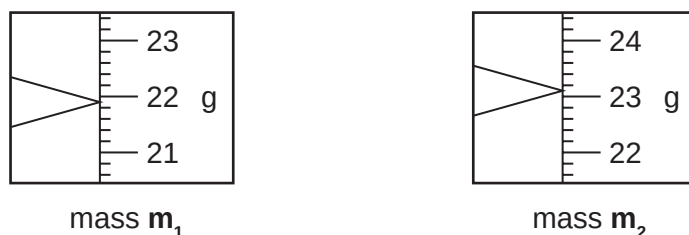


Fig. 3.2

- (a) (i) Read and record the masses of the bottle, m_1 and m_2 , before and after passing steam into it.

mass m_1 = ... g

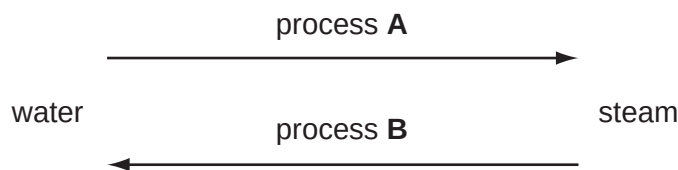
mass m_2 = ... g

[2]

- (ii) Find the increase in mass of the bottle.

increase in mass of the bottle = ... g [1]

- (b) Changing water into steam is a reversible process.



- (i) Name process A [1]

- (ii) Name process B [1]

The mass of water produced when the 2 dm^3 of steam cooled down is given in your answer to (a)(ii).

1 g of water has a volume of 1 cm^3 .

- (c) (i) What volume of water was produced when the 2 dm^3 of steam cooled down?

volume of water = ... cm^3 [1]

- (ii) Calculate the volume produced, in cubic centimetres, when 1 cubic centimetre of water is heated and becomes steam.

volume of steam from 1 cm^3 of water = ... cm^3 [2]

- (d) In a steam engine, water is heated to give steam. Use the result of this experiment to explain why a powerful force is produced by a steam engine.

.....

 [2]

- 4 This question compares the content of inhaled air with exhaled air. The experiment is done using gas-jars of inhaled and exhaled air.

- (a) Gas-jars that had been standing open in the laboratory were used for samples of inhaled air.

In the space below draw a labelled diagram to show how you would collect a sample of exhaled air in a gas-jar.

[2]

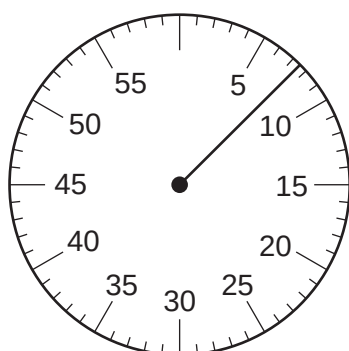
- (b) To compare the oxygen content of the air a student lit a candle and placed it in the gas-jar. The length of time that the flame burned was noted and the results were entered in Table 4.1. The experiment was repeated three times with each type of air.

Table 4.1

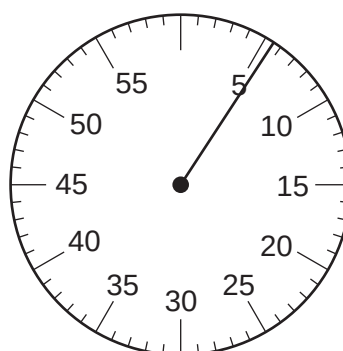
source of air sample	time of burning / s			
	test 1	test 2	test 3	average
inhaled air		7.0	6.5	
exhaled air	5.0		4.5	

- (i) Read the stop watches in Fig. 4.1 and enter the results in Table 4.1.

[2]



inhaled air, **test 1**
time / s



exhaled air, **test 2**
time / s

Fig. 4.1

- (ii) Calculate the average time of burning of the candle in each sample of air and enter your results in Table 4.1.

[2]

- (c) To compare the carbon dioxide content of inhaled and exhaled air the student continuously shook a fixed volume of limewater in the gas-jar of air.

- (i) No change was noted with the inhaled air after shaking the sample with limewater for one minute. However the limewater changed appearance within seconds when exhaled air was tested.

What was observed in the gas-jar of exhaled air?

[1]

- (ii) The carbon dioxide content of air is increased by the lungs. What process in the body produces carbon dioxide?

[1]

- (iii) The student then shook fresh limewater with more samples of exhaled air. One sample was collected **before exercise** and the other **after exercise**. The student forgot which sample was which. The times taken for the limewater to change were 3.2 s and 8.4 s.

Enter the times in the correct place in Table 4.2.

Table 4.2

exhaled air sample	time taken for change / s
before exercise	
after exercise	

[1]

- (iv) Explain why exercise changes the carbon dioxide content of exhaled air.

[1]

- 5 A student is investigating the rate of reaction between magnesium and dilute hydrochloric acid. She does several experiments using different concentrations of the acid with the same lengths of magnesium ribbon. Fig. 5.1 shows the apparatus she is using.

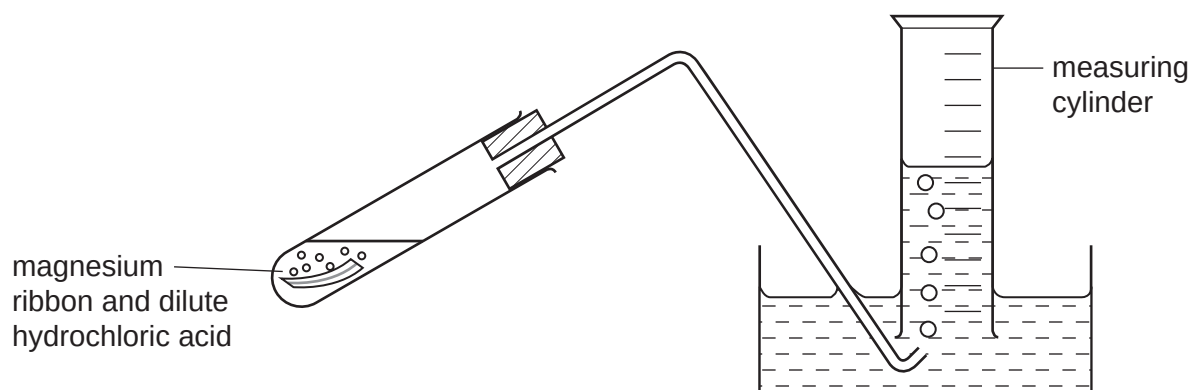


Fig. 5.1

- She measures out the volume of dilute hydrochloric acid for experiment 1, shown in Table 5.1, and places it in the test-tube.
- She adds water to make the total volume of liquid equal to 20 cm^3 .
- She cuts a 6 cm length of magnesium ribbon, puts it in the test-tube and quickly replaces the stopper and the delivery tube.
- After 40 seconds she measures the volume of hydrogen in the measuring cylinder and records it in Table 5.1.
- She carries out experiments 2, 3, 4 and 5 in the same way.

Table 5.1

experiment no.	volume of acid/cm ³	volume of water/cm ³	concentration of the acid in the test-tube/mol/dm ³	volume of hydrogen after 40 s/cm ³
1	20	0	2.0	80
2	16	4	1.6	
3	12	8		
4	8	12		20
5	4	16		

(a) Fig. 5.2 shows the measuring cylinder readings for experiments 2, 3 and 5.

Read the volumes of hydrogen and record the readings in Table 5.1.

[3]

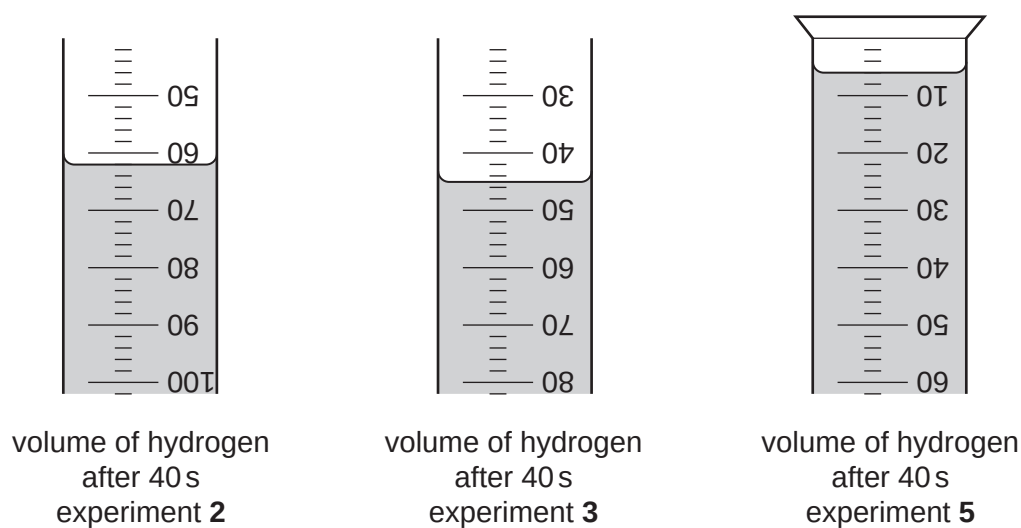


Fig. 5.2

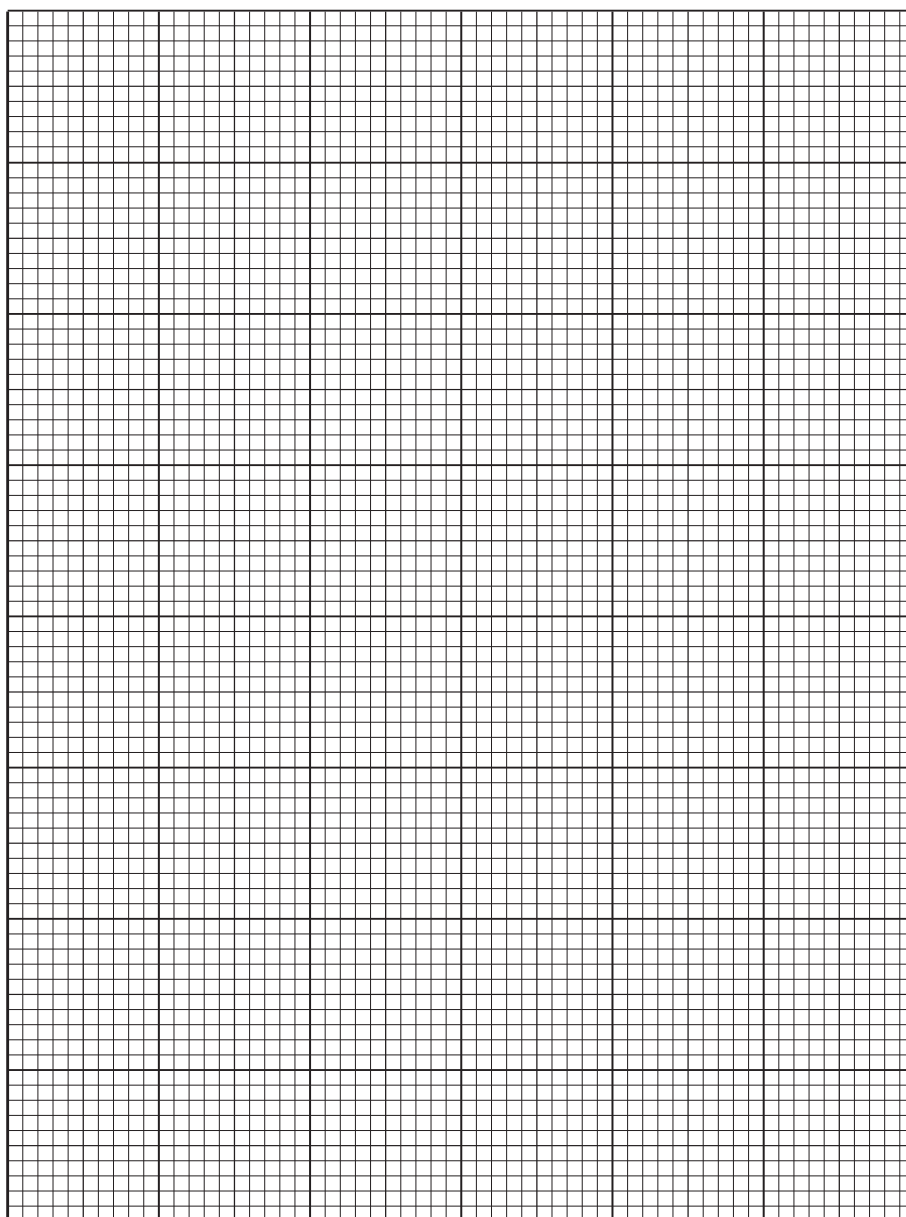
(b) Calculate the concentration of the acid in the test-tube used in experiments 3, 4, and 5.

Complete Table 5.1.

[1]

- (c) Plot a graph of **volume of hydrogen / cm³** (vertical axis) against **concentration of hydrochloric acid in mol/dm³** on the graph grid.

Draw the best straight line and extend it to pass through the origin.



- (d) (i) To make the experiment fair, it is important for the student to use the same of magnesium ribbon in all of these experiments.

Suggest **two** reasons for this.

reason 1

reason 2 [2]

- (ii) What does the shape of the graph show about the relationship between the volume of hydrogen given off in 40 seconds and the concentration of the acid used?

.....

..... [1]

- 6 The science teacher has asked the students to find the heat capacity of a metal food can. They heat water and then pour it into the weighed metal food can. Then they find the temperature of the water.

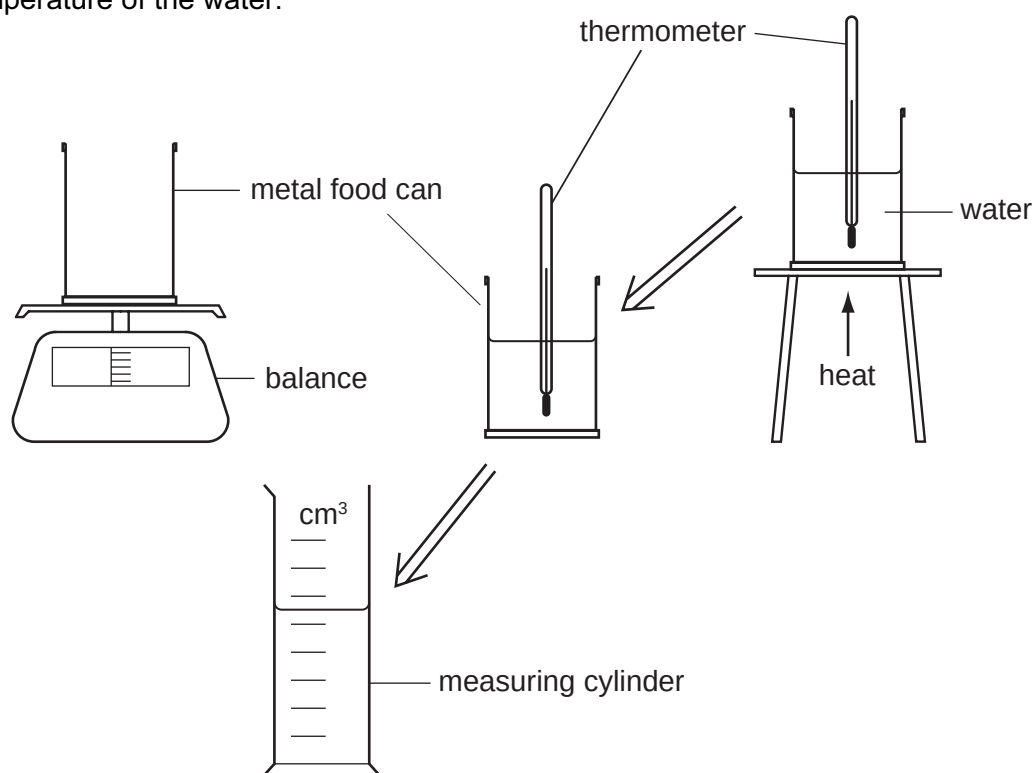


Fig. 6.1

- The food can is weighed to find its mass, m .
- The room temperature, t_1 , is recorded in Table 6.1.
- Some water is heated and its temperature, t_2 , is found.
- The water is poured into the can, it is stirred and the new temperature of the water and the metal food can t_3 , is found.
- A measuring cylinder is used to find the volume of water, $v \text{ cm}^3$.

- (a) Study the diagram, Fig. 6.2, and read the balance window, the measuring cylinder and the thermometers. Record these values in Table 6.1.

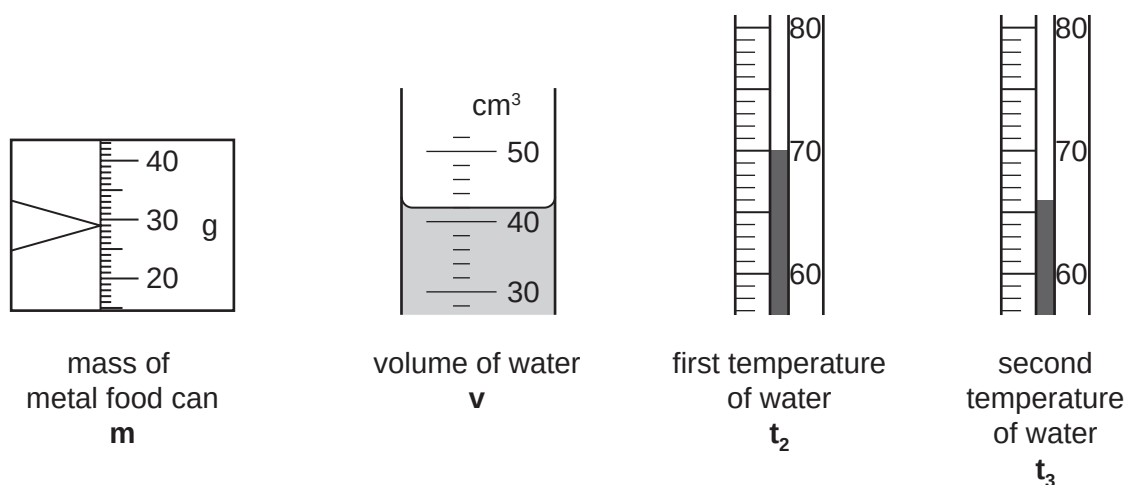


Fig. 6.2

Table 6.1

mass of metal food can	m = ... g
room temperature	t₁ = 25 °C
first temperature of water	t₂ = ... °C
second temperature of water	t₃ = ... °C
volume of water	v = ... cm ³

[4]

- (b) (i) The room temperature was 25 °C. Find **p**, the increase in the temperature of the metal food can, (**t₃** - 25) °C.

$$\mathbf{p} = \text{.....} \text{ } ^\circ\text{C} \quad [1]$$

- (ii) Find **q**, the decrease in the temperature of the water.

$$\mathbf{q} = \text{.....} \text{ } ^\circ\text{C} \quad [1]$$

- (iii) Find the specific heat of the metal of the food can using the formula below.

$$\text{specific heat} = \frac{\mathbf{q} \times \text{mass of water} \times 4.2}{\mathbf{p} \times \mathbf{m}} \text{ J g}^{-1} \text{ } ^\circ\text{C}^{-1}$$

$$\text{specific heat of the metal} = \text{.....} \text{ J g}^{-1} \text{ } ^\circ\text{C}^{-1} \quad [2]$$

- (c) The teacher says that the specific heat of the metal of the food can may be found using an electric heater. He sets up the apparatus shown in Fig. 6.3.

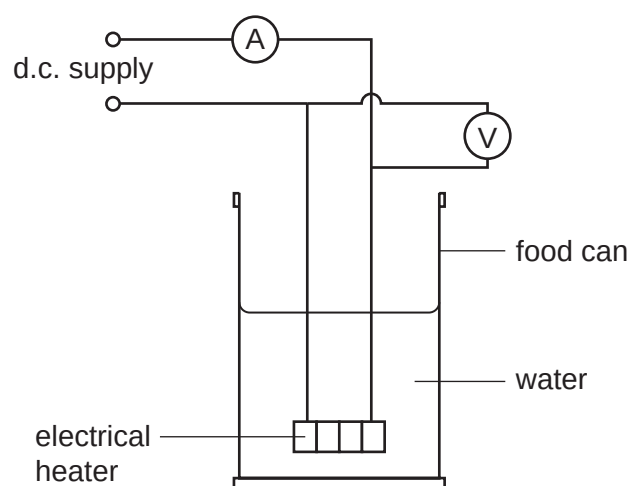


Fig. 6.3

E, the amount of energy supplied by the heater is equal to the energy absorbed by the water and the food can. To calculate **E**, the total energy supplied by the heater, three **different variables** must be measured and recorded.

Complete the list of these three values and their correct units. One of them has been done for you.

1. The e.m.f. in volts.
2. in
3. in [2]



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

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COMBINED SCIENCE

0653/63

Paper 6 Alternative to Practical

May/June 2010

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 a soft pencil for any diagrams, graphs, tables or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

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.

For Examiner's Use

1	
2	
3	
4	
5	
6	
Total	

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



1 This question is about variation in leaves.

- (a) A student was provided with the 20 leaves shown in Fig. 1.2. Measure the length l of each leaf in millimetres as shown in Fig. 1.1a. If the lamina does not meet the petiole evenly on either side of the leaf use the longer measurement. See Fig. 1.1b.

Enter your measurements in Table 1.1.

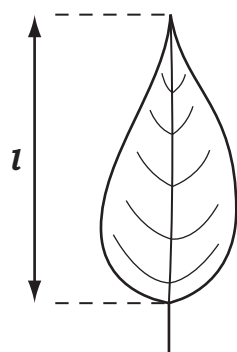


Fig. 1.1a

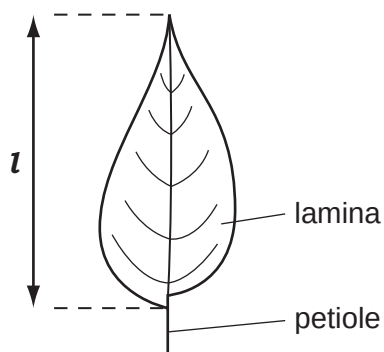


Fig. 1.1b

Table 1.1

length of leaf l / mm			
1		11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	

[2]

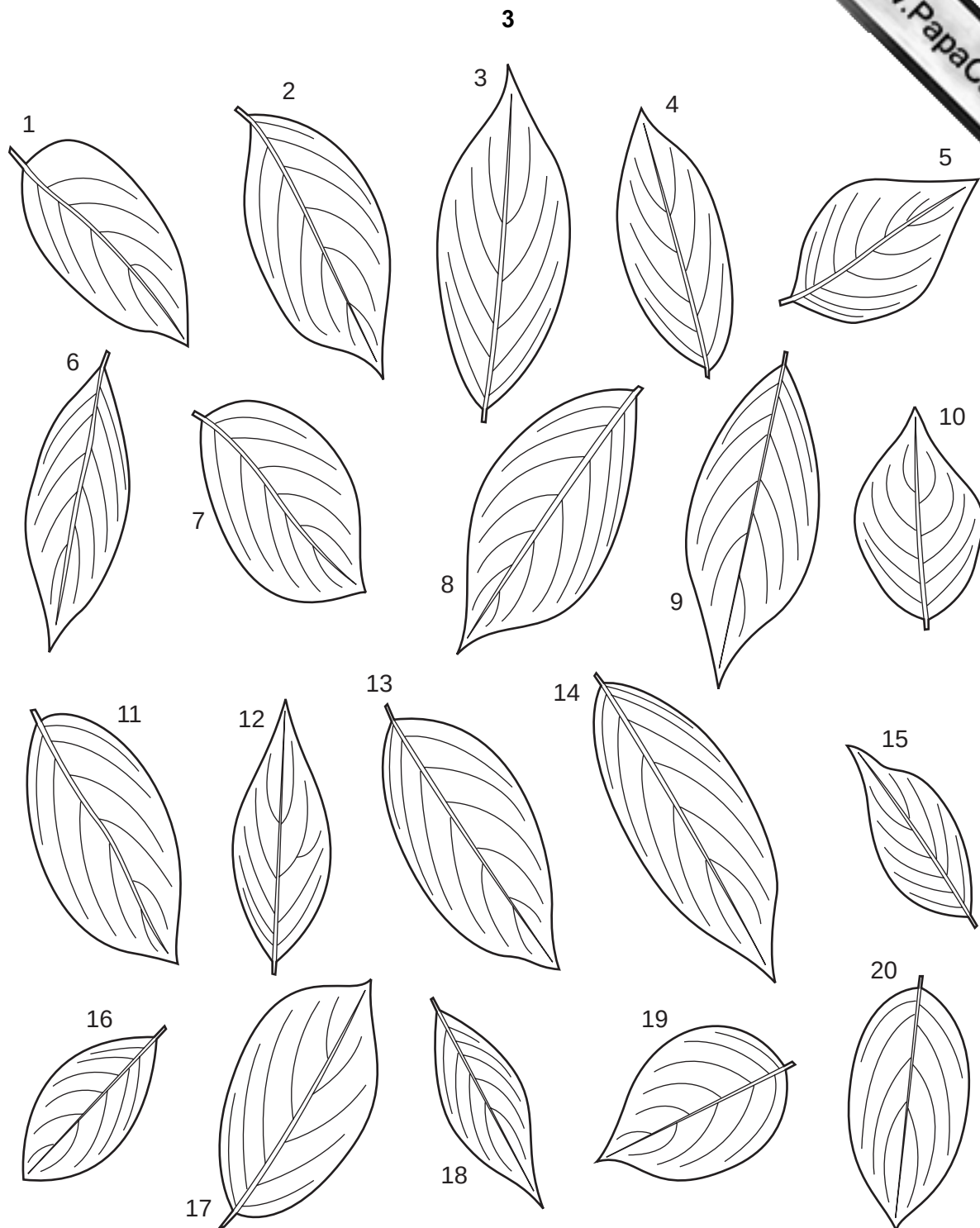


Fig. 1.2

(b) Calculate the average (mean) length of the 20 leaves. Show your working.

average = ... mm

[2]

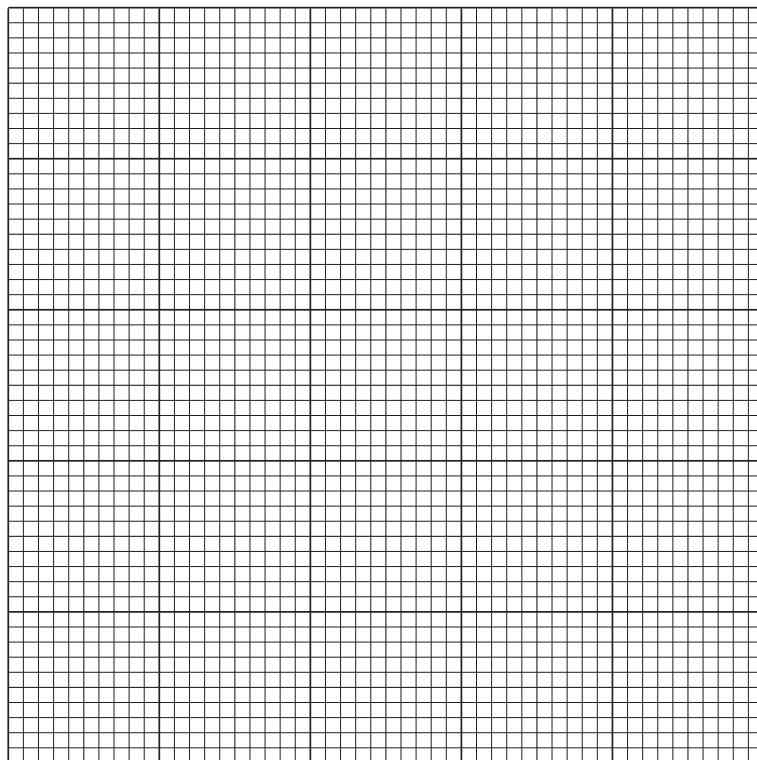
- (c) (i) Enter the number of leaves in each range in Table 1.2 below.

Table 1.2

range / mm	number of leaves in range
30 - 34	
35 - 39	
40 - 44	
45 - 49	
50 - 54	
55 - 59	

[2]

- (ii) Using the information you have entered in Table 1.2 draw a bar chart on the grid provided. Use the **number of leaves in range** as the vertical axis and the **range / mm** as the horizontal axis. Choose suitable scales for your data.



[3]

- (d) The leaves were all of the same species yet they showed variation in length. Suggest a reason for this.

.....
 [1]

- 2 Some science students are making ammonia gas, NH_3 . They are mixing solid calcium hydroxide, $\text{Ca}(\text{OH})_2$ and ammonium chloride, NH_4Cl . Then they are heating the mixture in the apparatus shown in Fig. 2.1.

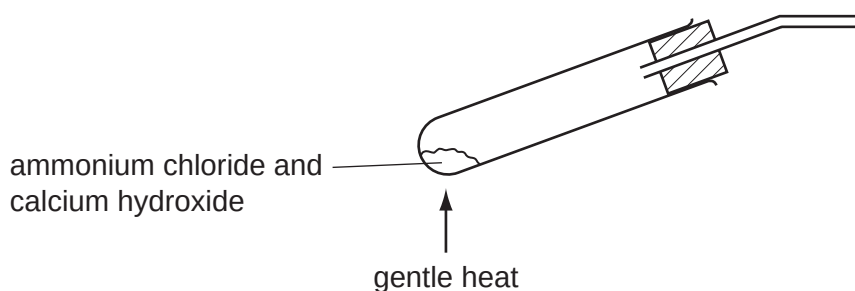


Fig. 2.1

- (a) (i) State the colour of ammonia gas.

..... [1]

- (ii) Water, ammonia and a solid substance are formed when calcium hydroxide reacts with ammonium chloride.

Name the solid substance that is formed. Do not write its formula.

..... [1]

- (b) The students have to decide how to collect the gas that will come out of the delivery tube. The teacher gives them the information shown in Table 2.1.

Table 2.1

name of gas	air	ammonia
density of gas in g / dm^3	1.2	0.7

Three methods of collecting a gas are shown in Fig. 2.2.

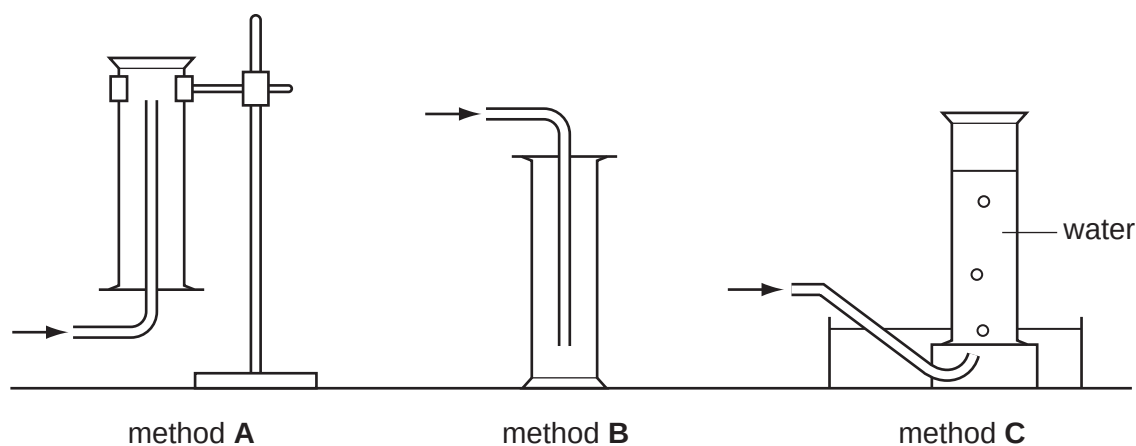


Fig. 2.2

- (i) Study methods **A**, **B** and **C** in Fig. 2.2. Choose the best method of collecting ammonia gas. Use the information in Table 2.1 and your knowledge of properties of ammonia to help you to choose.

The best way to collect ammonia gas is method [1]

- (ii) Choose **one** of the other two methods and complete the sentence below.

Method is **not** a good way to collect ammonia gas

because

.....

..... [1]

- (c) The students have collected some gas-jars of ammonia. They are testing the gas using the tests shown in Table 2.2.

Complete Table 2.2.

Table 2.2

test	result
(i) A few cm ³ of aqueous [1] sulfate is added to the gas.	A white precipitate is formed. After shaking, the precipitate re-dissolves forming a colourless solution.
(ii) A few cm ³ of aqueous copper(II) sulfate is added to the gas.	A precipitate is formed which has a colour. After shaking, the precipitate re-dissolves forming a [2] solution.
(iii) A few drops of litmus is added.	The litmus turns [1]

- (d) The teacher carries out an experiment with the gas-jar of ammonia. He soaks a filter paper in concentrated hydrochloric acid. Then he holds the filter paper at the mouth of the gas-jar of ammonia. This is shown in Fig 2.3.

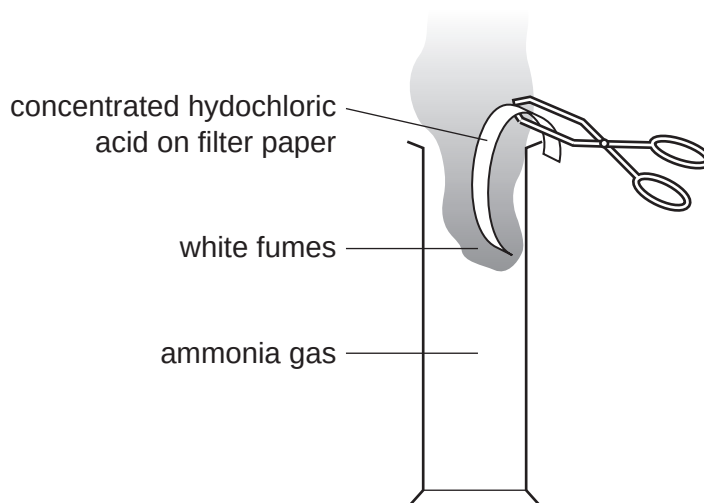


Fig. 2.3

The students see a cloud of white fumes.

Explain how the white fumes are formed.

.....

.....

..... [2]

- 3 A science student is trying to find out how much a liquid expands when it is turned gas. He is using water as the liquid. The apparatus is shown in Fig 3.1.

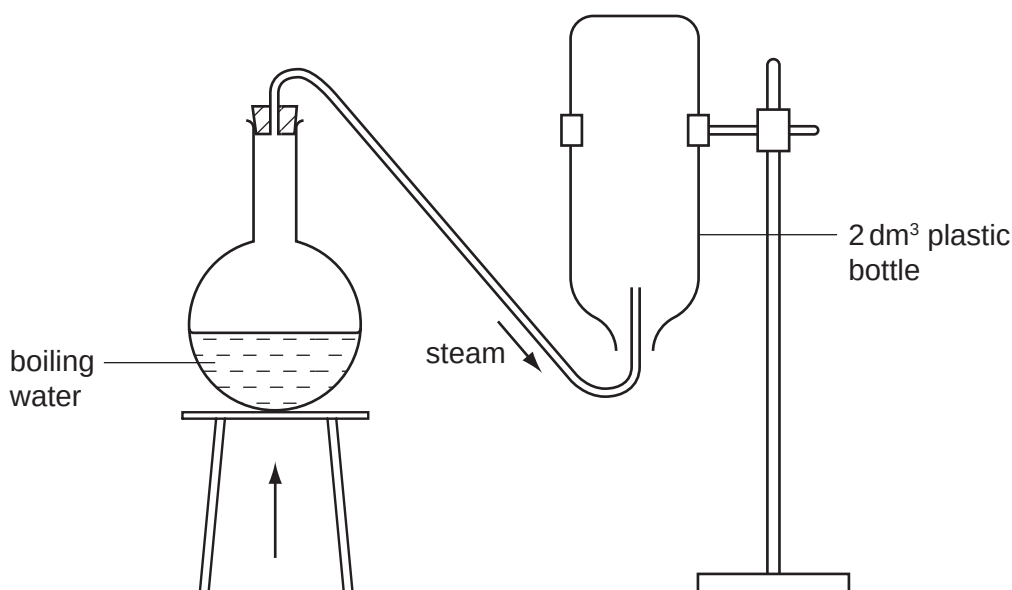


Fig. 3.1

- He weighs a clean, dry plastic 2 dm³ bottle with its lid on and records the mass, m_1 .
- He removes the lid and places the bottle in position as in Fig. 3.1.
- He boils the water and passes steam into the bottle for three or four minutes until the bottle is at 100 °C and no drops of water remain in it. The bottle is now full of steam.
- He quickly removes the bottle from its stand, places it upright and loosely replaces the lid.
- When the bottle has cooled to room temperature he weighs it again and records the mass, m_2 .

The balance windows for the masses, m_1 and m_2 are shown in Fig. 3.2.

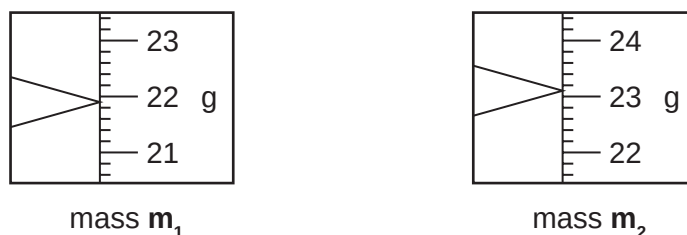


Fig. 3.2

- (a) (i) Read and record the masses of the bottle, m_1 and m_2 , before and after passing steam into it.

mass m_1 = ... g

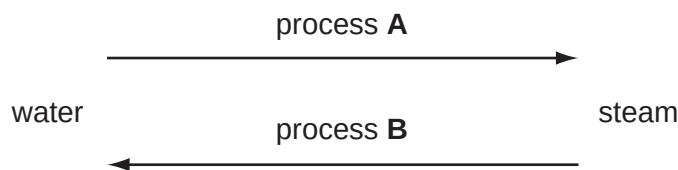
mass m_2 = ... g

[2]

- (ii) Find the increase in mass of the bottle.

increase in mass of the bottle = ... g [1]

- (b) Changing water into steam is a reversible process.



- (i) Name process A [1]

- (ii) Name process B [1]

The mass of water produced when the 2 dm^3 of steam cooled down is given in your answer to (a)(ii).

1 g of water has a volume of 1 cm^3 .

- (c) (i) What volume of water was produced when the 2 dm^3 of steam cooled down?

volume of water = ... cm^3 [1]

- (ii) Calculate the volume produced, in cubic centimetres, when 1 cubic centimetre of water is heated and becomes steam.

volume of steam from 1 cm^3 of water = ... cm^3 [2]

- (d) In a steam engine, water is heated to give steam. Use the result of this experiment to explain why a powerful force is produced by a steam engine.

.....

 [2]

- 4 This question compares the content of inhaled air with exhaled air. The experiment is done using gas-jars of inhaled and exhaled air.

- (a) Gas-jars that had been standing open in the laboratory were used for samples of inhaled air.

In the space below draw a labelled diagram to show how you would collect a sample of exhaled air in a gas-jar.

[2]

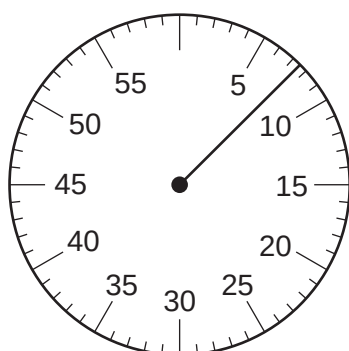
- (b) To compare the oxygen content of the air a student lit a candle and placed it in the gas-jar. The length of time that the flame burned was noted and the results were entered in Table 4.1. The experiment was repeated three times with each type of air.

Table 4.1

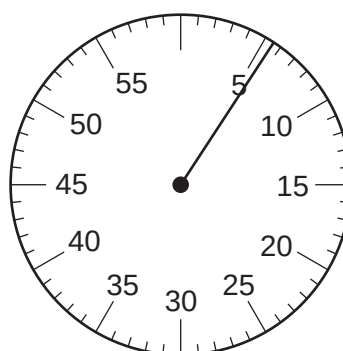
source of air sample	time of burning / s			
	test 1	test 2	test 3	average
inhaled air		7.0	6.5	
exhaled air	5.0		4.5	

- (i) Read the stop watches in Fig. 4.1 and enter the results in Table 4.1.

[2]



inhaled air, **test 1**
time / s



exhaled air, **test 2**
time / s

Fig. 4.1

- (ii) Calculate the average time of burning of the candle in each sample of air and enter your results in Table 4.1.

[2]

- (c) To compare the carbon dioxide content of inhaled and exhaled air the student continuously shook a fixed volume of limewater in the gas-jar of air.

- (i) No change was noted with the inhaled air after shaking the sample with limewater for one minute. However the limewater changed appearance within seconds when exhaled air was tested.

What was observed in the gas-jar of exhaled air?

[1]

- (ii) The carbon dioxide content of air is increased by the lungs. What process in the body produces carbon dioxide?

[1]

- (iii) The student then shook fresh limewater with more samples of exhaled air. One sample was collected **before exercise** and the other **after exercise**. The student forgot which sample was which. The times taken for the limewater to change were 3.2 s and 8.4 s.

Enter the times in the correct place in Table 4.2.

Table 4.2

exhaled air sample	time taken for change / s
before exercise	
after exercise	

[1]

- (iv) Explain why exercise changes the carbon dioxide content of exhaled air.

[1]

- 5 A student is investigating the rate of reaction between magnesium and dilute hydrochloric acid. She does several experiments using different concentrations of the acid with the same lengths of magnesium ribbon. Fig. 5.1 shows the apparatus she is using.

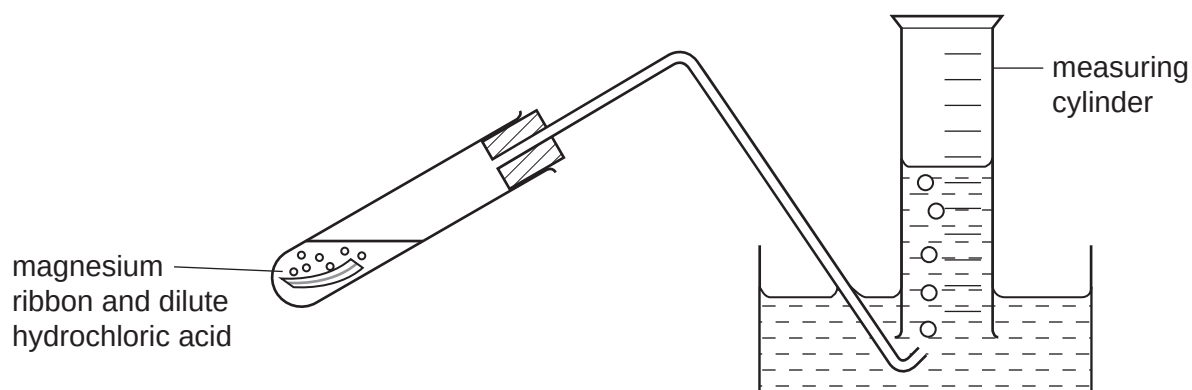


Fig. 5.1

- She measures out the volume of dilute hydrochloric acid for experiment 1, shown in Table 5.1, and places it in the test-tube.
- She adds water to make the total volume of liquid equal to 20 cm^3 .
- She cuts a 6 cm length of magnesium ribbon, puts it in the test-tube and quickly replaces the stopper and the delivery tube.
- After 40 seconds she measures the volume of hydrogen in the measuring cylinder and records it in Table 5.1.
- She carries out experiments 2, 3, 4 and 5 in the same way.

Table 5.1

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(a) Fig. 5.2 shows the measuring cylinder readings for experiments 2, 3 and 5.

Read the volumes of hydrogen and record the readings in Table 5.1.

[3]

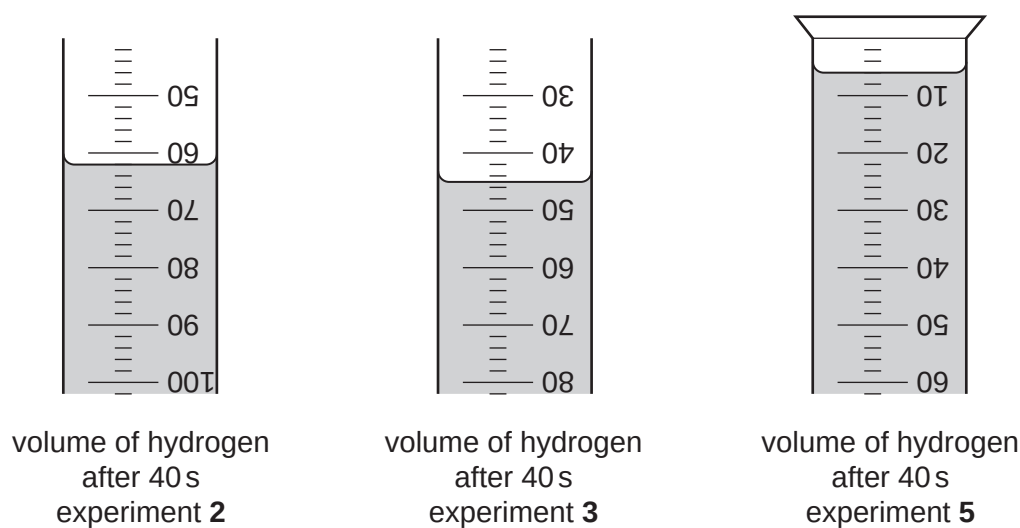


Fig. 5.2

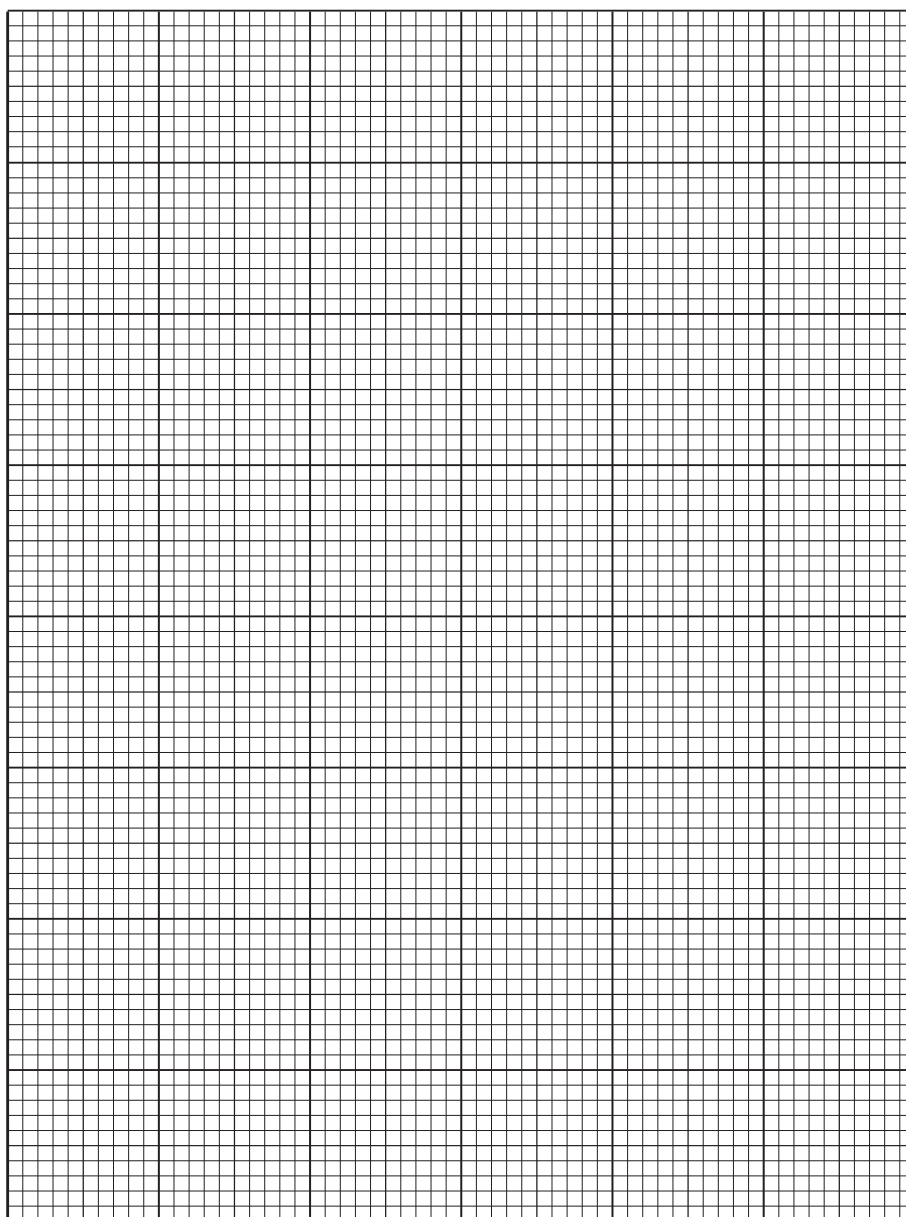
(b) Calculate the concentration of the acid in the test-tube used in experiments 3, 4, and 5.

Complete Table 5.1.

[1]

- (c) Plot a graph of **volume of hydrogen / cm³** (vertical axis) against **concentration of hydrochloric acid in mol/dm³** on the graph grid.

Draw the best straight line and extend it to pass through the origin.



- (d) (i) To make the experiment fair, it is important for the student to use the same of magnesium ribbon in all of these experiments.

Suggest **two** reasons for this.

reason 1

reason 2 [2]

- (ii) What does the shape of the graph show about the relationship between the volume of hydrogen given off in 40 seconds and the concentration of the acid used?

.....

..... [1]

- 6 The science teacher has asked the students to find the heat capacity of a metal food can. They heat water and then pour it into the weighed metal food can. Then they find the temperature of the water.

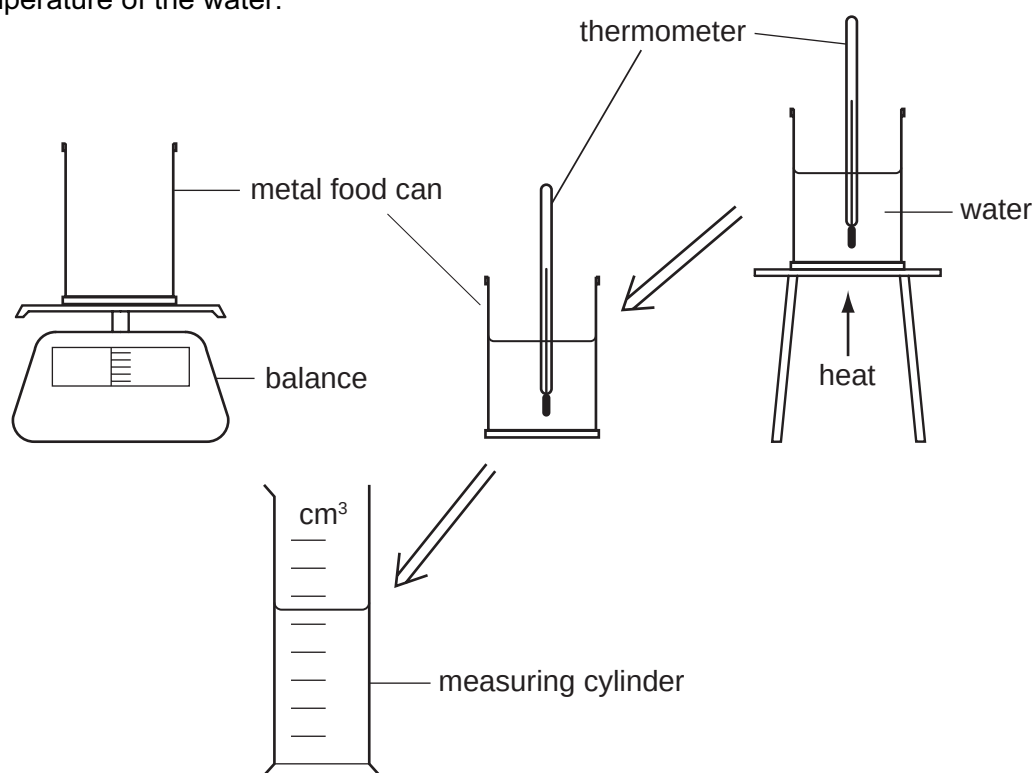


Fig. 6.1

- The food can is weighed to find its mass, m .
- The room temperature, t_1 , is recorded in Table 6.1.
- Some water is heated and its temperature, t_2 , is found.
- The water is poured into the can, it is stirred and the new temperature of the water and the metal food can t_3 , is found.
- A measuring cylinder is used to find the volume of water, $v \text{ cm}^3$.

- (a) Study the diagram, Fig. 6.2, and read the balance window, the measuring cylinder and the thermometers. Record these values in Table 6.1.

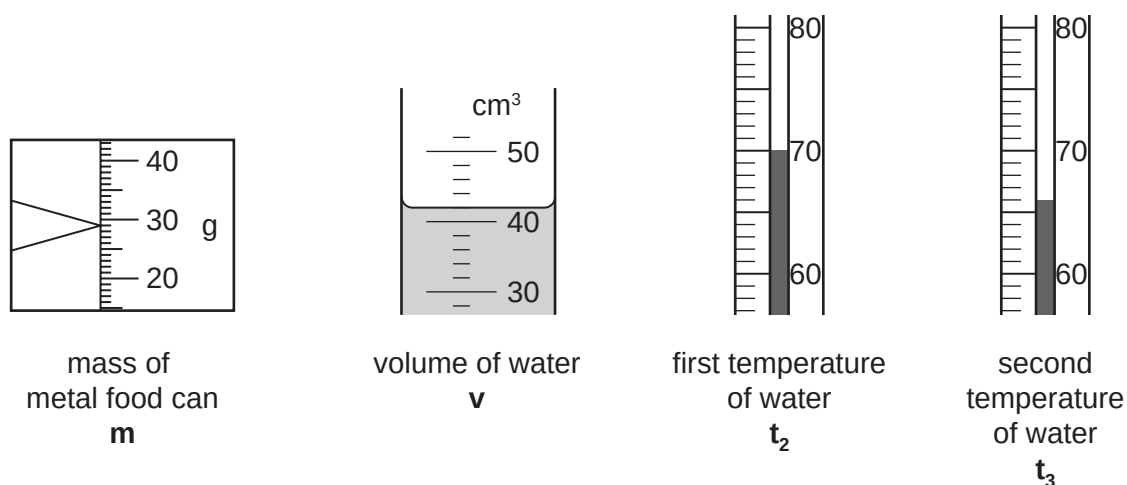


Fig. 6.2

Table 6.1

mass of metal food can	m = ... g
room temperature	t₁ = 25 °C
first temperature of water	t₂ = ... °C
second temperature of water	t₃ = ... °C
volume of water	v = ... cm ³

[4]

- (b) (i) The room temperature was 25 °C. Find **p**, the increase in the temperature of the metal food can, (**t₃** - 25) °C.

$$\mathbf{p} = \text{.....} \text{ } ^\circ\text{C} \quad [1]$$

- (ii) Find **q**, the decrease in the temperature of the water.

$$\mathbf{q} = \text{.....} \text{ } ^\circ\text{C} \quad [1]$$

- (iii) Find the specific heat of the metal of the food can using the formula below.

$$\text{specific heat} = \frac{\mathbf{q} \times \text{mass of water} \times 4.2}{\mathbf{p} \times \mathbf{m}} \text{ J g}^{-1} \text{ } ^\circ\text{C}^{-1}$$

$$\text{specific heat of the metal} = \text{.....} \text{ J g}^{-1} \text{ } ^\circ\text{C}^{-1} \quad [2]$$

- (c) The teacher says that the specific heat of the metal of the food can may be found using an electric heater. He sets up the apparatus shown in Fig. 6.3.

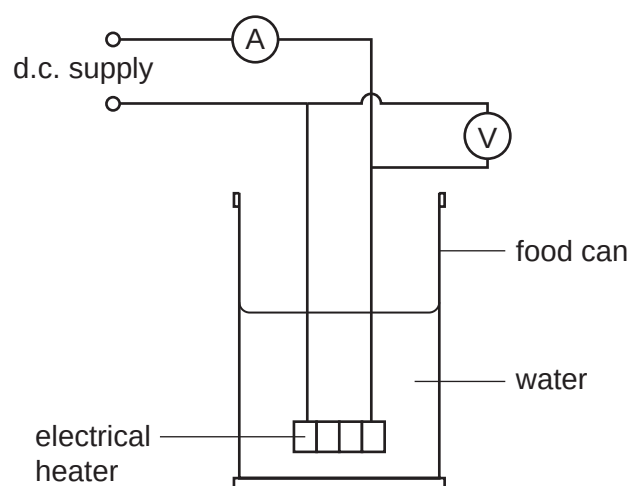


Fig. 6.3

E, the amount of energy supplied by the heater is equal to the energy absorbed by the water and the food can. To calculate **E**, the total energy supplied by the heater, three **different variables** must be measured and recorded.

Complete the list of these three values and their correct units. One of them has been done for you.

1. The e.m.f. in volts.
2. in
3. in [2]

