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0653/61

May/June 2016

1 hour

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

You may lose marks if you do not show your working or if you do not use appropriate units.

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.

1 A student investigates the effectiveness of using an enzyme in the extraction of apple juice.

He has two beakers of apple pulp warmed to a temperature of 35 °C.

- He adds 2 cm³ of enzyme solution to beaker **A** and 2 cm³ of distilled water to beaker **B** and mixes the contents of each beaker.
- He returns the beakers to the water-bath and immediately starts a stopclock.
- After five minutes he empties the contents of both beakers into separate filter funnels as shown in Fig. 1.1.
- He records in Table 1.1 the volume of the juice collected in each measuring cylinder every 2 minutes for a total of 10 minutes.

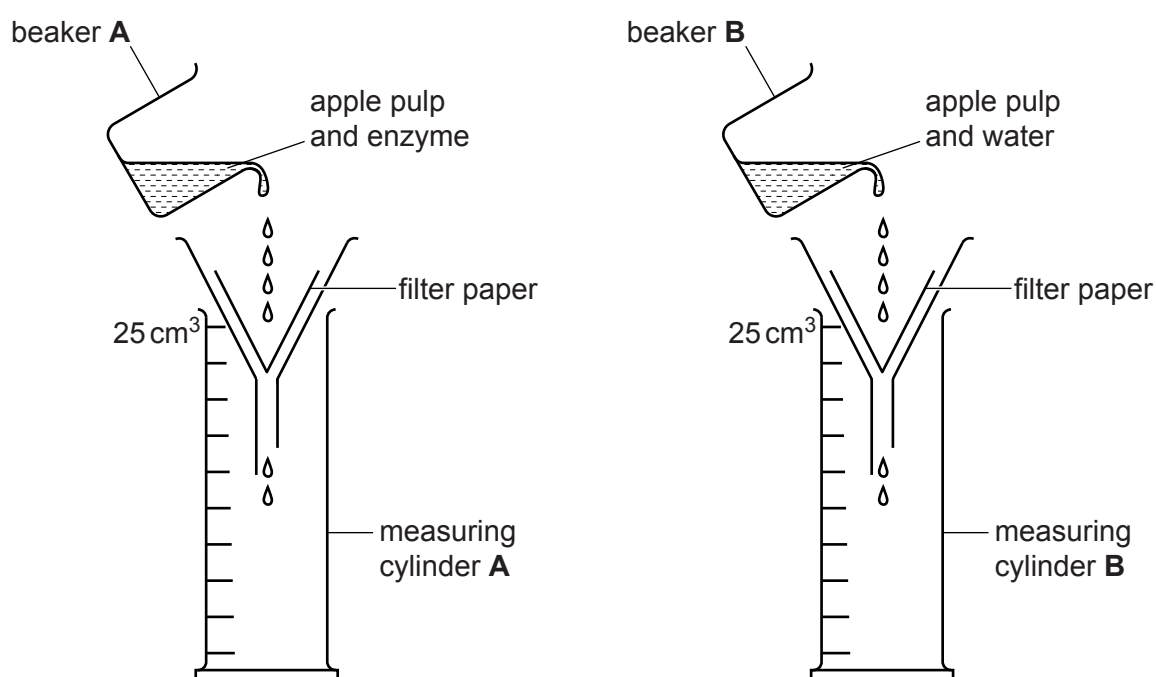


Fig. 1.1

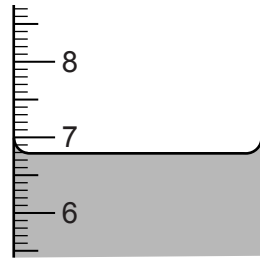
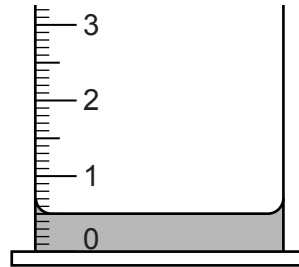
(a) Insert headings, including units, in Table 1.1.

[2]

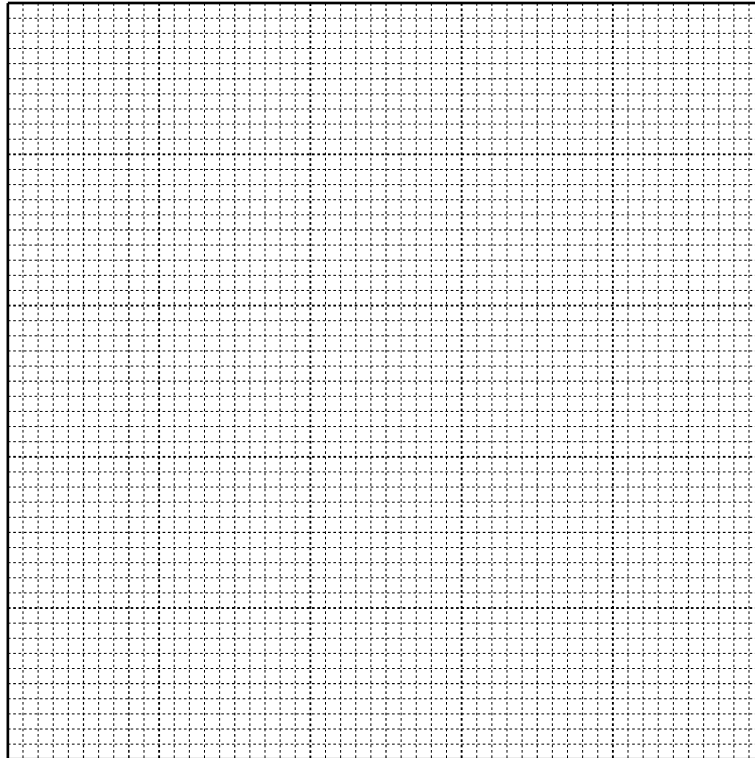
Table 1.1

..... /	 /	
	cylinder A	cylinder B
2	3.6	0.0
4	5.3	0.3
6		
8	7.5	0.5
10	8.1	0.5

- (b) Fig. 1.2 shows the volume of juice in measuring cylinders **A** and **B** after 6 minutes. Read these volumes and enter the values in Table 1.1. [2]

measuring cylinder **A**measuring cylinder **B****Fig. 1.2**

- (c) On the grid provided, plot a graph of the results in measuring cylinder **A only** (vertical axis) against the values in column one of Table 1.1. Draw the best-fit line.



[4]

- (d) Enzymes are used for juice extraction in the fruit juice industry. Use the results to suggest an advantage to manufacturers in using an enzyme in the production of fruit juice.

.....[1]

- (e) Explain how beaker **B** acts as a control.

.....[1]

2 A student is given three solutions **C**, **D** and **E** of acid **X**.

He does not know the concentrations of the solutions.

(a) The student carries out an investigation to find out the concentration of each solution.

- Using a measuring cylinder he places 5 cm^3 of solution **C** in a test-tube.
- He adds a 1 cm piece of magnesium ribbon to this test-tube and starts the stopclock.
- When the magnesium ribbon has completely reacted and disappeared he stops the stopclock.
- If the magnesium ribbon is still present after 3 minutes, he records this time as $>180\text{ s}$.
- He repeats the above procedure for solutions **D** and **E**.

The time for solutions **C** and **D** have been entered in Table 2.1. The times are in seconds.

Table 2.1

solution of acid X	time taken for magnesium to disappear/s
C	42
D	>180
E	

(i) Fig. 2.1 shows the stopclock reading for solution **E**.

Record the reading on the stopclock in Table 2.1.

[1]



Fig. 2.1

(ii) Use the results in Table 2.1 to draw a line from each solution to its concentration.

solution C	0.5 mol/dm ³	least concentrated
solution D	1.0 mol/dm ³	
solution E	2.0 mol/dm ³	most concentrated

[2]

(b) Plan, in detail, another experiment that you could carry out to confirm the concentration of solutions **C**, **D** and **E**. The experiment must be different to the one in (a).

You may use any of the chemicals in the following list but **you do NOT have to use all of them**.

Choose a chemical or chemicals which you know will react with acids.

barium chloride solution
limewater
magnesium ribbon
marble chips
silver nitrate solution
sodium hydroxide solution
Universal Indicator solution

State clearly:

- what you will do to carry out a fair test
- what apparatus you will use
- what observations and measurements you will make
- how you will use your observations and measurements to make conclusions.

.....

.....

.....

.....

.....

.....[5]

- (c) The student is told that acid **X** is hydrochloric acid.

He carries out one test on **X** to confirm the identity of the negative ion in **X**. He uses only chemical reagents from the list in (b) to do this.

Record in column one of Table 2.2 the chemical reagent he should use and in column two the expected observation.

Table 2.2

chemical reagent	observations

[1]

- (d) The teacher suggests it would be difficult to carry out the experiment in (a) for concentrations of acid less than 0.001 mol/dm^3 .

Explain why the teacher is correct.

.....

.....[1]

3 A student measures the mass of a metre rule using a balancing method.

He uses a load **L** of 100g, a metre rule and a pivot.

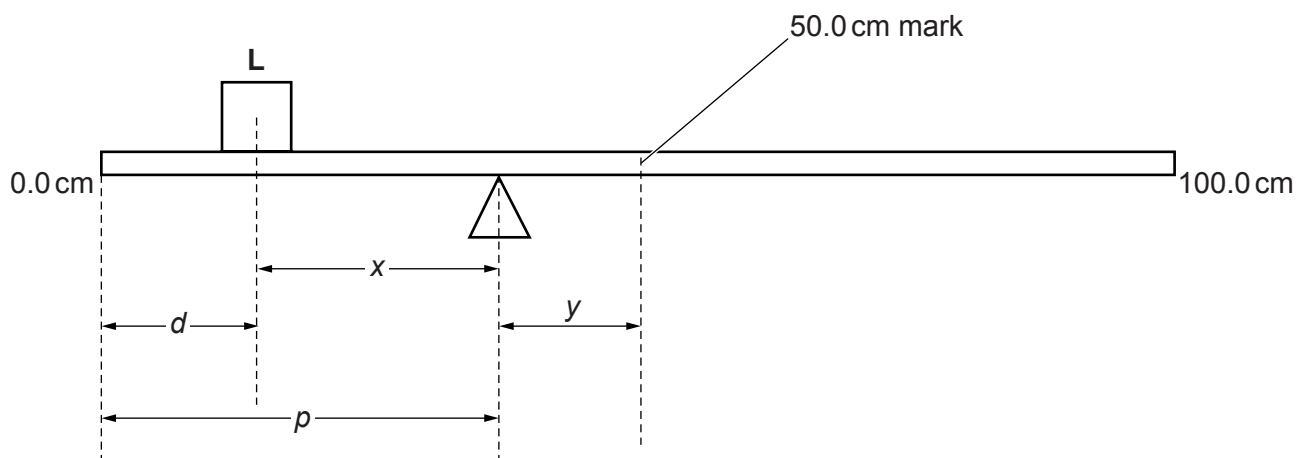


Fig. 3.1

- He places the load on the rule so that its centre is at a distance $d = 5.0$ cm from the zero end of the rule, as shown in Fig. 3.1.
- He adjusts the position of the pivot so that the rule balances on it.

(a) Fig. 3.2 shows the position of the pivot at balance.

Record in Table 3.1 on page 8, to the nearest 0.1 cm, the distance p from the pivot to the zero end of the rule. [1]

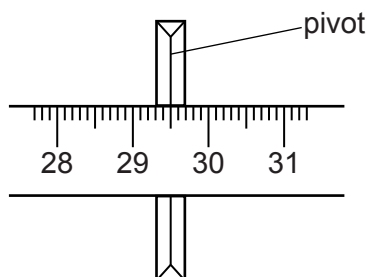


Fig. 3.2

- (b) The student repeats the procedure in (a) for values of d of 10.0 cm, 15.0 cm, 20.0 cm and 25.0 cm.

His results are given in Table 3.1.

Table 3.1

d/cm	p/cm	$x = (p - d)/\text{cm}$	$y = (50 - p)/\text{cm}$
5.0			
10.0	31.8	21.8	18.2
15.0	34.1		
20.0	36.4		
25.0	38.6		

For each value of d , calculate the distances x and y as shown in Table 3.1 using the equations shown. One has been done for you.

$$x = (p - d)$$

$$y = (50 - p)$$

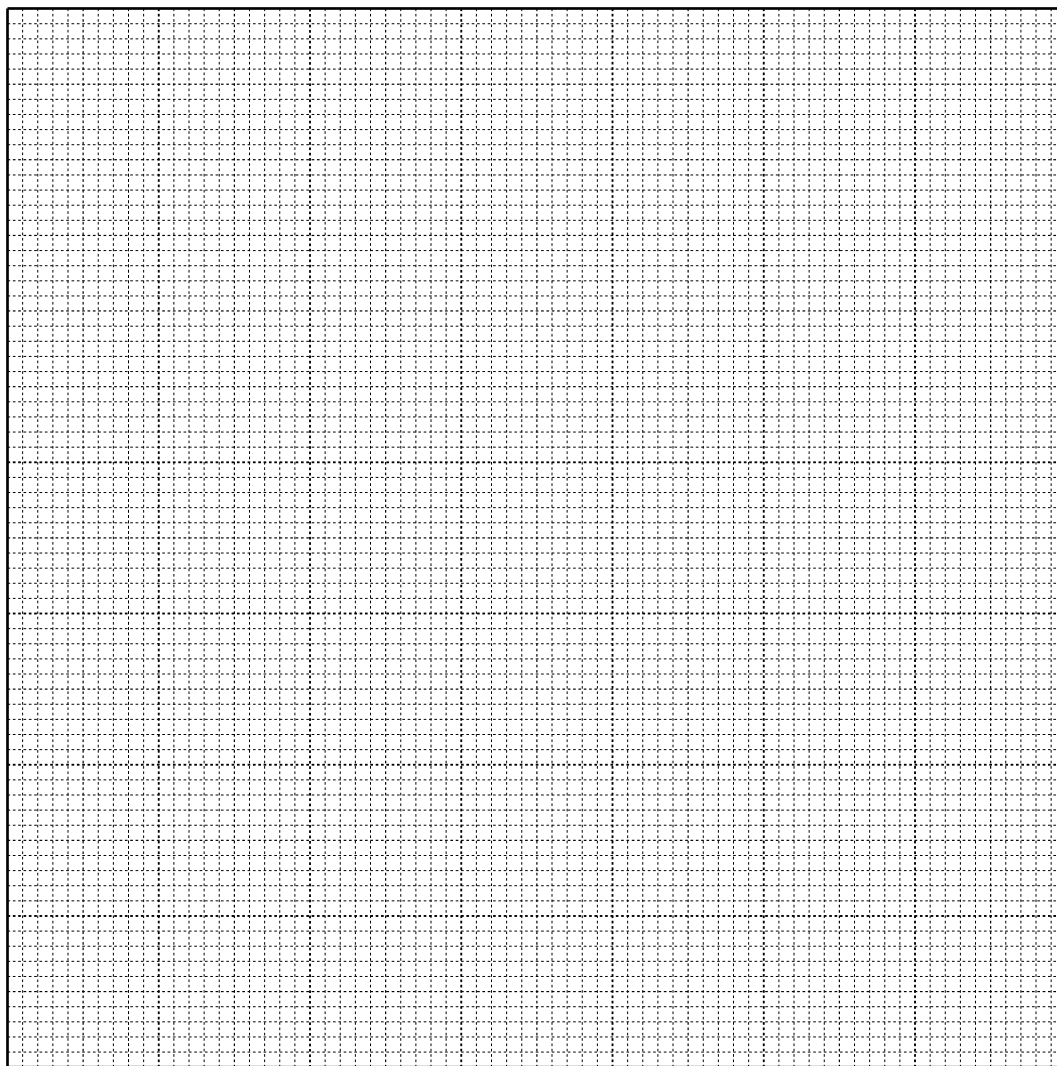
Record in Table 3.1 your calculated values of x and y .

[2]

- (c) (i) On the grid provided plot a graph of y against x . You do **not** need to start your axes from the origin (0, 0).

Draw the best-fit straight line.

y/cm



x/cm

[3]

- (ii) Calculate the gradient of your line.

Show all working and indicate on your graph the values you chose to enable the gradient to be calculated.

gradient of line = ... [2]

- (d) The mass in grams of the metre rule is given by the equation shown.

$$\text{mass} = \frac{100}{\text{gradient}}$$

Use this equation to calculate the mass of the rule, giving your answer to an appropriate number of significant figures.

mass of rule = ...g [1]

- (e) The student now checks his result and measures the mass of the rule using a digital balance.

Suggest **one practical** reason why, despite carrying out the experiment with care, the value for the mass calculated in (d) may be different from the value recorded by the digital balance. Assume that the digital balance used is accurate.

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

Please turn over for Question 4.

- 4 A student investigates whether plants need carbon dioxide for photosynthesis.

He sets up two experiments, **F** and **G**, as shown in Fig. 4.1. The plants have previously been destarched.

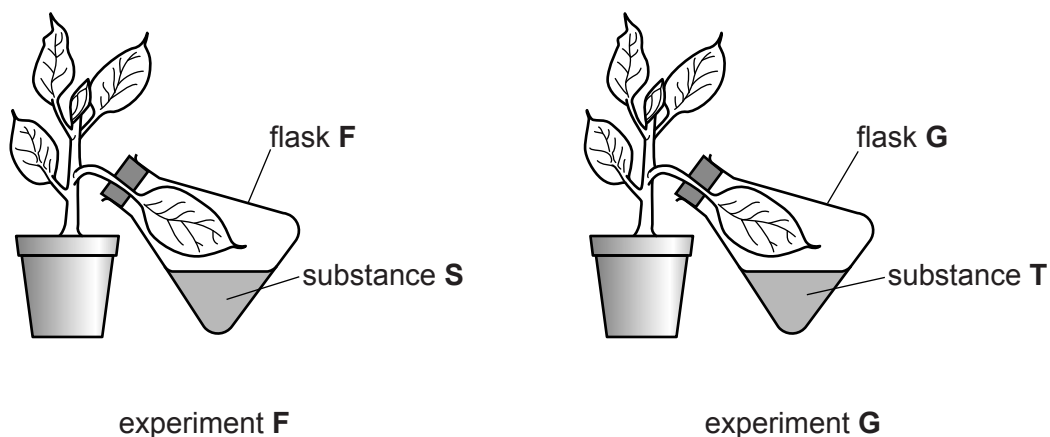


Fig. 4.1

- (a) Describe how the plants are destarched.

.....

.....

.....[2]

- (b) The student needs to remove carbon dioxide from flask **F**.

- (i) Name a **solid** or a **liquid** that can be used for substance **S** that would remove carbon dioxide from flask **F**.

.....[1]

- (ii) Suggest a suitable substance **T**, to make experiment **G** a control.

.....[1]

(c) After several hours, the student removes the leaves from the two flasks and tests them for starch.

(i) Describe in detail the procedure for testing a leaf for starch. In your answer, include any safety precautions.

.....

.....

.....

.....

.....

.....[4]

(ii) Describe and explain the appearance of each leaf after testing for starch.

.....

.....

.....[2]

- 5 (a) A student investigates solid **M**, which is a green powder.

She places a portion of **M** in a beaker and adds some sulfuric acid.

She observes bubbles and a gas is evolved. The teacher says the gas evolved is carbon dioxide.

- (i) State the test the student could use to show that the gas is carbon dioxide. Give the positive result.

test

positive result [2]

- (ii) The student separates the mixture produced in (a)(i) to give a blue solution.

Draw a labelled diagram to show how she could produce the blue solution from the mixture.

[2]

- (iii) The student pours the blue solution produced in (a)(ii) into three test-tubes.

To one of the test-tubes she adds aqueous ammonia in small amounts until there is no further change.

To the second test-tube she adds aqueous sodium hydroxide in small amounts until there is no further change.

Complete Table 5.1 with the expected observations that show the blue solution contains copper(II) ions.

Table 5.1

	reagent	
	aqueous ammonia	aqueous sodium hydroxide
observations on adding a small amount of reagent		
observations on adding an excess of reagent		

[3]

- (b) Use the information from part (a) to identify solid **M**.

solid **M** is[1]

- (c) The student uses the third test-tube of blue solution from (a)(iii) to show that the solution contains sulfate ions.

Describe how she shows that the solution contains sulfate ions. State any chemicals she should use and the observations for a positive result.

.....

.....

.....

.....[2]

- 6 (a) A student investigates how much thermal energy is produced by an electric heater.

She pours some water into a measuring cylinder.

She records the volume of water and places the water into a beaker.

Fig. 6.1 shows part of the measuring cylinder.

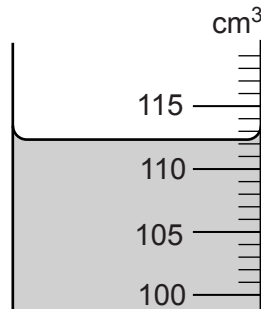


Fig. 6.1

- (i) Read the volume of water and record the value to the nearest cm^3 .

volume of water cm^3 [1]

The student places an electric heater in the beaker of water as shown in Fig. 6.2.

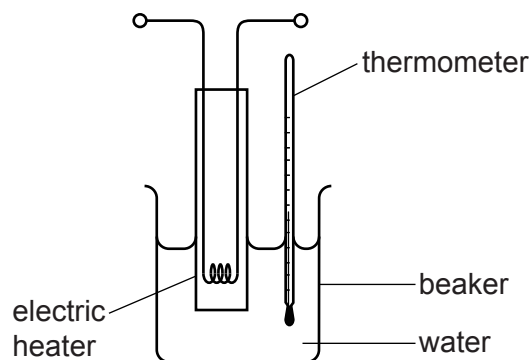


Fig. 6.2

(ii) Draw a circuit diagram, using appropriate circuit symbols, in Fig. 6.3. Include the following:

- an ammeter to measure the current in the heater
- a voltmeter to measure the potential difference across the heater
- a switch and a lamp in series with the heater.

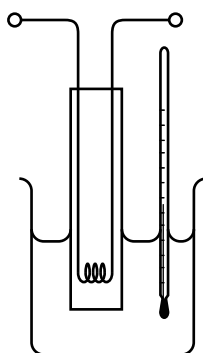
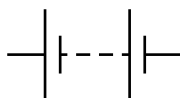


Fig. 6.3

[4]

- (iii) The student measures the temperature of the water. She closes the switch to turn on the heater.

After some time she opens the switch and measures the temperature of the hot water.

Record the values shown on the thermometers in Fig. 6.4 in the spaces below, and calculate the temperature rise ΔT .

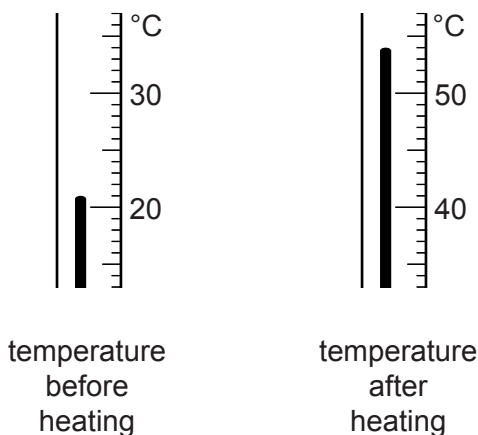


Fig. 6.4

temperature **after** heating°C

temperature **before** heating°C

ΔT °C [2]

- (iv) Calculate the energy gained, in kJ, by the water using the equation shown.

$$\text{energy gained} = \frac{M \times \Delta T \times 4.2}{1000}$$

M is the mass of water used and 1 cm^3 has a mass of 1 g.

energy gained = ... kJ [1]

- (b) The teacher says that not all the thermal energy produced by the heater results in a rise in the temperature of the water.

Suggest **two** other places to which the energy could be transferred.

1

2 [2]

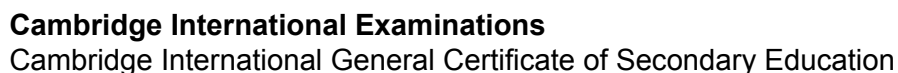
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This document consists of **19** printed pages and **1** blank page.

1 A student investigates the food content of peas and sweetcorn using the tests shown in Table 1.1.

- (a) Complete the second **row** of Table 1.1 to show the food group that can be identified by each of the tests. [2]

The student carries out the following procedure.

- She places five peas in each of three test-tubes.
- She gently crushes the peas in each test-tube with a glass rod.
- She adds Benedict's solution to one test-tube and then places it in a hot water-bath for a few minutes.
- She adds biuret solution to the second test-tube.
- She adds a few drops of iodine solution to the third test-tube.

She repeats the procedure with sweetcorn using three new test-tubes.

- (b) Explain why the peas and sweetcorn are crushed before carrying out the tests.

.....[1]

- (c) The student makes the following observations:

- the peas test positive for starch
- the sweetcorn tests positive for starch and a **small** amount of reducing sugar
- all other observations are negative results.

Complete Table 1.1 to show the results of the tests that match the student's observations. [3]

Table 1.1

	Benedict's test	biuret test	iodine test
food group tested for			
colour obtained with peas			
colour obtained with sweetcorn			

(d) Plan an investigation to test for the presence of fat in peas and sweetcorn.

You should include the following in your plan:

- what you will do
- the reagents you will use
- any safety precautions you will take
- the observations you will make that would indicate the presence of fat.

.....

.....

.....

.....

.....

.....[4]

- 2 A student is told that solids **D**, **E** and **F** have the same metal cation, but different anions.

He is provided with:

ammonia solution
barium chloride solution
distilled water
limewater
silver nitrate solution

(a) Identifying the cation

Describe how the student can identify the metal cation present in **D** using liquids from the list above.

State how the observation leads to the identity of the metal cation.

test.....

.....

observations

.....

[3]

(b) Identifying the anion in D

- (i) The student places solid **D** in a hard glass test-tube and connects this to a test-tube one quarter full of limewater using a delivery tube.

Draw a labelled diagram of this apparatus connected together.

[2]

- (ii) The student then heats the hard glass test-tube in the apparatus as in (b)(i).
He stops heating when there is no further change in the limewater.

Table 2.1 shows his observations.

Table 2.1

observation of solid D	observation of limewater
green to black	white ppt. which then disappears giving a colourless solution

Use the observations in Table 2.1 to state what can be concluded about the anion in solid **D**.

conclusion
..... [1]

(c) Identifying the anions in E and F

The student makes a solution of solid **E** in distilled water. He divides this solution between two test-tubes.

- to one test-tube of solution **E** he adds barium chloride solution
- to the other test-tube he adds silver nitrate solution
- he records his observations in Table 2.2

He then repeats the procedure for solid **F**. The observations are shown in Table 2.2.

Table 2.2

	solution of E	solution of F
barium chloride solution	white ppt.	no reaction
silver nitrate solution	no reaction	white ppt.

Use the observations in Table 2.2 to identify the anions in solids **E** and **F**.

anion in **E**

anion in **F**

[2]

- (d) Suggest a different reagent, **not** listed on page 4, that could be used to identify the metal cation.

State the expected observation for your chosen reagent if the metal cation in **D**, **E** and **F** is Cu^{2+} .

reagent

expected observation

[2]

Please turn over for Question 3.

- 3 A student carries out an experiment to investigate two different methods of insulating a beaker of water. Fig. 3.1. shows the apparatus used.

Beaker **P** has a layer of insulation wrapped around it, but has no lid.

Beaker **Q** has a lid, but no insulation.

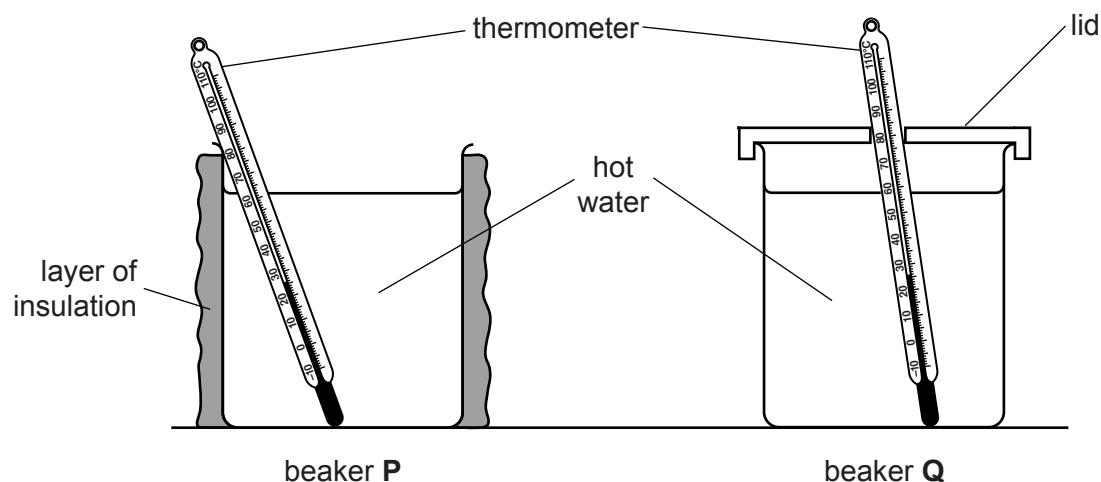


Fig. 3.1

The student carries out the following procedure.

- He pours 200 cm^3 of hot water into beaker **P**.
- He places the thermometer into the water and when the reading stops rising, measures the temperature T of the hot water and starts a stopwatch.
- He then measures the temperature of the hot water every 30 s for 180 s.

The student repeats the procedure with beaker **Q**. Table 3.1 shows his results.

Table 3.1

	beaker P	beaker Q
time t /	temperature T /	
0	83.5	85.0
30	81.5	83.5
60	80.0	82.5
90	78.5	81.0
120		80.0
150	76.0	79.0
180	75.0	78.5

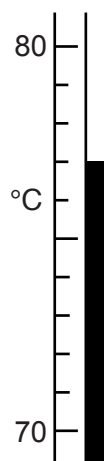


Fig. 3.2

- (a) Read the temperature shown by the thermometer in Fig. 3.2, and record it at time $t = 120$ in Table 3.1, to the nearest 0.5°C . [1]

- (b) Complete the headings in Table 3.1 by inserting the units. [1]

- (c) (i) Calculate the fall in temperature T_P of the hot water in beaker **P** over the 180 s.

$$T_P = \dots\dots\dots [1]$$

- (ii) Calculate the average rate of fall in temperature R_P of the hot water in beaker **P** over the 180 s, using the equation shown.

$$R_P = \frac{T_P}{180}$$

$$R_P = \dots\dots\dots [1]$$

- (d) (i) Calculate the fall in temperature T_Q of the hot water in beaker **Q** over the 180 s.

$$T_Q = \dots\dots\dots [1]$$

- (ii) Calculate the average rate of fall in temperature R_Q of the hot water in beaker **Q** over the 180 s.

$$R_Q = \dots\dots\dots [1]$$

- (e) State which is the more effective method of reducing thermal energy loss from a beaker of hot water. Explain your answer.

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

- (f) Apart from adding a lid, state **two** other ways that the student could have reduced the loss of thermal energy from beaker **P** even further.

1.
2.[2]

- (g) State **one** condition which he should control to ensure that the comparison between beaker **P** and beaker **Q** is fair.

.....[1]

Please turn over for Question 4.

- 4 A student investigates the effect of gravity on the growth of bean seedlings.

She sets up the apparatus shown in Fig. 4.1.

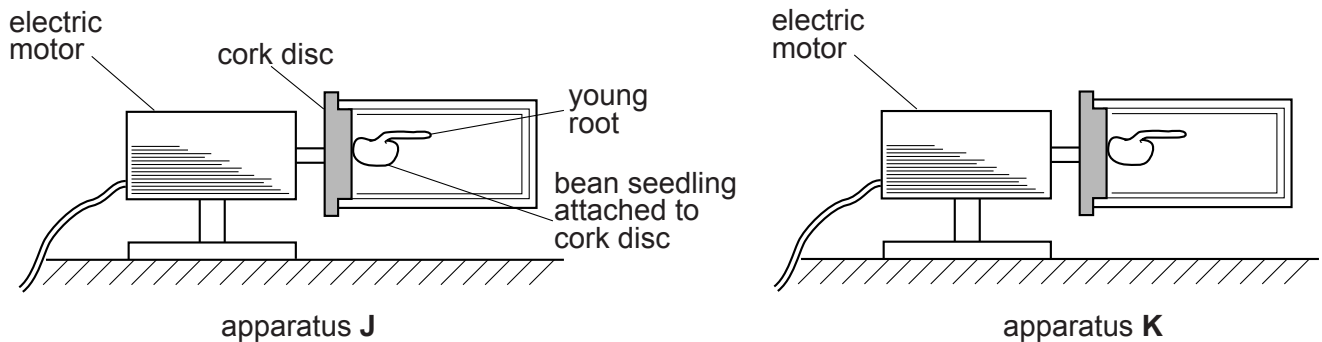


Fig. 4.1

When the electric motor in **J** is switched on the cork disc slowly rotates causing the bean seedling in **J** to rotate. She keeps the motor in apparatus **K** switched **off** throughout the experiment.

- (a) Name the type of response that the student is investigating.

..... [1]

- (b) Apparatus **J** is a control.

Fig. 4.2 shows the appearance of the young root for apparatus **J** after six days' growth.

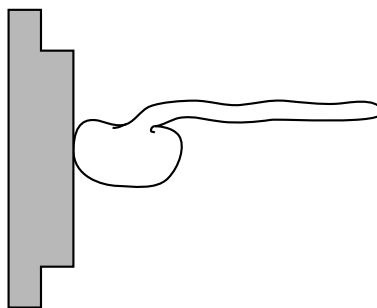


Fig. 4.2

- (i) Describe how the young root grew in **J** over this six-day period.

.....
 [1]

- (ii) Explain this pattern of growth.

.....
 [1]

- (c) Fig. 4.3 shows the bean seedling in apparatus **K**.

On Fig. 4.3, show the likely appearance of the seedling after the six days by drawing the young root. [2]

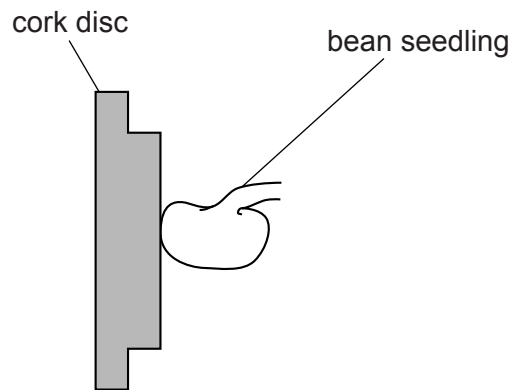


Fig. 4.3

- (d) The teacher says that the results of this experiment are **not** reliable. Explain why the results may **not** be reliable. [1]

..... [1]

- (e) A few days later, the bean seedling in apparatus **K** produces a young stem. The apparatus is placed in the dark for a further six days. Predict how the stem will grow during this time. [1]

..... [1]

- (f) The bean seedlings were obtained by germinating bean seeds. Describe how this can be done in a laboratory. [3]

..... [3]

- 5 A student uses the energy change in the reaction between hydrochloric acid and sodium hydroxide solution to find the concentration of the sodium hydroxide solution. She carries out the following procedure.

- (a) **step 1** She places 50 cm^3 of hydrochloric acid (this is volume, V_1) of known concentration C_1 in a flask.
- step 2** She measures the initial temperature of the hydrochloric acid and leaves the thermometer in the flask.
- step 3** She records this temperature in Table 5.1 for zero volume of sodium hydroxide solution added.
- step 4** She adds 10 cm^3 of sodium hydroxide solution at room temperature to the acid in the flask, stirs and records in Table 5.1 the highest temperature measured.
- step 5** When the temperature stops changing, she immediately adds a further 10 cm^3 of sodium hydroxide solution to the acid in the flask, stirs and records in Table 5.1 the highest temperature measured.
- step 6** She repeats step 5 three more times until she has added a total of 50 cm^3 sodium hydroxide solution.

Table 5.1

volume of sodium hydroxide solution added each time / cm^3	total volume of sodium hydroxide solution added / cm^3	temperature, $T / ^\circ\text{C}$	change in temperature, $\Delta T / ^\circ\text{C}$
0	0	20.0	0.0
10	10	26.0	
10	20	30.0	10.0
10	30	32.5	12.5
10	40	31.0	11.0
10	50	30.0	

- (i) Name a suitable piece of apparatus for measuring the volume of the hydrochloric acid in step 1.

.....[1]

- (ii) Explain why the student stirs the mixture after the addition of each 10 cm^3 of sodium hydroxide solution.

.....

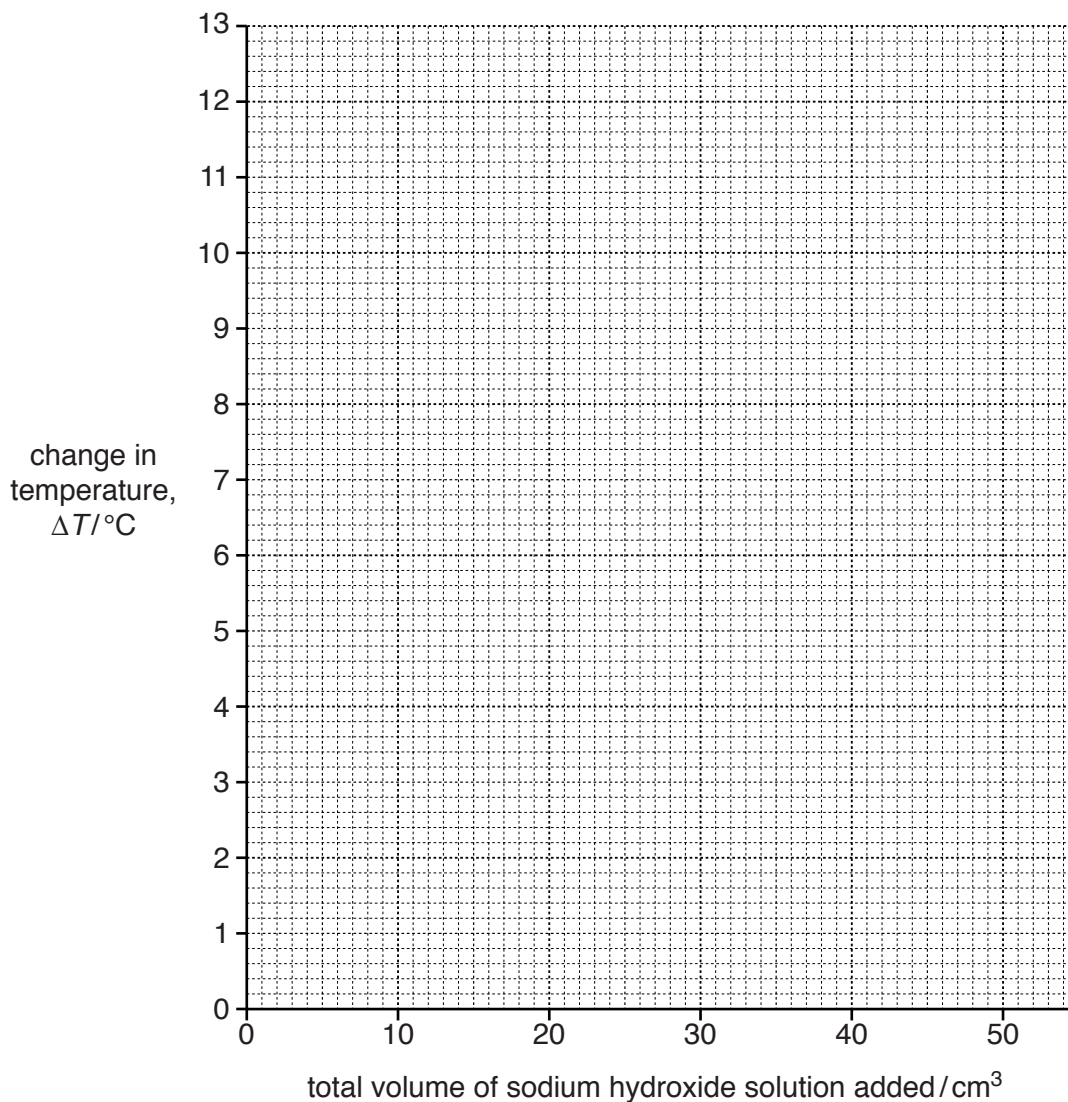
.....[1]

- (iii) This reaction is exothermic. Explain why the temperature drops when a total of 40 cm^3 of sodium hydroxide solution has been added.

.....

.....[1]

- (b) (i) Complete Table 5.1 by calculating the change in temperature, ΔT for each addition of 10 cm^3 sodium hydroxide solution compared with the initial temperature of 20.0°C . Three have been done for you. [1]
- (ii) Plot a graph of change in temperature against total volume of sodium hydroxide solution added. Draw the best-fit curve. [2]



- (iii) Draw a vertical line from the maximum on your curve down to the horizontal axis.

Where this line meets the horizontal axis is the total volume of sodium hydroxide solution added to the acid which gives the maximum change in temperature. Record this volume which is V_2 .

$V_2 = \dots\dots\dots$ [1]

- (iv) Use the data in (a) and the formula shown to calculate the concentration of the sodium hydroxide solution C_2 used.

$$C_2 = \frac{2V_1}{V_2}$$

$C_2 =$ [1]

- (c) The teacher suggests that the values obtained for V_2 and C_2 may **not** be accurate using this method.

Suggest how the **experiment** could be modified to obtain more accurate values of V_2 and C_2 . State the values of any volumes you would use.

.....

.....

.....

.....

[2]

- 6 (a) A student investigates the absorption of infra-red radiation by different surfaces.

Fig. 6.1 shows the apparatus used.

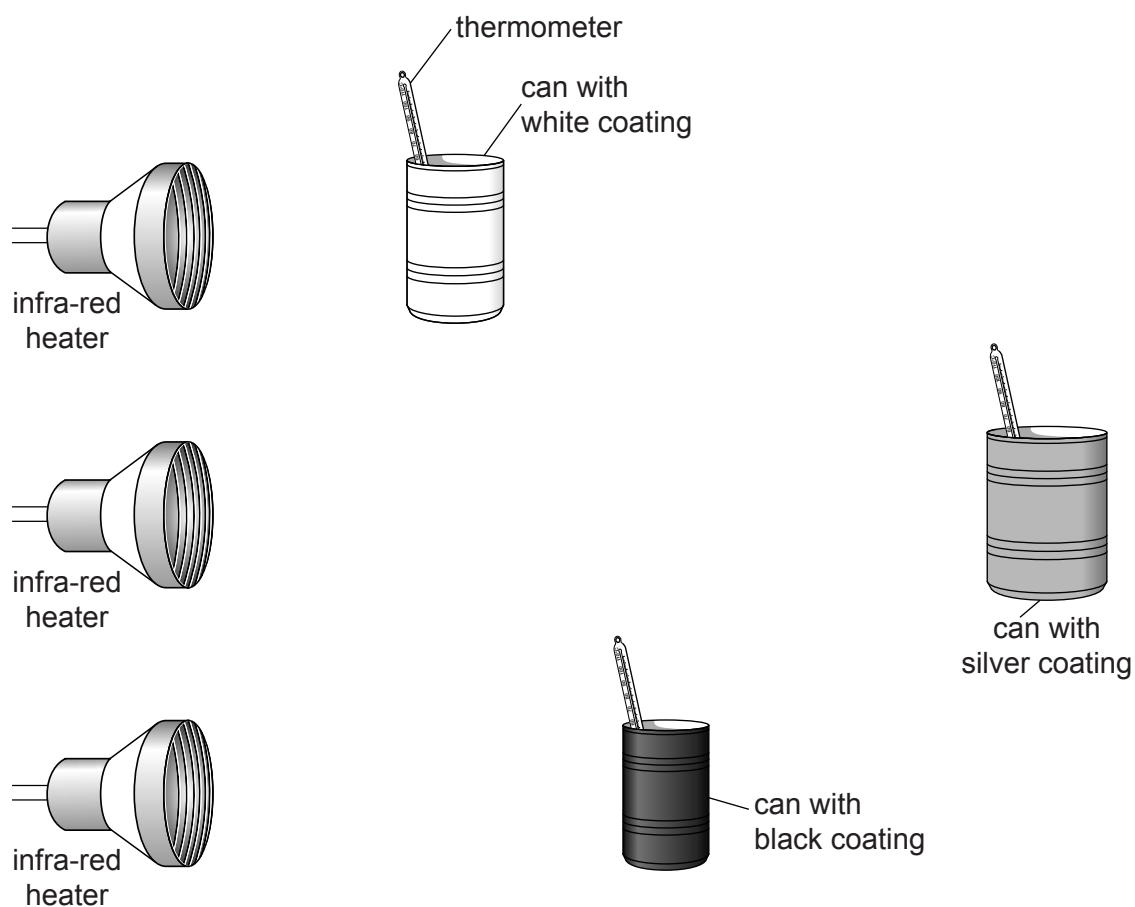


Fig. 6.1

The student adds some water to each can.

He uses a thermometer to measure the temperature of the water in each can. These temperature readings are shown in the first row of Table 6.1, on page 18, at time = 0.

Table 6.1

	temperature/°C		
time/min	silver coating	white coating	black coating
0	21	21	21
2	22	23	24
4	23	24	27
6	26	28	33
8	31	34	40
10			50

The student switches on the infra-red heaters at the same time and starts a stopclock.

He takes the temperature of the water in each can every 2 minutes for 10 minutes.

Fig. 6.2 shows the thermometers for the water in the can with the silver coating and the can with the white coating at 10 minutes.

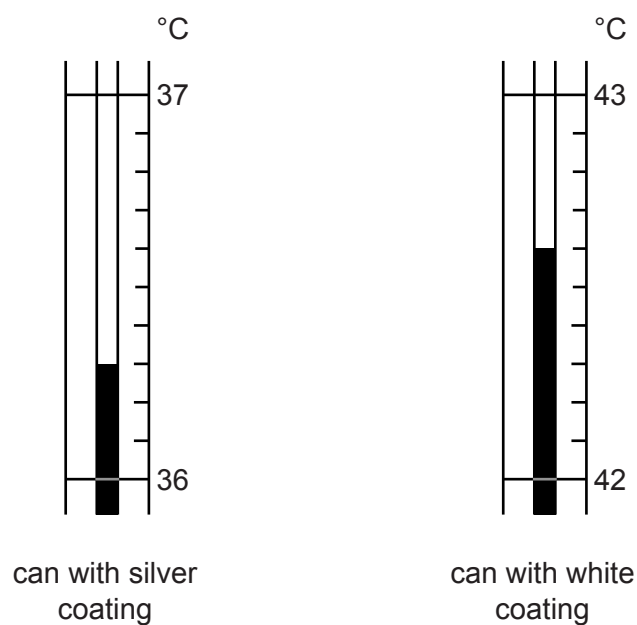


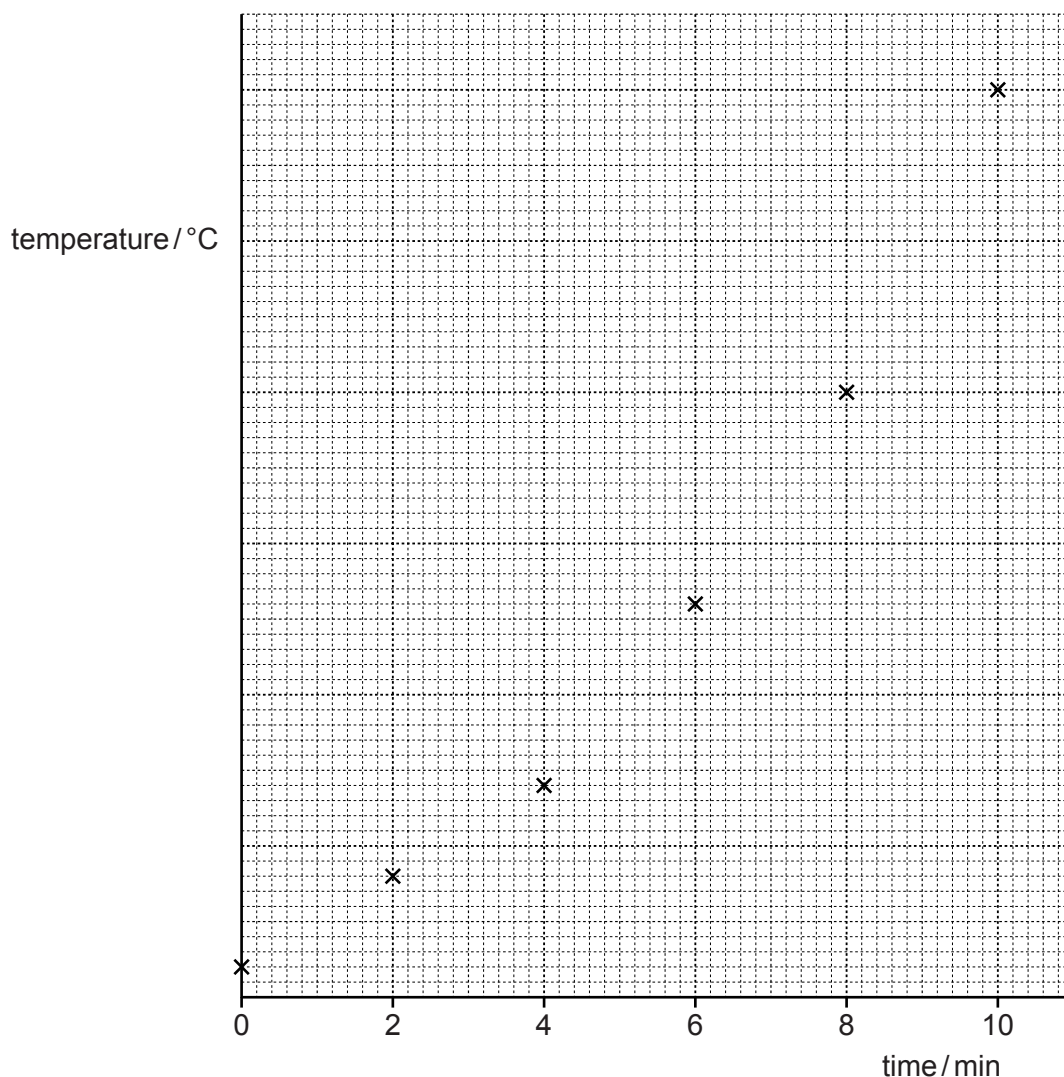
Fig. 6.2

- (i) Read the scales and record the values in Table 6.1 to the nearest 1 °C.

[2]

The student plots a graph of temperature against time for the can with the **black** coating as shown.

- (ii) Using Table 6.1 and the points plotted, add the scale to the vertical axis. The scale **does not start** at 0. [1]



- (iii) Complete the graph by plotting the points for the can with the silver coating **and** the can with the white coating.

Draw the best-fit curve for each of the cans. Label all three lines appropriately. [4]

- (b) The teacher says the results are **not** very reliable.

State **three** things the student can change to improve the reliability of the results.

1.....

2.....

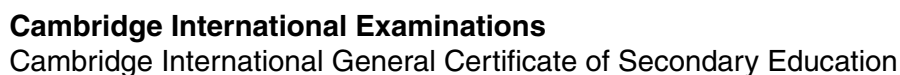
3..... [3]

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0653/63

May/June 2016

1 hour

No Additional Materials are required.

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 **19** printed pages and **1** blank page.

- 1 (a) Fig. 1.1 shows a set of human teeth.

Complete the two labels on Fig. 1.1 to name two different types of teeth.

[2]



Fig. 1.1

- (b) If teeth are not brushed regularly bacteria can multiply on the surface of the teeth and cause a layer called plaque to form.

A scientist takes a plaque sample from a student who has recently eaten a sugary food and tests its pH.

- (i) Describe how the scientist can measure the pH of the plaque.

.....

 [2]

- (ii) Suggest a value that the scientist obtained when testing the plaque.

..... [1]

- (iii) Explain your answer to (b)(ii).

..... [1]

- (c) Disclosing tablets, when chewed, stain plaque a red colour.

Plan an investigation that a group of students can carry out to see if brushing teeth three times a day instead of twice a day reduces the amount of plaque on teeth.

You should include in your answer:

- what you would do
- what you would control
- what you would measure
- how you would use the results to make a conclusion.

.....

.....

.....

.....

.....

.....

.....

.....[4]

2 Solid **A** is a mixture of two salts, **B** and **C**.

Salt **B** is soluble in water.

Salt **C** is insoluble in water.

(a) A student separated the two salts by adding water to solid **A**, stirring well and filtering the mixture. The apparatus he used for filtering is shown in Fig. 2.1.

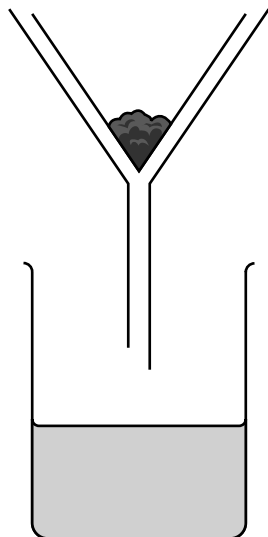


Fig. 2.1

(i) Add labels to Fig. 2.1 to show the positions of salt **B** and salt **C** after filtration. [1]

(ii) Add labels to Fig. 2.1 to show the filtrate and the residue. [1]

(b) The student carries out the tests shown in Table 2.1 on separate samples of the liquid from (a).

The observations he makes are shown in Table 2.1.

(i) Complete Table 2.1 by writing appropriate conclusions. [3]

Table 2.1

test	observation	conclusion
add dilute hydrochloric acid	no visible reaction	
add hydrochloric acid, followed by barium chloride solution	white ppt.	
add sodium hydroxide solution	light blue ppt.	

- (ii) State the **name** of the salt in the liquid.

.....[1]

- (c) The student reacts the solid from (a) with dilute hydrochloric acid.

A colourless solution and bubbles of a colourless gas are produced.

- (i) Name the test the student carries out and state the observations he makes to show that the colourless gas is carbon dioxide.

.....

.....[1]

- (ii) The student slowly adds an excess of ammonia solution to the colourless solution from (c)(i).

From his observations he concludes that the residue is a zinc salt.

Describe the observations he makes.

.....

.....

.....[2]

- (iii) Using information from (c)(i) and (c)(ii), deduce the **formula** of the salt in the solid.

formula of salt [1]

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- 3 A student investigates how the resistance of a metal wire **PQ** depends upon its length l . He sets up the circuit shown in Fig. 3.1.

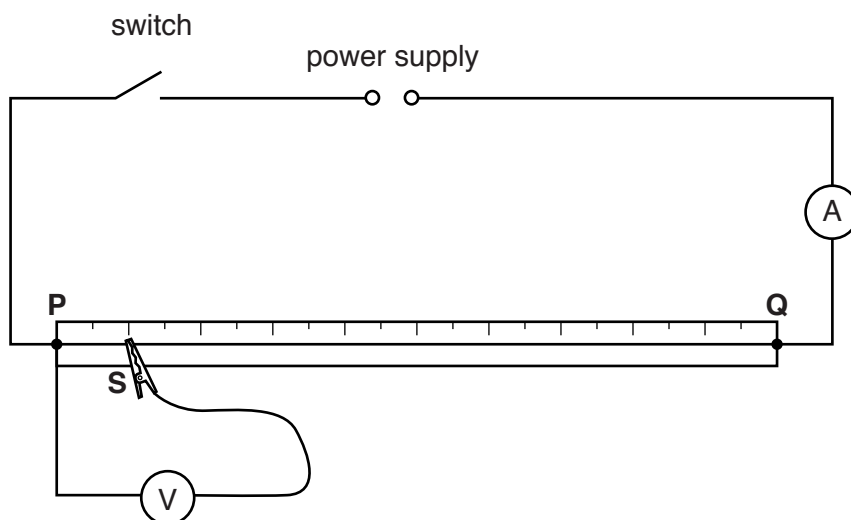


Fig. 3.1

- He places the sliding contact **S** on the wire **PQ** at a distance of $l = 10.0\text{ cm}$ from end **P**.
- He switches on and measures the potential difference V across the wire between **P** and **S**.

Part of the scale of the voltmeter is shown in Fig. 3.2.

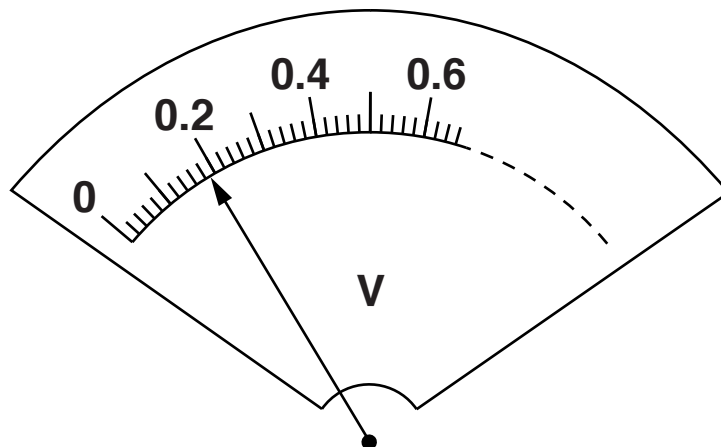


Fig. 3.2

(a) Read the scale in Fig. 3.2, on page 7, and record the value in Table 3.1.

[1]

Table 3.1

l/cm	V/V	R/Ω
10.0		
20.0	0.37	1.54
30.0	0.58	
50.0	0.96	
80.0	1.48	6.17

He measures the current I in the wire. The value of I is 0.24 A. This current **does not change** during the investigation.

He repeats this procedure for different values of l . His readings are shown in Table 3.1.

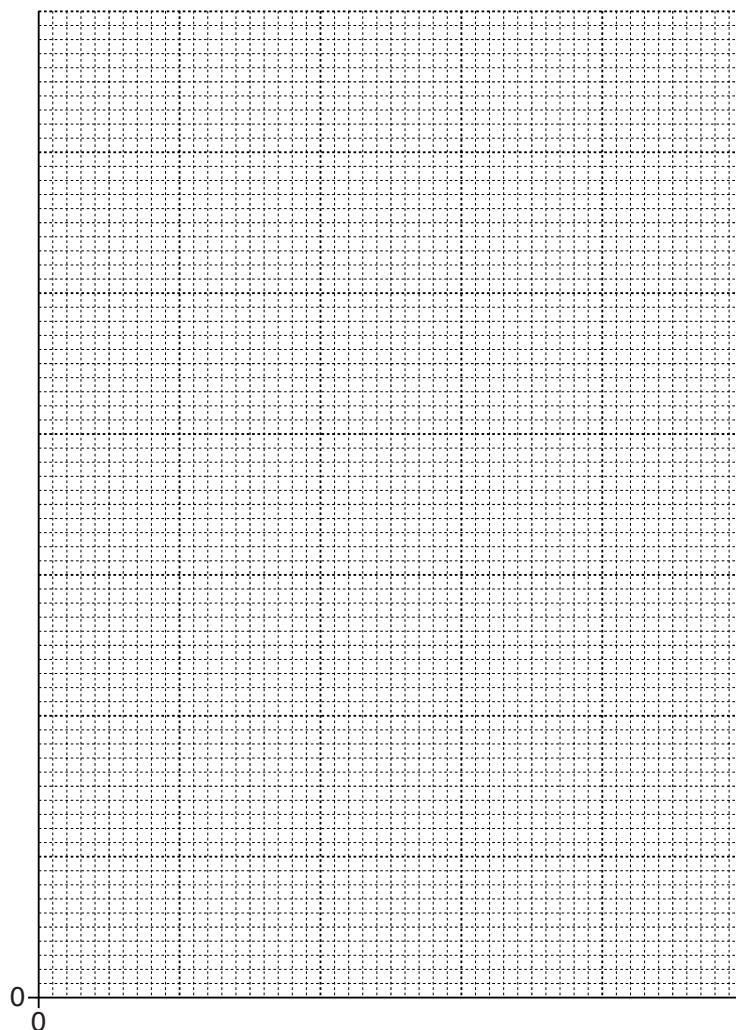
(b) Calculate the resistance R of each length of wire. Use the equation shown.

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

Record your values of R in Table 3.1.

[2]

- (c) On the grid provided, use the information from Table 3.1 to plot a graph of R (vertical axis) against l . Start your graph from the origin (0, 0). Draw the best-fit straight line. [4]



- (d) State the relationship between the length of the wire and its resistance. Refer to your graph to support your answer.

relationship

justification

..... [2]

- (e) When a wire carries a current it experiences a heating effect. This heating effect changes the resistance of the wire.

Suggest what the student should do to minimise the heating effect when carrying out this experiment.

.....

..... [1]

- 4 A scientist uses a microscope to view and measure some cells.

She observes the cells in Fig. 4.1.

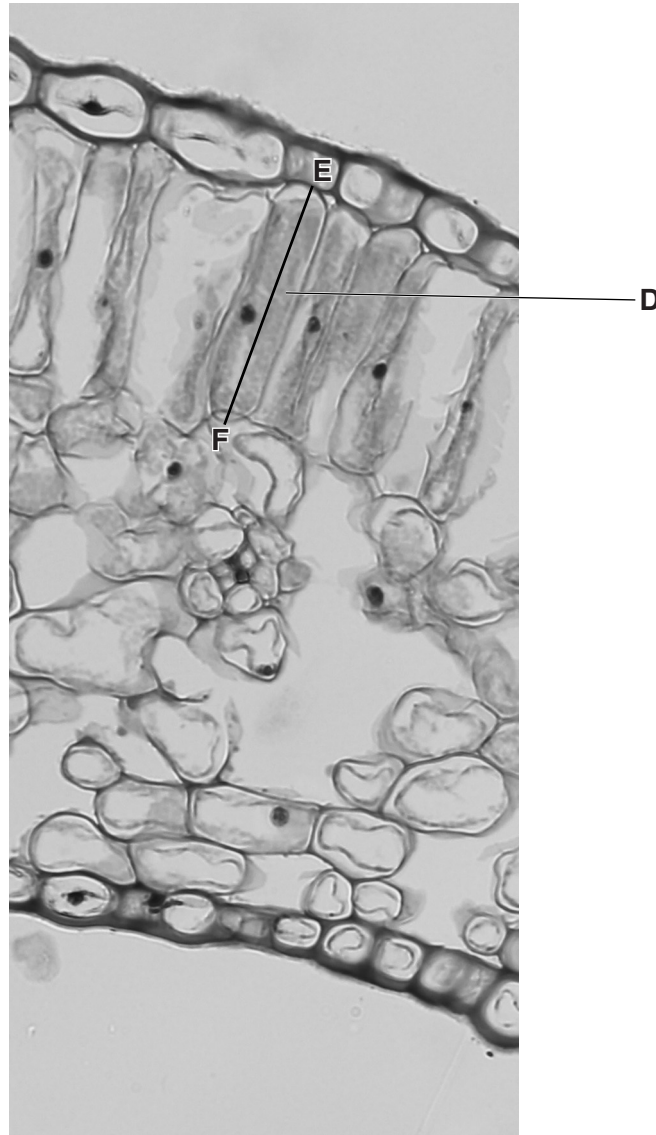
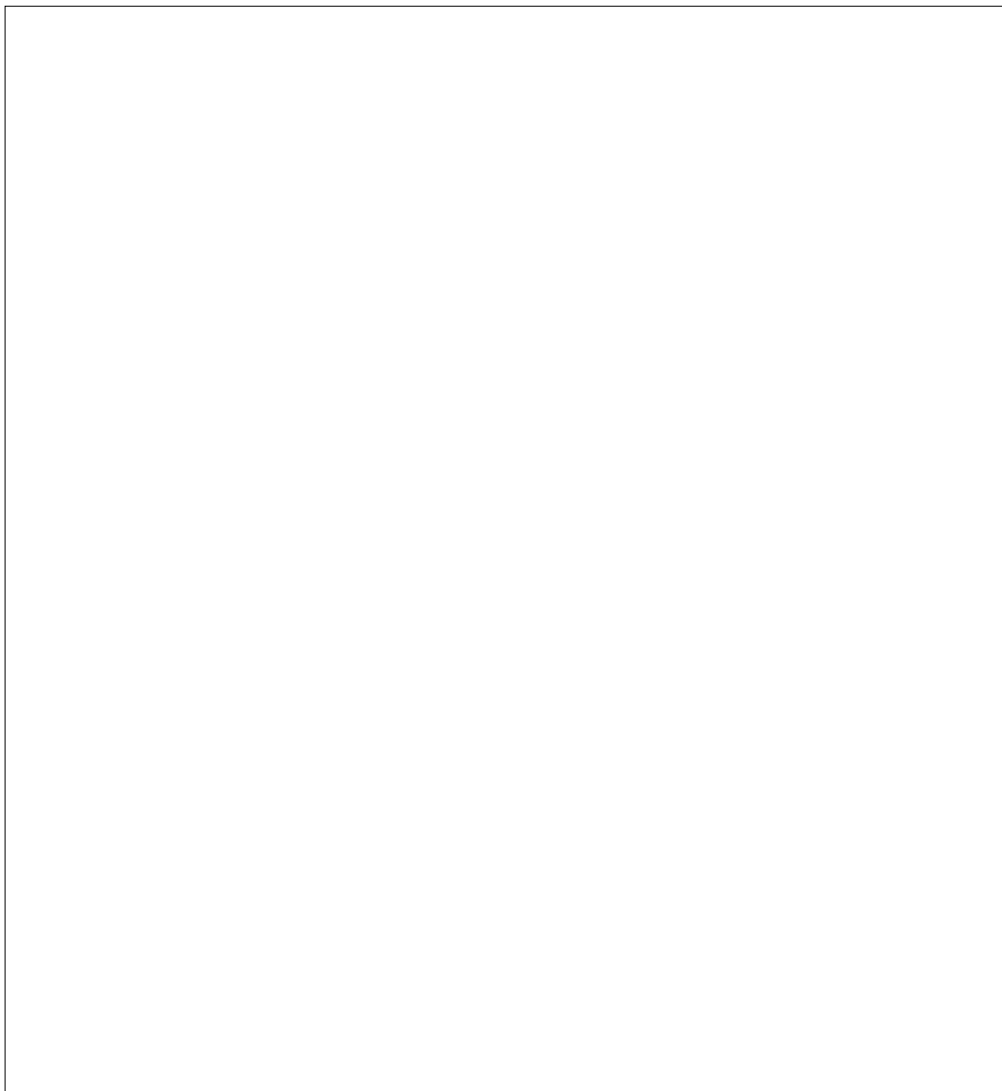


Fig. 4.1

- (a) Make a **large** pencil drawing in the box below of the cell labelled **D** in Fig. 4.1. [2]



- (b) (i) Measure the length of the line **E–F** on Fig. 4.1 Record its length in millimetres.

length = ... mm [1]

- (ii) Draw the line, **E–F**, on your cell drawing. Measure and record the length of this line in millimetres.

length = ... mm [1]

- (iii) Use your measurements to calculate the magnification of your drawing. Show your working in the space below.

magnification = ... [1]

(c) The scientist then looks at the cells under a higher magnification, as shown in Fig. 4.2.

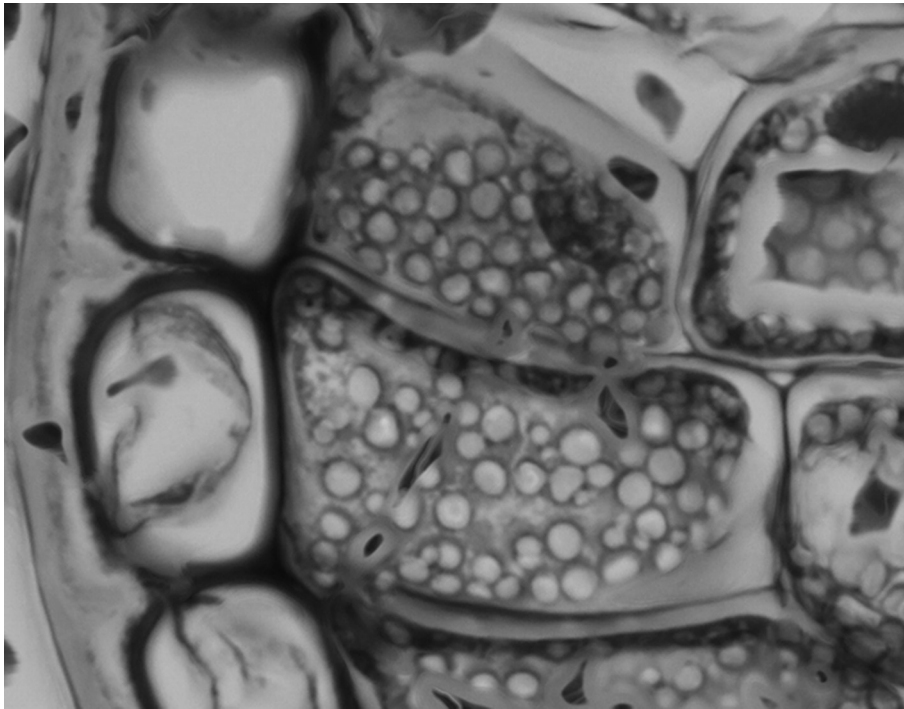


Fig. 4.2

(i) Use label lines to identify and name **three** visible features. [3]

(ii) The scientist identifies the cells as plant cells.

State whether you agree or disagree with the scientist. Give **two** reasons to support your answer.

statement

reason 1

.....

reason 2

.....

[2]

Please turn over for Question 5.

- 5 (a) A student investigates the reaction between iron and chlorine.

The apparatus is set up as shown in Fig. 5.1.

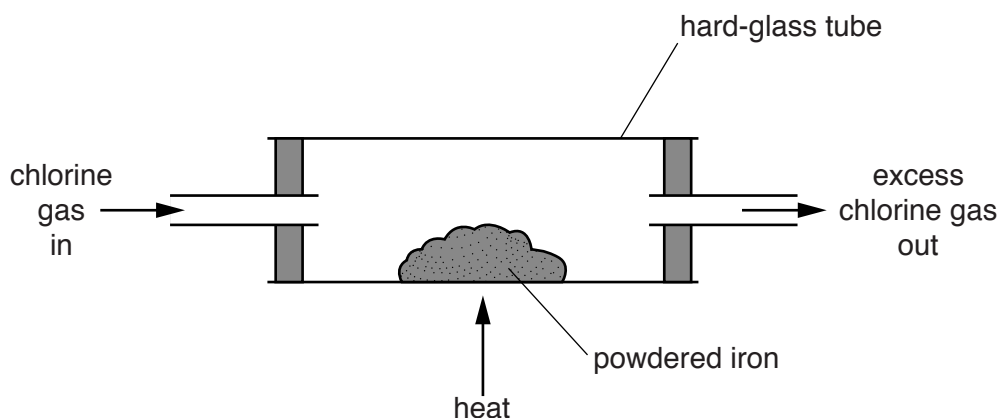


Fig. 5.1

- He measures the mass of the apparatus before adding the powdered iron.
- He adds the powdered iron to the apparatus.
- He measures the new mass of the apparatus.
- He heats the apparatus for several minutes.
- He measures the mass again after the apparatus has cooled.

Fig. 5.2 shows the balance readings.

- (i) Read the masses to the nearest 0.1 g and record the values in Table 5.1.

[2]

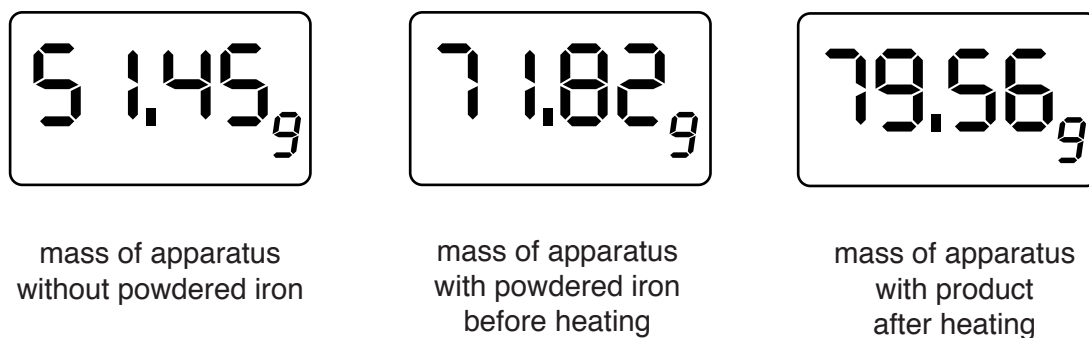


Fig. 5.2

Table 5.1

	mass/g
apparatus without powdered iron	51.5
apparatus with powdered iron before heating	
apparatus with product after heating	

- (ii) Use the information in Table 5.1 to calculate

the mass of powdered iron used,

mass of iron = ... g

the mass of product formed.

mass of product = ... g
[2]

- (iii) The maximum expected mass of product formed from this mass of powdered iron is 58.9 g.

Calculate the percentage yield, **Y**, of this reaction using the formula shown.

$$Y = \frac{\text{mass of product formed}}{\text{expected mass of product}} \times 100\%$$

Y = ... % [1]

- (iv) Suggest **one** reason why the mass of product formed in the experiment is less than the maximum expected mass.

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

- (b) Explain why the student should carry out the experiment in a fume cupboard.

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

- (c) Iron forms two chlorides, iron(II) chloride and iron(III) chloride.

Describe an experiment to show which chloride was formed in this experiment.

.....

.....

.....

..... [3]

- 6 (a) A student investigates heat loss from two metal containers labelled **X** and **Y**.

Container **X** has no insulation.

Container **Y** has a layer of wool around it.

The apparatus she uses is shown in Fig. 6.1.

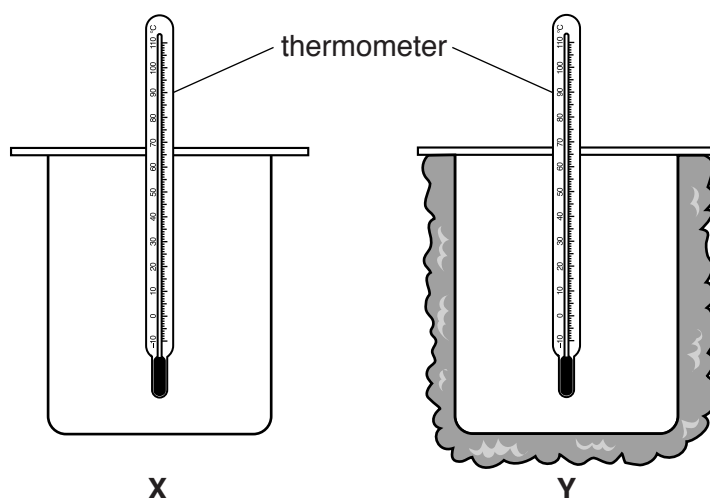


Fig. 6.1

She places some hot water into a measuring cylinder and measures the volume.

- (i) Read the volume in Fig. 6.2 and record the value in the space below.

volume = ... cm^3 [1]

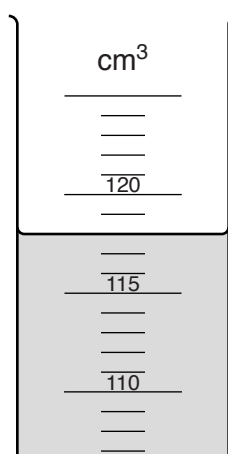


Fig. 6.2

- (ii) She reads the temperature of the water in the measuring cylinder.

This is the temperature at time 0 mins for **X** and **Y**.

Read the thermometer in Fig. 6.3 and record the value to the nearest degree in the correct spaces in Table 6.1. [1]

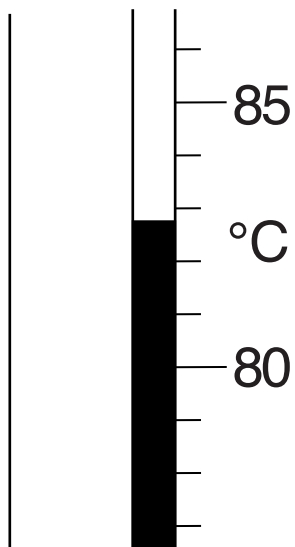


Fig. 6.3

Table 6.1

time/min	temperature X /°C	temperature Y /°C
0		
2	61	67
4	49	55
6	40	46
8	34	83
10	32	36

She quickly pours about half the water into container **X** and the rest into container **Y**.

She covers each container with a lid and starts a stopclock.

She reads the temperature of both containers every two minutes for ten minutes.

The results are shown in Table 6.1.

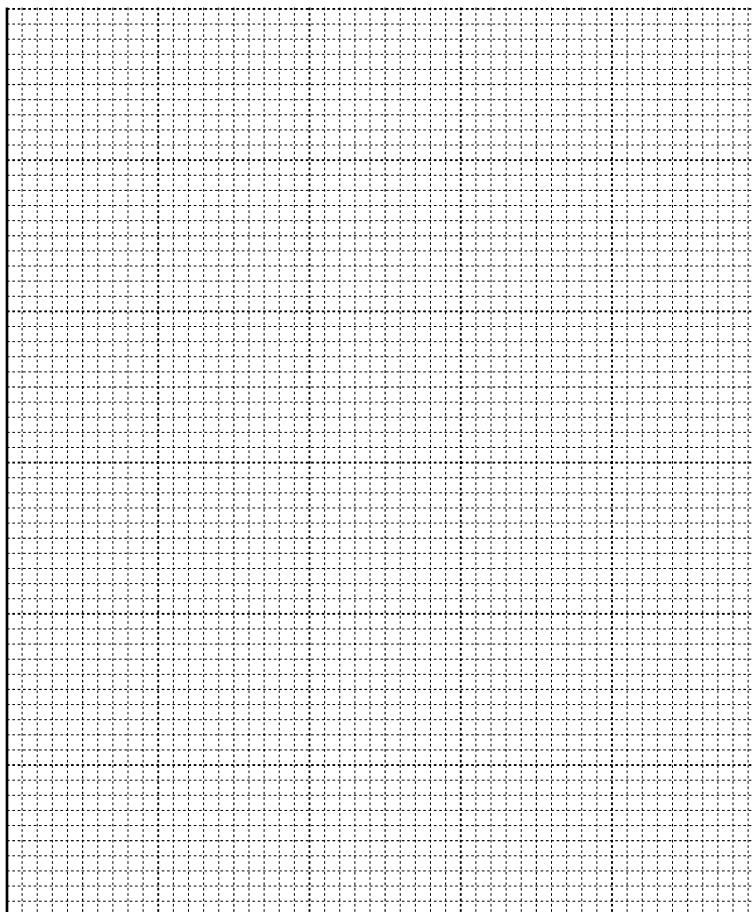
- (iii) On the grid provided plot a graph of temperature against time for both containers.

Use as much of the grid as possible.

Draw best-fit smooth curves and label each line.

[4]

temperature / °C



time / min

- (iv) Describe **one** way in which the curves you have drawn for container **X** and container **Y** are

similar, ...

.....

different.

.....

[2]

- (b) The teacher states that the experiment with the wool insulation should be repeated.

Suggest a reason why.

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

- (c) The teacher says that the results from this experiment are unreliable.

Suggest how the method could be changed to increase the reliability of the results.

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

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