



CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

0653/61

October/November 2020

1 hour

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

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

This document has **16** pages. Blank pages are indicated.

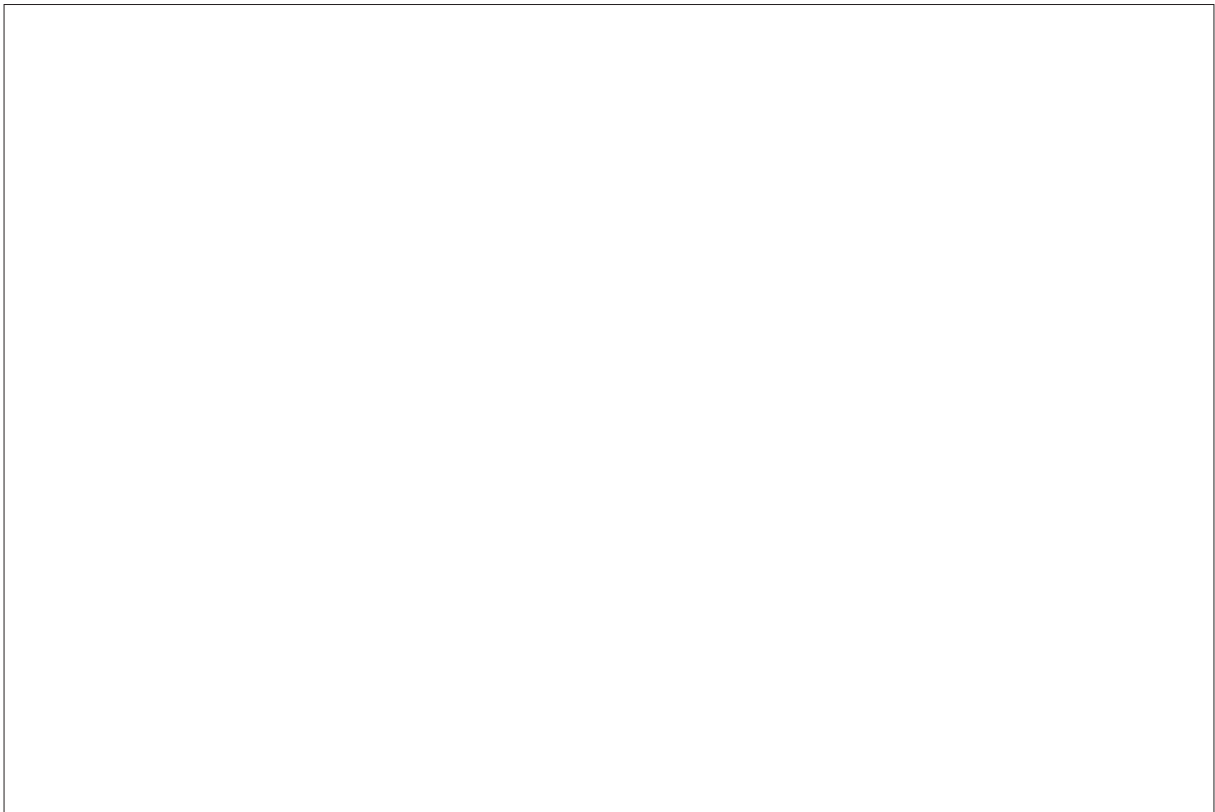
- 1 (a) A student investigates the amount of vitamin C in orange juice.

She is given half an orange, as shown in Fig. 1.1.



Fig. 1.1

In the box, make a large drawing of the orange shown in Fig. 1.1.

A large, empty rectangular box with a thin black border, intended for a student to draw a large representation of the orange shown in Fig. 1.1.

[3]

BLANK PAGE

- (b) The student tests the juice from the orange with DCPIP.

DCPIP is a dark blue solution that turns colourless when vitamin C is added.

If the orange juice contains a lot of vitamin C, less orange juice is needed to turn the DCPIP colourless.

Procedure

The student:

- puts 2.0 cm^3 DCPIP into a test-tube
- fills a syringe with 10.0 cm^3 orange juice
- adds orange juice to the DCPIP until the DCPIP turns colourless
- records the volume of orange juice **remaining** in the syringe in Table 1.1.

The student repeats the procedure two more times (experiment **2** and experiment **3**).

- (i) Fig. 1.2 shows the volume of orange juice **remaining** in the syringe in experiment **3**.

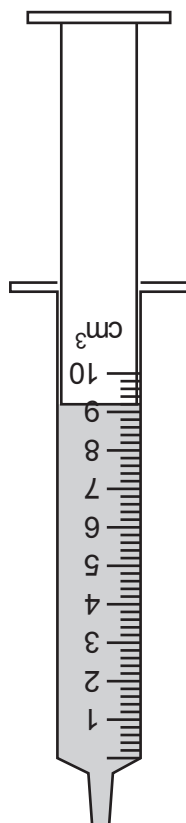


Fig. 1.2

Record in Table 1.1 the volume of orange juice **remaining** in the syringe in experiment **3**.

Table 1.1

experiment	volume of orange juice remaining in syringe/cm ³	volume of orange juice added to the DCPIP/cm ³
1	9.4	0.6
2	9.3	0.7
3		

[1]

- (ii) The student calculates the volume of orange juice **added** to the DCPIP in experiment **1** and experiment **2** using the equation shown.

volume of orange juice **added** = 10.0 – volume of orange juice **remaining** in the syringe

Calculate the volume of orange juice **added** to the DCPIP in experiment **3** and record your answer in Table 1.1.

[1]

- (iii) Calculate the average volume of orange juice **added** to the DCPIP.

Show your working.

average volume of orange juice **added** = ... cm³ [1]

- (iv) Explain why the student repeats the experiment.

.....
 [1]

[Total: 7]

2 A manufacturer makes two drinks, **A** and **B**, as shown in Fig. 2.1.

- Drink **A** contains sugar and fat.
- Drink **B** is low in sugar and contains no fat.



Fig. 2.1

Plan an investigation to compare the sugar and fat content of the two drinks.

In your answer, include:

- your predictions for results for drink **A** and drink **B**
- the apparatus and chemicals you will need
- a brief description of the method, including how you will treat variables and any safety precautions you will take
- the observations you will make and how they will help you compare drink **A** and drink **B**.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [7]

- 3 (a) When magnesium ribbon is added to hydrochloric acid, bubbles of hydrogen gas are produced.

State the test which shows that the gas is hydrogen. Give the observation for a positive result.

test

observation

[1]

- (b) A student investigates the effect of concentration of hydrochloric acid on the rate of a reaction.

M is a unit of acid concentration. The higher the number, the more concentrated the acid.

A sample of 2.0 M hydrochloric acid is two times more concentrated than 1.0 M hydrochloric acid.

Procedure

The student:

- measures 25 cm^3 of 2.5 M hydrochloric acid with a measuring cylinder and pours it into a conical flask
- adds a 1 cm piece of magnesium ribbon to the 2.5 M hydrochloric acid and starts a stop-watch
- stops the stop-watch as soon as all of the magnesium has fully reacted
- records this time in Table 3.1.

The student repeats the procedure using 2.0 M, 1.5 M and 1.0 M hydrochloric acid instead of 2.5 M hydrochloric acid.

- (i) Fig. 3.1 shows the stop-watches for the 2.0 M and 1.5 M hydrochloric acid tests.



2.0 M hydrochloric acid



1.5 M hydrochloric acid

Fig. 3.1

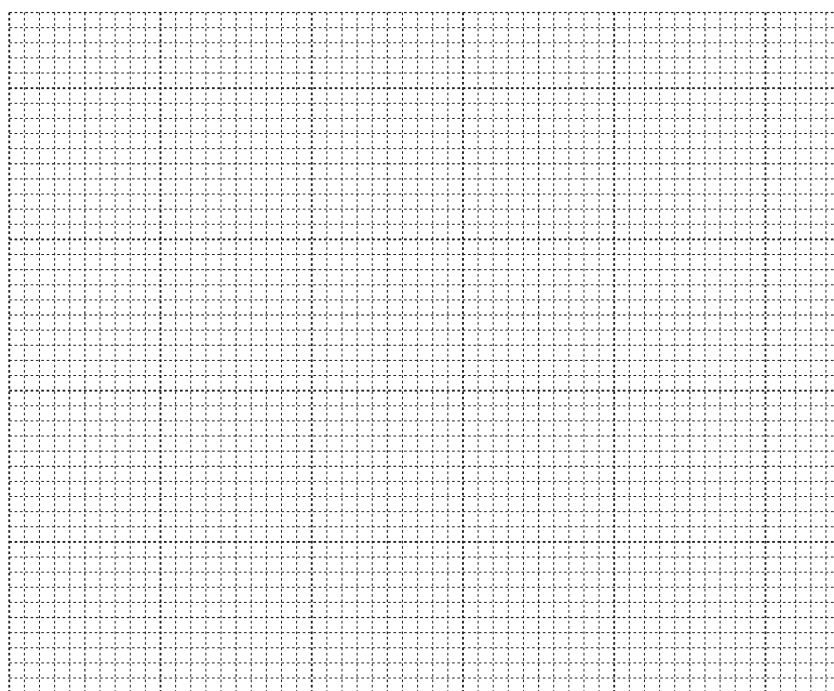
In Table 3.1, record these times to the nearest second.

[2]

Table 3.1

acid concentration /M	time for magnesium to fully react/s
2.5	12
2.0	
1.5	
1.0	78

- (ii) Plot a graph of time for magnesium to fully react (vertical axis) against acid concentration.



[3]

- (iii) Draw the straight best-fit line. Label the line **B**. [1]

- (iv) Describe the relationship between acid concentration and time for magnesium to fully react.

.....

..... [1]

- (v) Use your graph to determine the time it takes for a 1 cm piece of magnesium ribbon to fully react with 1.8M hydrochloric acid.

time = ... s [1]

- (vi) Suggest **one** improvement to this experiment to make the results more accurate.

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

- (vii) The student repeats the experiment in (b).

The student uses the same concentrations of hydrochloric acid at a temperature of 50 °C instead of room temperature.

Everything else is kept the same.

The student finds the reactions happen more quickly.

On the grid in (b)(ii), draw the best-fit line you would expect to get at 50 °C. Label the line **C**. [1]

- (c) The rate of the reaction of magnesium and hydrochloric acid can be determined by collecting the hydrogen gas given off. The volume of gas collected is measured at regular time intervals.

Draw a labelled diagram of the assembled apparatus used to react magnesium with hydrochloric acid **and** collect **and** measure the volume of gas given off.

[2]

[Total: 13]

- 4 (a) A student determines the density of a glass block.

Fig. 4.1 shows the glass block with dimensions:

length = 11.0 cm
width = 6.0 cm
height = 2.0 cm.

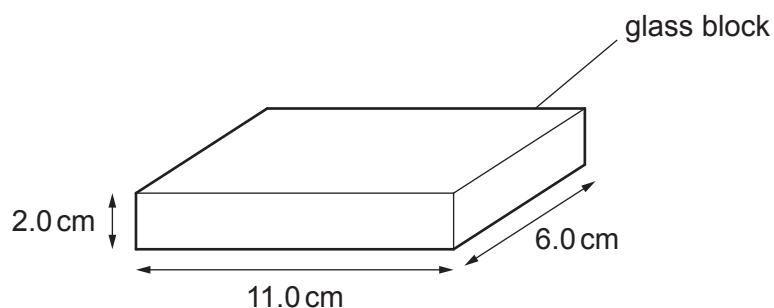


Fig. 4.1

- (i) Calculate the volume of the glass block. Use the equation shown.

$$\text{volume} = \text{length} \times \text{width} \times \text{height}$$

$$\text{volume} = \dots\dots\dots \text{cm}^3 \quad [1]$$

- (ii) The student measures the mass of the glass block using a balance.
Fig. 4.2 shows the reading on the balance.



Fig. 4.2

Record the mass of the glass block to the nearest 0.1 g.

$$\text{mass} = \dots\dots\dots \text{g} \quad [1]$$

- (iii) Calculate the density of the glass block. Use the equation shown.

Give your answer to 2 significant figures.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$\text{density} = \dots\dots\dots \text{g/cm}^3 \quad [2]$$

- (b) The student investigates the refraction of light through the glass block.

Procedure

The student:

- draws around the glass block on a sheet of paper and labels the corners **ABCD** as shown in Fig. 4.3
- draws a line **EF** as shown in Fig. 4.3
- places two optics pins P_1 and P_2 on **EF**
- views the images of P_1 and P_2 **through** the glass block
- places two more optics pins P_3 and P_4 on the sheet of paper lined up with the images of P_1 and P_2
- labels the positions of P_3 and P_4 on the paper
- removes the glass block and the pins.

- (i) On Fig. 4.3, draw an **X** to show the approximate position from which the student views the images of P_1 and P_2 **through** the glass block. [1]

- (ii) On Fig. 4.3, draw the normal to **AB** (a line at 90° to **AB**) at point **E**. Label the upper end of the normal **N**. [1]

- (iii) Measure and record the angle θ between lines **EF** and **EN**.

$$\theta = \dots\dots\dots^\circ \quad [1]$$

- (c) On Fig. 4.3:

- draw a line through P_3 and P_4 and extend it to meet **CD**
- label the point at which this line meets **CD** with the letter **G**
- draw a line through **G** at 90° to **CD** and extend this line until it crosses **AB**
- label the point at which this line meets **AB** with the letter **H**
- extend the line **FE** until it meets the line **GH**
- label the point at which this line meets **GH** with the letter **J**
- draw a straight line joining points **E** and **G**.

[2]

- (d) (i) Measure and record to the nearest 0.1 cm the length of the line **EG**.

$$\mathbf{EG} = \dots\dots\dots \text{ cm} \quad [1]$$

- (ii) Measure and record to the nearest 0.1 cm the length of the line **EJ**.

$$\mathbf{EJ} = \dots\dots\dots \text{ cm} \quad [1]$$

- (iii) Calculate the refractive index n of the glass block. Use the equation shown.

(If you do not have values for **EG** and **EJ**, use **EG** = 6.5 cm and **EJ** = 4.1 cm. These are **not** the correct values.)

$$n = \frac{\mathbf{EG}}{\mathbf{EJ}}$$

$$n = \dots\dots\dots \quad [1]$$

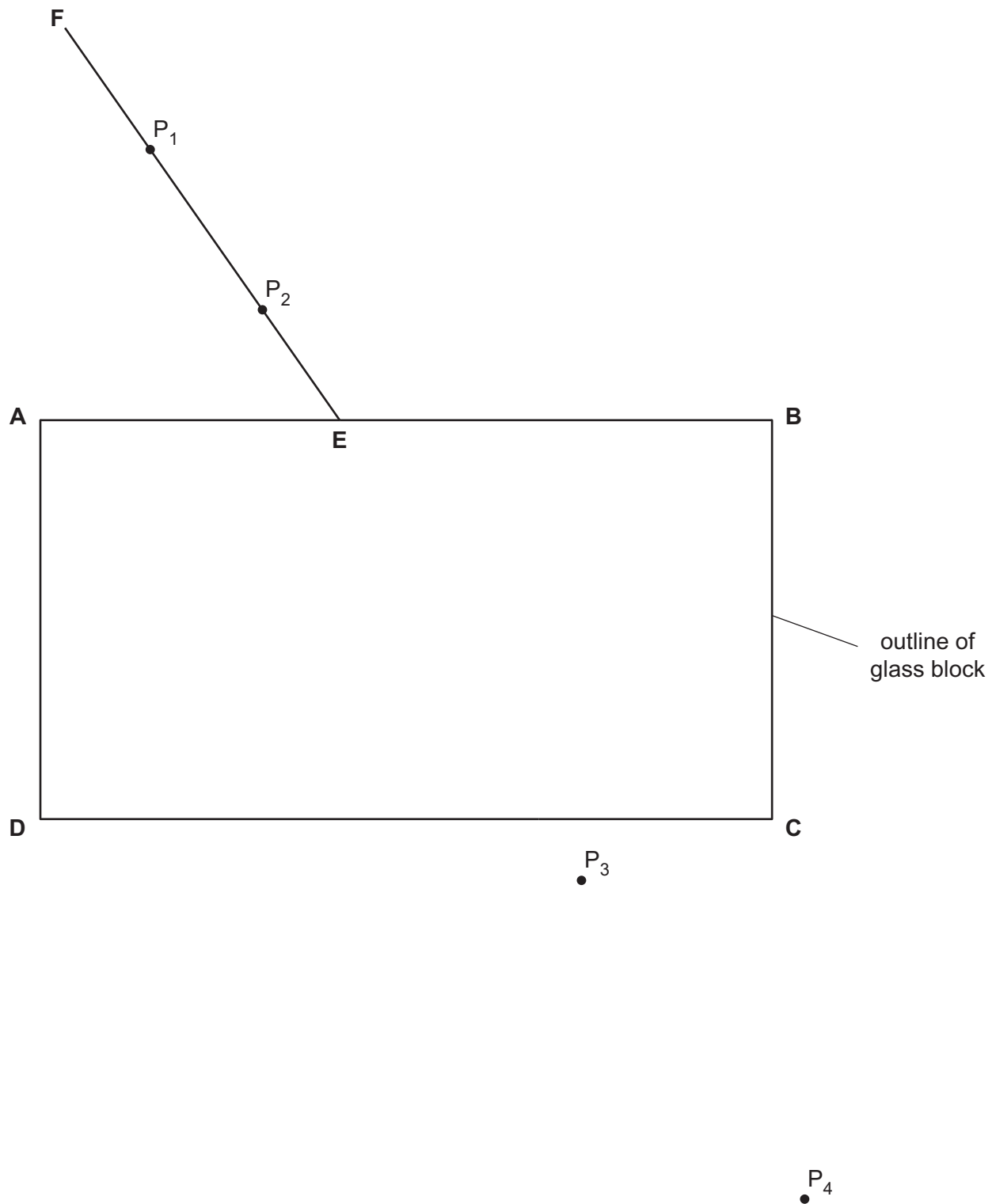


Fig. 4.3

- (e) The refractive index of the glass block the student used in this experiment is 1.5.

Compare this value of the refractive index n with the value of n you calculated in (d)(iii).
State whether the two values agree within the limits of experimental accuracy. Justify your
answer with reference to the values.

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

[Total: 13]

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.



CANDIDATE
NAME

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

0653/62

October/November 2020

1 hour

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

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

This document has **16** pages. Blank pages are indicated.

- 1 (a) Diatoms are single-celled organisms that live in water.

Fig. 1.1 shows a diatom.



Fig. 1.1

In the box, make a large drawing of the diatom shown in Fig. 1.1.



[3]

(b) Fig. 1.2 shows a different species of diatom. The photograph is magnified $\times 1500$.

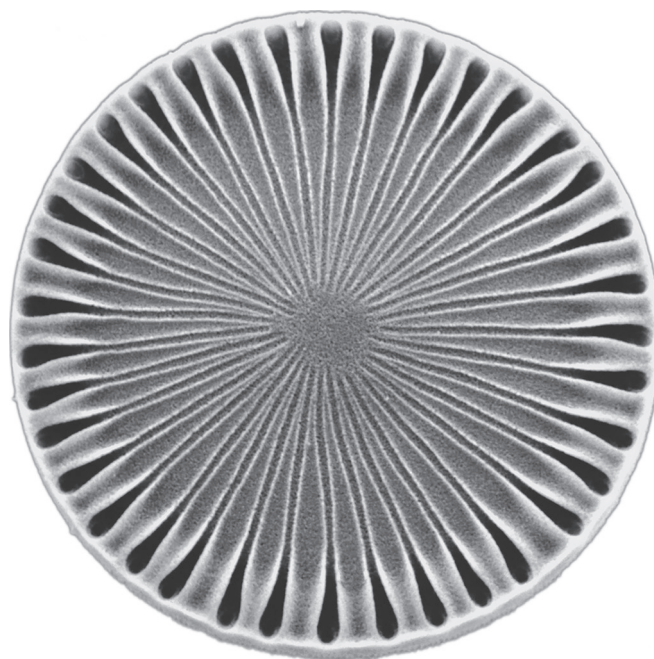


Fig. 1.2 (magnification $\times 1500$)

(i) Measure the diameter of the photograph of the diatom in Fig. 1.2.

diameter of photograph = ... mm [1]

(ii) Calculate the actual diameter of the diatom.

Use the equation shown.

$$\text{actual diameter} = \frac{\text{diameter of photograph}}{\text{magnification}}$$

actual diameter = ... mm [1]

(c) Describe **one** similarity and **one** difference between the diatom in Fig. 1.1 and the diatom in Fig. 1.2.

similarity

.....

difference

.....

[2]

[Total: 7]

- 2 A student wants to investigate two plant tissues to identify which plant tissue loses the most water when placed in aqueous concentrated salt solution.

The student is provided with a potato, a carrot and aqueous concentrated salt solution.

Plan an investigation to compare the loss of water in pieces of potato and carrot placed in aqueous concentrated salt solution.

In your answer, include:

- the apparatus you will need, including a labelled diagram if you wish
- a brief description of the method and the measurements you will make
- the variables you will control
- how you will process and use the results to draw a conclusion.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [7]

BLANK PAGE

- 3 A student investigates the changes in temperature that occur when dilute acid is added to aqueous sodium hydroxide. The student investigates two dilute acids, dilute hydrochloric acid and dilute sulfuric acid.

The student uses methyl orange as an indicator. Methyl orange is yellow in alkaline solutions and red in acidic solutions.

(a) Procedure

The student:

- step 1 measures 20cm^3 aqueous sodium hydroxide in a measuring cylinder and pours it into a conical flask
- step 2 adds 6 drops of methyl orange to the aqueous sodium hydroxide in the conical flask
- step 3 measures the temperature of the aqueous sodium hydroxide in the conical flask and records the value in Table 3.1
- step 4 uses a burette to add 5.0cm^3 dilute hydrochloric acid to the aqueous sodium hydroxide in the conical flask and swirls the mixture
- step 5 measures the temperature of the mixture in the conical flask and records the value in Table 3.1
- step 6 records the colour of the methyl orange in the mixture in Table 3.1
- step 7 repeats steps 4–6 until a total of 40.0cm^3 dilute hydrochloric acid has been added.

- (i) Fig. 3.1 shows the thermometer readings for 0.0cm^3 , 30.0cm^3 and 35.0cm^3 of dilute hydrochloric acid added.

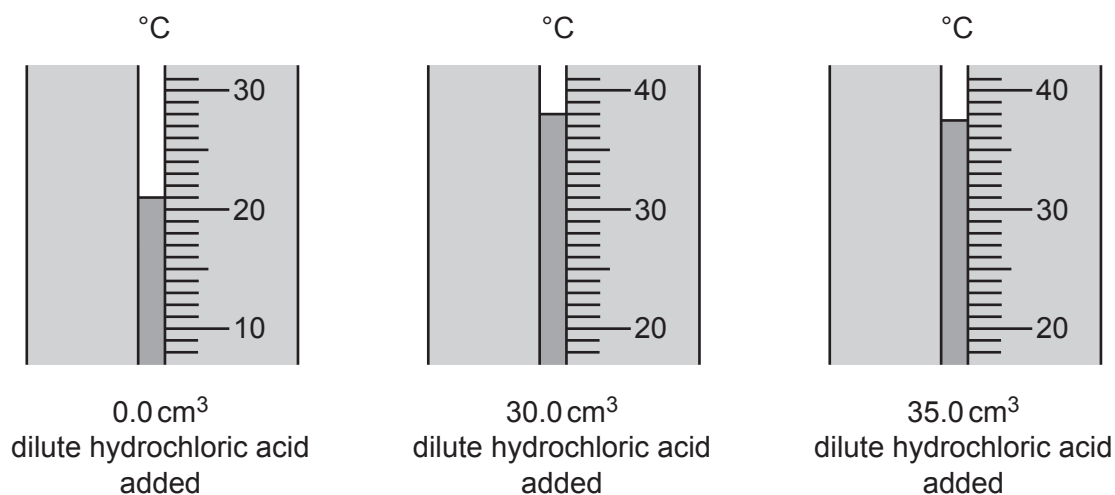


Fig. 3.1

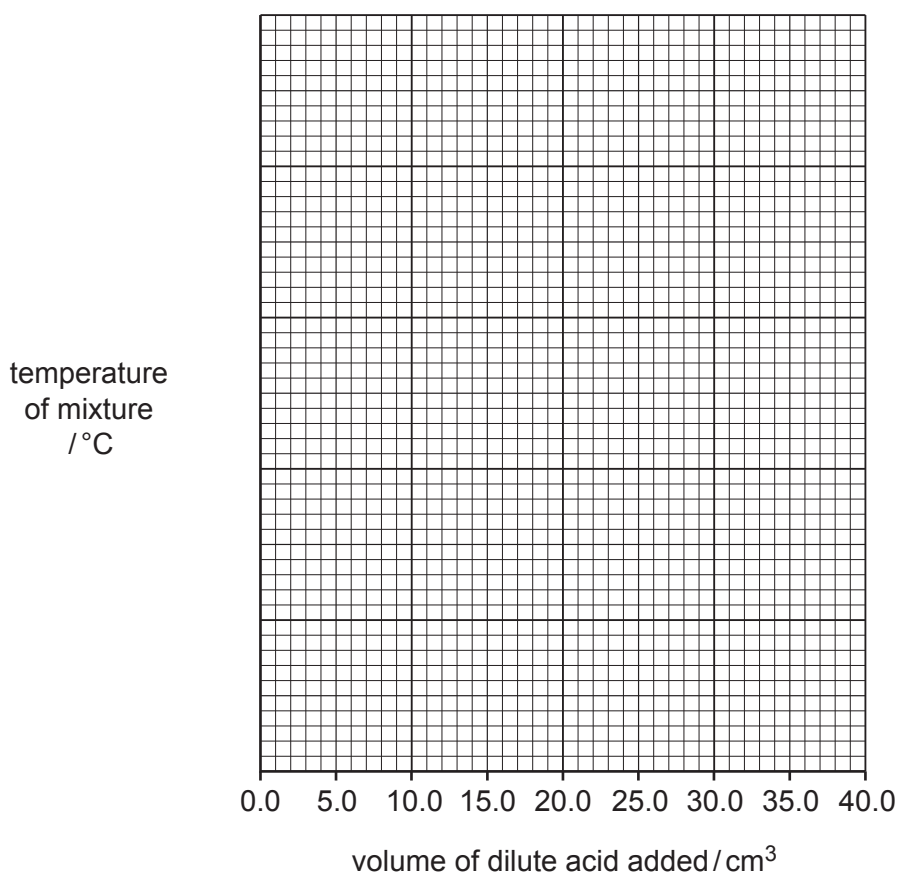
Record these values in Table 3.1.

Table 3.1

volume of dilute hydrochloric acid added / cm ³	temperature of mixture / °C	colour of methyl orange
0.0		yellow
5.0	25.5	yellow
10.0	29.5	yellow
15.0	34.5	yellow
20.0	38.0	yellow
25.0	38.5	red
30.0		red
35.0		red
40.0	37.0	red

[3]

- (ii) Using the data in Table 3.1, plot on the grid the points for temperature of mixture against volume of dilute hydrochloric acid added.



[2]

- (iii) Draw a straight best-fit line for the first **five** points.
 Draw a straight best-fit line for the last **four** points.
 Extend both lines until they cross.
 The point where the two lines cross is the maximum temperature reached.
 Label these two lines **hydrochloric acid**.

[1]

- (b) The student repeats the procedure in (a) using dilute sulfuric acid instead of dilute hydrochloric acid.

The results are shown in Table 3.2.

Table 3.2

volume of dilute sulfuric acid added/cm ³	temperature of mixture/°C	colour of methyl orange
0.0	21.5	yellow
5.0	28.0	yellow
10.0	35.5	yellow
15.0	39.0	red
20.0	38.0	red
25.0	37.0	red
30.0	36.5	red
35.0	35.0	red
40.0	33.5	red

On the grid in (a)(ii), plot the points for temperature against volume of dilute sulfuric acid added.

Draw a straight best-fit line for the first **three** points.

Draw a straight best-fit line for the last **six** points.

Extend both lines until they cross.

The point where the two lines cross is the maximum temperature reached.

Label these two lines **sulfuric acid**.

[2]

- (c) State the maximum temperature reached for each acid.

dilute hydrochloric acid = ... °C

dilute sulfuric acid = ... °C

[1]

- (d) Suggest what happens to the colour of the methyl orange when the mixture is near the maximum temperature.

.....

..... [1]

(e) The concentrations of the dilute hydrochloric acid and the dilute sulfuric acid are the same.

- (i) State which dilute acid neutralises the aqueous sodium hydroxide using a smaller volume of acid.

Use data from your graph to explain your answer.

acid

explanation

..... [1]

- (ii) Hydrochloric acid has the formula HCl .
Sulfuric acid has the formula H_2SO_4 .

Suggest why the dilute acid chosen in (e)(i) uses a smaller volume to neutralise the sodium hydroxide.

.....

..... [1]

- (iii) Suggest a change to the apparatus which would give you greater confidence in your answer to (e)(i).

..... [1]

[Total: 13]

- 4 The 'internal resistance' of a cell is the resistance **inside** the cell.

A student investigates the internal resistance of a cell.

(a) The student uses a series circuit containing:

- a cell
- a switch
- a variable resistor to control the current in the circuit
- an ammeter to measure the current in the circuit
- a voltmeter to measure the potential difference (p.d.) across the cell.

Complete the circuit diagram in Fig. 4.1 to show how the student measures the current in the circuit and the potential difference across the cell.

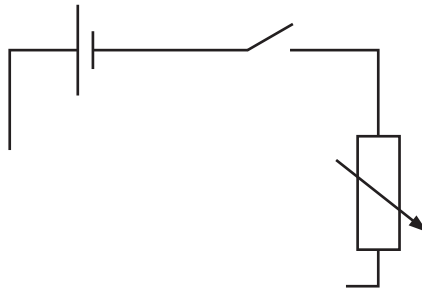


Fig. 4.1

[2]

(b) Procedure

The student:

- uses the variable resistor to change the current in the circuit
- measures the current in the circuit
- measures the potential difference (p.d.) across the cell
- plots the graph of p.d. against current shown in Fig. 4.2.

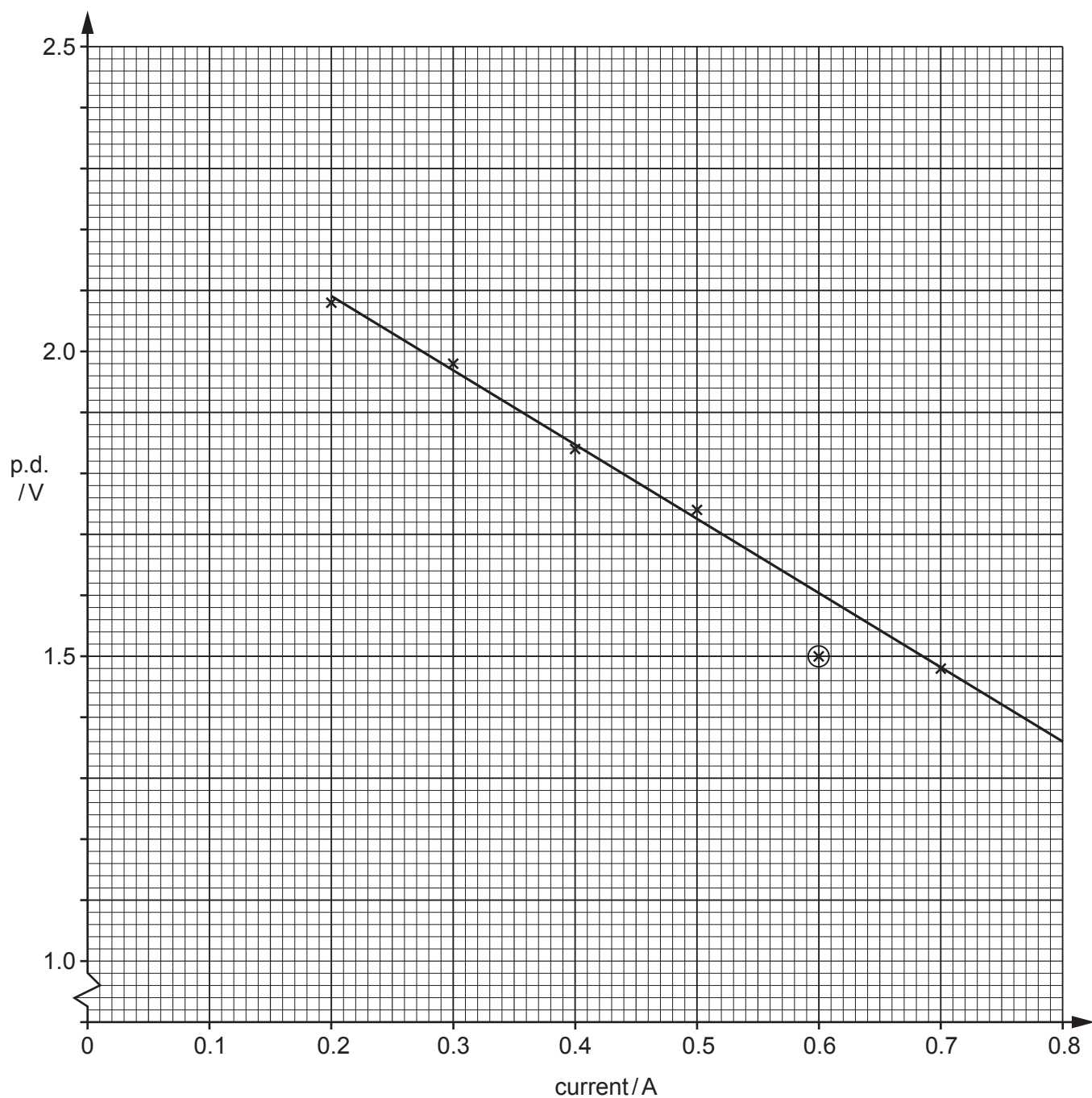


Fig. 4.2

- (i) Use Fig. 4.2 to find the p.d. when the current is 0.44 A.

p.d. = ... V [1]

- (ii) Fig. 4.3 shows the voltmeter used by the student.

On Fig. 4.3, draw the pointer to show the p.d. in **(b)(i)**.

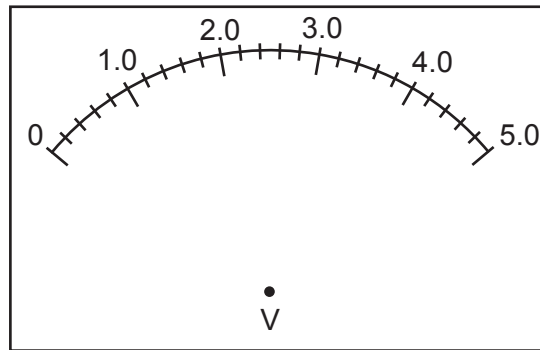


Fig. 4.3

[1]

- (iii) The electromotive force (e.m.f.) of the cell is the p.d. when the current = 0 A.

Extend the straight best-fit line on Fig. 4.2 to determine the e.m.f. of the cell.

e.m.f. = ... V [2]

- (iv) The internal resistance of the cell is found from the gradient of the straight best-fit line in Fig. 4.2.

Determine the gradient of the straight best-fit line in Fig. 4.2.
Show on Fig. 4.2 the values you use to calculate the gradient.
Show your working.

gradient = ... Ω [3]

- (c) The student identifies the point circled on Fig. 4.2 as an anomalous result.

The student repeats the measurements for this point.

Fig. 4.4 shows the repeated ammeter and voltmeter readings.

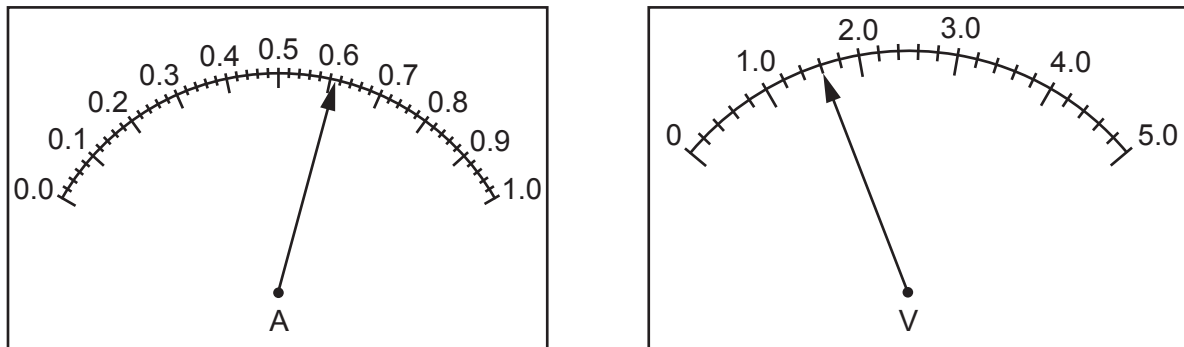


Fig. 4.4

Record the readings of current and potential difference shown in Fig. 4.4.

current = ... A

potential difference = ... V
[2]

- (d) A second student predicts that the graph will **not** be straight at higher values of current.

Explain how the first student can extend the investigation to find out if this prediction is correct.

.....

 [2]

[Total: 13]

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.



CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

0653/63

October/November 2020

1 hour

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

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

This document has **16** pages. Blank pages are indicated.

- 1 A student investigates the effect of minerals on the growth of plants.

Procedure

The student:

- chooses three plants of the same species and same size
- grows the plants in three separate pots
- waters the plants with water containing different minerals:
 - Plant **A** is given water containing all of the minerals it needs.
 - Plant **B** is given water containing all of the minerals it needs apart from nitrates.
 - Plant **C** is given water containing all of the minerals it needs apart from magnesium.

Fig. 1.1 shows the three plants after two weeks of growth.

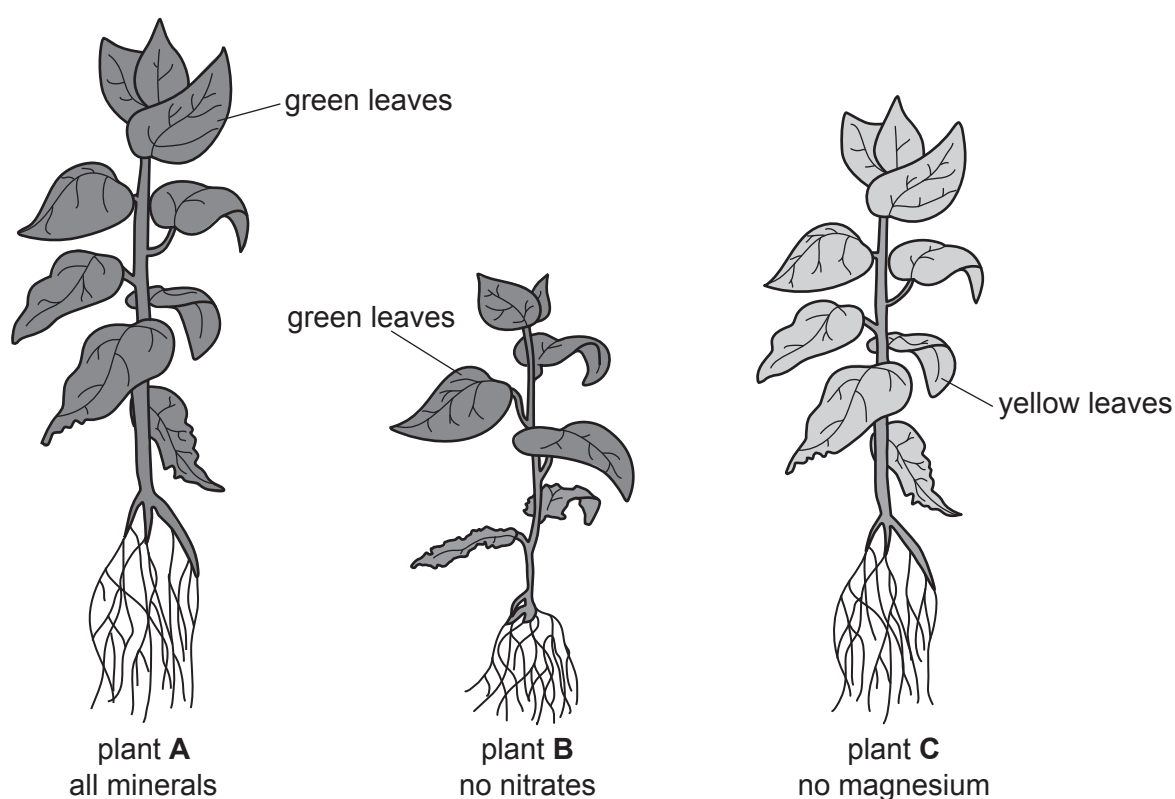


Fig. 1.1

- (a) (i) Explain why the student uses plants that are the same species.

.....
 [1]

- (ii) Measure the height (from the top of the leaves to the bottom of the roots) of plant **C** in Fig. 1.1.

Record this value in Table 1.1. Include the units in the table heading.

Table 1.1

plant	height /
A	93
B	60
C	

[2]

- (iii) Calculate the percentage difference in height between plant **A** and plant **B**.

Use the equation shown.

$$\text{percentage difference} = \frac{\text{height of plant A} - \text{height of plant B}}{\text{height of plant B}} \times 100\%$$

percentage difference = ... % [1]

- (b) State two **visible** differences, other than height, between plant **B** and plant **C**.

1

.....

2

.....

[2]

- (c) Chlorophyll is a green pigment.

Suggest a reason for the appearance of plant **C**.

.....

..... [1]

[Total: 7]

2 A student states:

'If I double the intensity of light, the rate of photosynthesis will also double.'

The student places a water plant in the apparatus shown in Fig. 2.1.

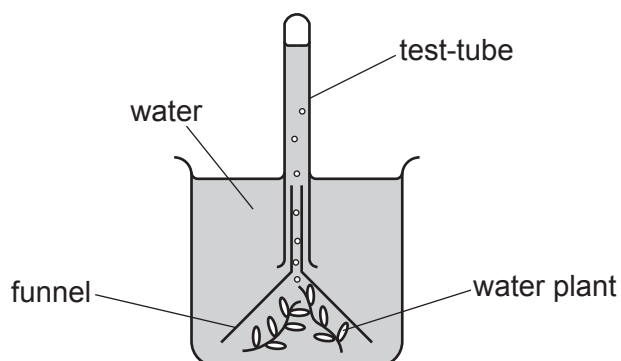


Fig. 2.1

Plan an investigation to test if the student's statement is correct.

In your answer, include:

- any **additional** apparatus and chemicals you will need, including a labelled diagram if you wish
- a brief description of the method and the measurements you will make
- the variables you will control
- how you will use your results to check if the student's statement is correct.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [7]

BLANK PAGE

3 A student investigates the effect of temperature on the rate of a reaction.

Aqueous sodium thiosulfate and dilute hydrochloric acid are both colourless liquids.

When aqueous sodium thiosulfate reacts with dilute hydrochloric acid, a yellow precipitate is made. As the precipitate forms, the mixture becomes opaque (you cannot see through it).

The apparatus is shown in Fig. 3.1.

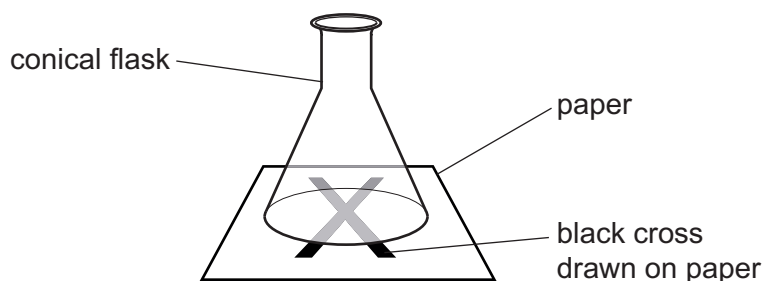


Fig. 3.1

(a) Procedure

The student:

- measures 50 cm^3 of aqueous sodium thiosulfate in a measuring cylinder and pours it into a conical flask
- heats the aqueous sodium thiosulfate to approximately 20°C
- places the conical flask onto a black cross drawn on a piece of paper
- measures the actual temperature of the aqueous sodium thiosulfate and records it in Table 3.1
- adds 5 cm^3 dilute hydrochloric acid and starts a stop-watch
- looks at the cross through the mixture in the conical flask
- stops the stop-watch when the mixture becomes opaque and the cross cannot be seen (note that it is quite difficult to decide the exact time when the cross cannot be seen)
- records this time in Table 3.1.

The student repeats this procedure, heating the aqueous sodium thiosulfate to approximately 30 °C, 40 °C, 50 °C, 60 °C, 70 °C and 80 °C.

- (i) The temperature for the fourth experiment is shown on the thermometer in Fig. 3.2.

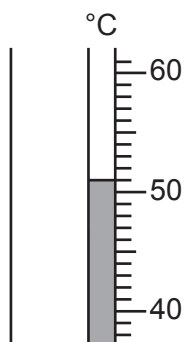


Fig. 3.2

Record this temperature to the nearest 0.5 °C in Table 3.1.

[1]

Table 3.1

temperature / °C	time for mixture to become opaque / s
20.0	96
31.0	
42.5	35
	42
59.5	
72.0	6
80.0	2

- (ii) The times for the temperatures 31.0 °C and 59.5 °C are shown on the stop-watches in Fig. 3.3.

Record these times to the nearest second in Table 3.1.

[2]

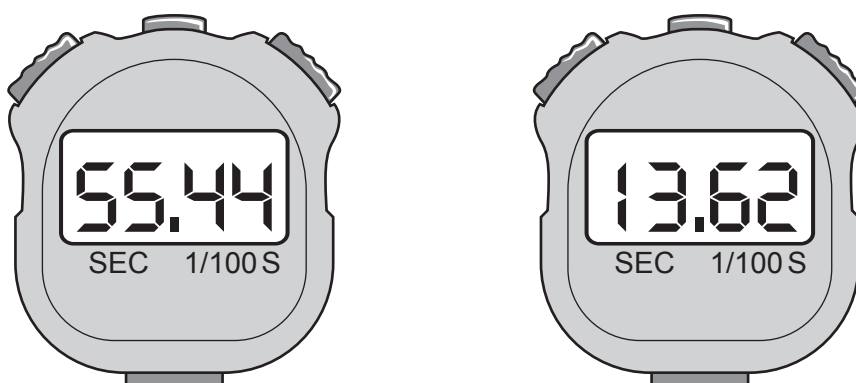
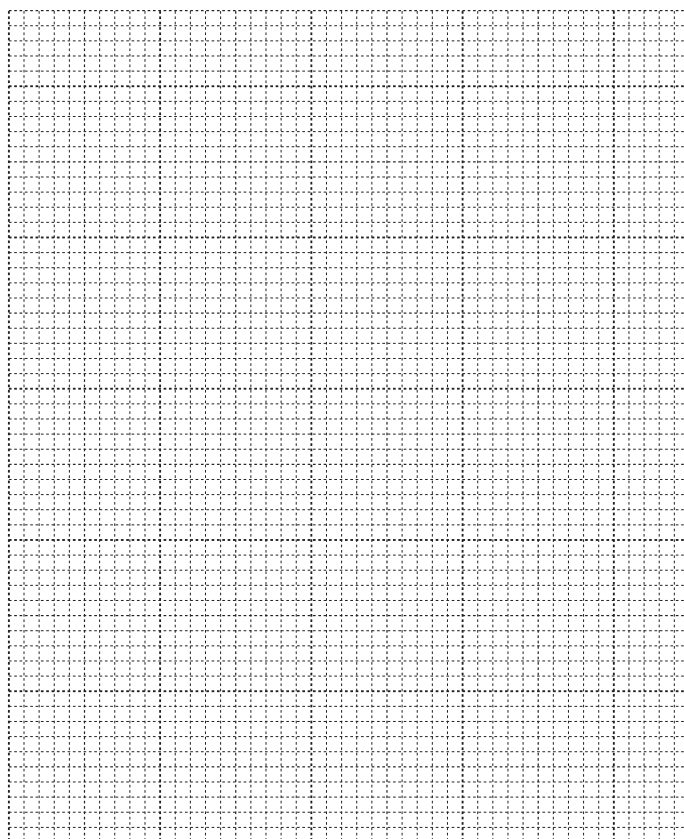


Fig. 3.3

- (b) (i) On the grid, plot a graph of time for mixture to become opaque (vertical axis) against temperature.



[3]

- (ii) Draw a circle around the point of the anomalous result. [1]
- (iii) State if the anomalous result is too high or too low.

Suggest what happened to cause this anomalous result.

anomalous result is too

suggestion

..... [1]

- (iv) Draw the best-fit curve. [1]

- (v) Describe in detail the relationship between temperature and **rate** of reaction.

.....

.....

.....

..... [2]

(vi) Suggest a reason why this experiment is not repeated at 90 °C.

Do **not** include safety in your answer.

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

(c) Suggest **one** change to the procedure that would improve accuracy.

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

[Total: 13]

- 4 A student compares the temperature changes that occur when three different liquids **A**, **B** and **C** evaporate.

(a) Procedure

The student:

- covers the bulb of a thermometer with cotton wool
- reads the initial temperature of the thermometer and records this value in Table 4.1
- dips the bulb and cotton wool into liquid **A** and shakes off any excess liquid so that the cotton wool is wet but not dripping
- starts a stop-watch and swings the thermometer gently from side to side
- records the final temperature of the thermometer after two minutes.

Fig. 4.1 shows how the apparatus is set up for the experiment.

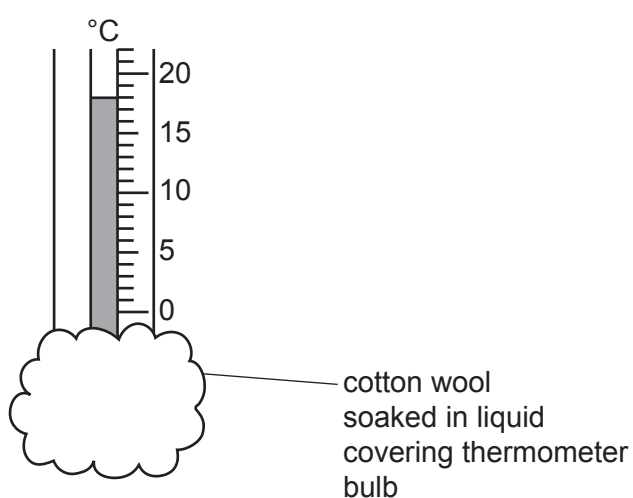


Fig. 4.1

The student repeats the procedure using liquid **B** and then repeats it again with liquid **C**.

Table 4.1

liquid	initial temperature / °C	final temperature / °C	temperature change / °C
A	22.0	18.0	
B	22.0	21.5	
C	22.0	12.5	
no liquid	22.0	22.0	

- (i) The student also repeats the procedure with dry cotton wool (no liquid) as a control experiment.

Explain how doing this control experiment helps the student to draw conclusions about temperature changes during the evaporation of liquids.

.....
 [1]

- (ii) Calculate the temperature change for each experiment.

Record your results in Table 4.1.

[2]

- (iii) Use the results in Table 4.1 to place liquids **A**, **B** and **C** in order of temperature change.

smallest temperature change

.....

largest temperature change

[1]

- (iv) Suggest **two** improvements to the procedure that would allow the student to make a more accurate comparison of the differences in temperature change between liquids **A**, **B** and **C**.

improvement 1

improvement 2

[2]

- (b) Table 4.2 shows the amounts of thermal energy needed for liquids **A**, **B** and **C** to evaporate.

Table 4.2

liquid	thermal energy for 1.0 kg of liquid to evaporate/kJ
A	779
B	2257
C	518

- (i) Describe the relationship between the temperature change and the amount of thermal energy needed for a liquid to evaporate. Use the information in Table 4.2 and your answer to (a)(iii).

.....

 [1]

- (ii) Calculate the energy E required to evaporate 3.0 kg of liquid **B**. Use the equation shown.

Give your answer to 2 significant figures.

$$\begin{array}{ccccc} \text{energy } E & = & \text{mass} & \times & \text{thermal energy for 1.0 kg} \\ \text{in kJ} & & \text{in kg} & & \text{in kJ} \end{array}$$

energy E = ... kJ [2]

- (c) The student investigates the rate of evaporation of liquid **C**.

The student measures the mass of an empty beaker using a balance.

$$\text{mass of empty beaker} = 43.77 \text{ g}$$

The student pours 10 cm^3 of liquid **C** into the beaker.

- (i) Fig. 4.2 shows the total mass of the beaker and liquid **C**.

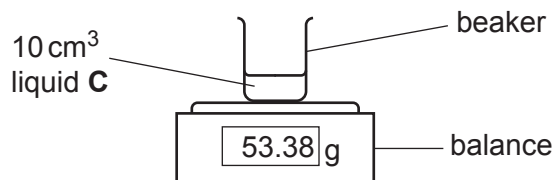


Fig. 4.2

Record the total mass.

$$\text{total mass of beaker and liquid C} = \dots\dots\dots \text{ g [1]}$$

- (ii) Calculate the mass of liquid **C** in the beaker.

$$\text{mass of liquid C} = \dots\dots\dots \text{ g [1]}$$

- (iii) The student leaves the beaker on a table in the laboratory for one hour.

Fig. 4.3 shows the total mass of the beaker and liquid **C** after one hour.

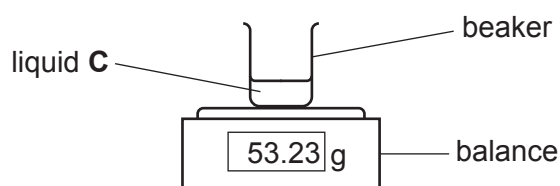


Fig. 4.3

Use Fig. 4.3 to calculate the mass of liquid **C** that has evaporated.

$$\text{mass} = \dots\dots\dots \text{ g [1]}$$

- (iv) Suggest **one** change that the student can make to the experiment to increase the rate of evaporation of liquid **C**.

.....

..... [1]

[Total: 13]

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.