



CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

0653/61

May/June 2022

1 hour

No additional materials are needed.

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

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

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

- 1 A student investigates the effect of ethanol on cell membranes.

Beetroot cells contain a red colour that comes out of the cells when the cell membranes break. Ethanol can break down the cell membranes.

The student is given five pieces of beetroot of equal size.

Procedure

The student:

- sets up five test-tubes containing the volumes of ethanol and distilled water shown in Table 1.1

Table 1.1

test-tube	volume of ethanol /cm ³	volume of distilled water /cm ³	colour score
A	8	2	
B	6	4	
C	4	6	
D	2	8	
E	0	10	

- uses a sharp knife to cut each piece of beetroot into 10 thin discs as shown in Fig. 1.1

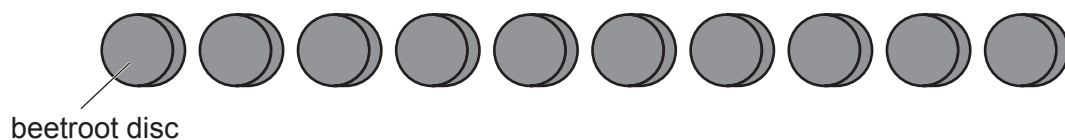


Fig. 1.1

- puts 10 discs of cut beetroot into each test-tube and starts a stop-watch
- waits 10 minutes and then gently swirls each test-tube to mix the contents.

Fig. 1.2 shows the student's test-tubes after 10 minutes.

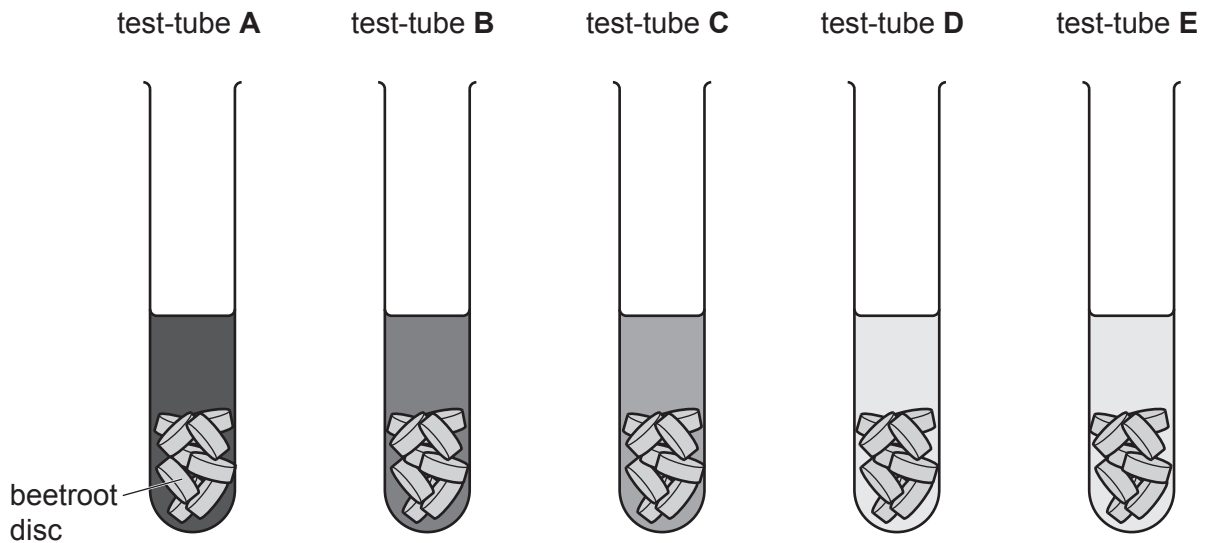


Fig. 1.2

(a) Use Fig. 1.3 to judge the darkness of the colour of the solution in each test-tube.



Fig. 1.3

Record in Table 1.1 the colour score for each test-tube.

[3]

(b) State the relationship between concentration of ethanol and colour score.

Use the information in Table 1.1 to help you.

.....
 [1]

(c) State why different volumes of water are used in this experiment.

.....
 [1]

- (d) In the procedure, the student uses different syringes to measure the ethanol and the water.

Explain why different syringes are used.

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

- (e) Identify **one** safety hazard in the procedure and suggest a way to reduce the risk.

safety hazard

.....

way to reduce risk

..... [1]

[Total: 7]

BLANK PAGE

- 2 Photosynthesis takes place in aquatic plants (plants that live in water). Photosynthesis produces bubbles of oxygen gas. The greater the rate of photosynthesis, the faster the oxygen is produced.

Figure 2.1 shows apparatus used to investigate the effect of light intensity (amount of light) on the rate of photosynthesis.

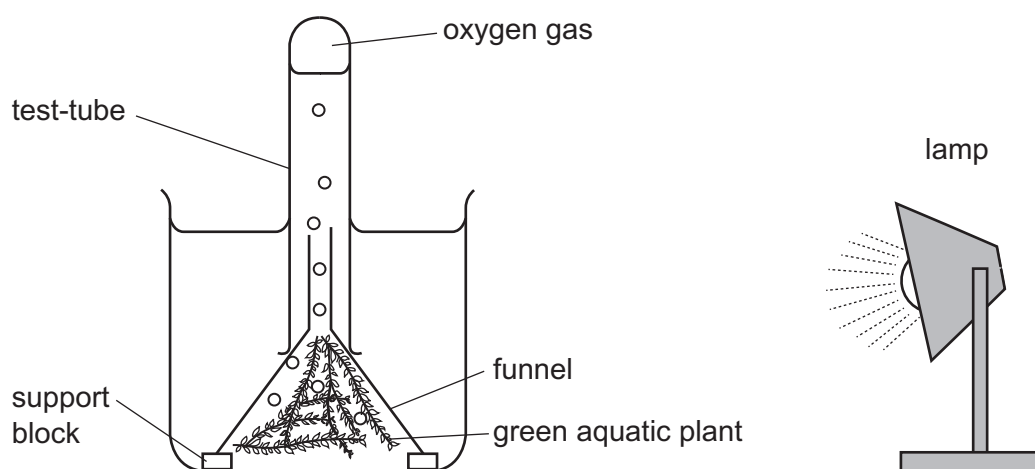


Fig. 2.1

Plan an investigation to find the relationship between light intensity and the rate of photosynthesis.

You are provided with the apparatus in Fig. 2.1.

You may also use any other common laboratory apparatus.

In your plan, include:

- the additional apparatus needed
- a brief description of the method and an explanation of any safety precautions you will take
- what you will measure
- which variables you will keep constant
- how you will process your results to draw a conclusion.

You may include a table that can be used to record the results if you wish.

3 A student investigates some reactions of dilute sulfuric acid.

(a) Procedure

The student:

- adds dilute sulfuric acid to a test-tube
- adds dilute nitric acid to the test-tube
- adds aqueous barium nitrate to the test-tube.

The student observes a white precipitate.

(i) Tick (✓) the box to identify the negative ion (anion) present in dilute sulfuric acid.

carbonate	☐
chloride	☐
nitrate	☐
sulfate	☐

[1]

(ii) The student separates the insoluble white precipitate from the reaction mixture.

Draw a labelled diagram to show the assembled apparatus the student uses.

Include labels for the precipitate and the filtrate.

[3]

(b) Procedure

The student:

- adds dilute sulfuric acid to a test-tube
- adds magnesium to the test-tube and starts a stop-watch
- stops timing when the mixture stops fizzing.

The mixture makes a gas that gives a squeaky pop with a lighted splint.

(i) Name the gas made.

..... [1]

(ii) Fig. 3.1 shows the reading on the stop-watch.



Fig. 3.1

Record, to the nearest second, the reading on the stop-watch.

time = ... s [2]

(c) Procedure

The student:

- adds dilute sulfuric acid to a test-tube
- records the temperature of the dilute sulfuric acid
- adds aqueous sodium hydroxide to the dilute sulfuric acid
- stirs the mixture
- records the temperature of the reaction mixture.

Fig. 3.2 shows the two thermometer readings.

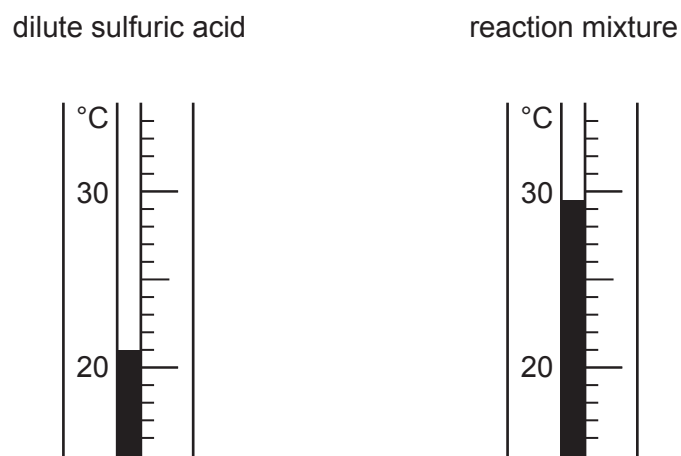


Fig. 3.2

- (i) Record in Table 3.1 the thermometer reading of the dilute sulfuric acid to the nearest 0.5 °C.

Table 3.1

temperature of dilute sulfuric acid / °C	
temperature of reaction mixture / °C	
temperature increase / °C	

[1]

- (ii) Record in Table 3.1 the thermometer reading of the reaction mixture to the nearest 0.5 °C.

[1]

- (iii) Calculate the temperature increase.

Record your answer in Table 3.1.

[1]

- (iv) The temperature increase is not as large as expected.

This is because some thermal energy (heat) is transferred into the air.

Suggest a change in the **apparatus** or an addition to the **apparatus** that reduces this loss in thermal energy (heat).

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

- (v) Suggest why the reaction mixture is stirred before its temperature is recorded.

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

- (vi) Suggest why it is better to repeat the experiment and calculate the average temperature increase.

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

[Total: 13]

- 4 A student uses a spring to determine the mass of an unknown object **U**.

The apparatus is shown in Fig. 4.1.

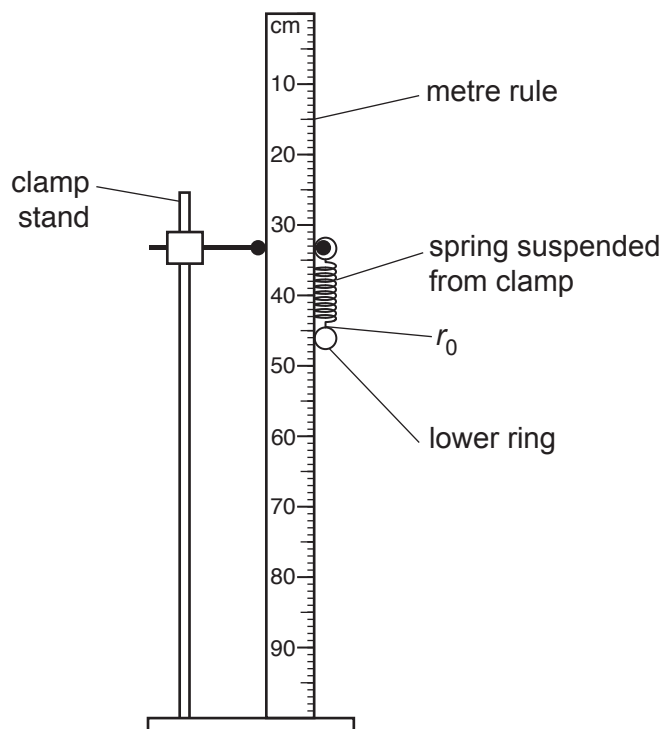


Fig. 4.1

- (a) The student records the reading r_0 on the metre rule at the bottom of the spring (not including the lower ring).

The reading $r_0 = 44.5$ cm.

Procedure

The student:

- adds a mass $m = 100$ g to the spring
- records in Table 4.1 the reading r_l on the metre rule at the bottom of the spring
- removes the mass from the spring.

The student repeats the procedure using masses $m = 200$ g, 300 g, 400 g and 500 g.

- (i) Fig. 4.2 shows part of the metre rule when the 100 g mass is suspended from the spring.

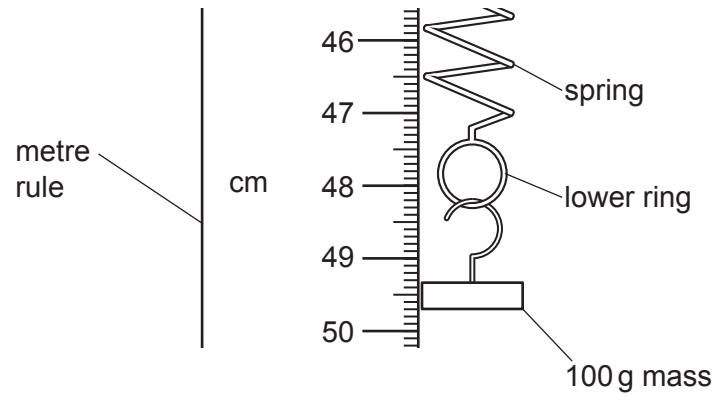


Fig. 4.2

Record in Table 4.1 the reading r_l on the metre rule at the bottom of the spring. (Do not include the lower ring.)

Table 4.1

m /g	r_l /cm	e /cm
100		
200	51.1	6.6
300	55.0	10.5
400	58.8	14.3
500	62.6	18.1

[2]

- (ii) Describe how the student avoids line-of-sight (parallax) errors when taking the reading at the bottom of the spring.

.....
 [1]

- (b) Calculate the extension e of the spring when the 100 g mass is suspended from the spring.

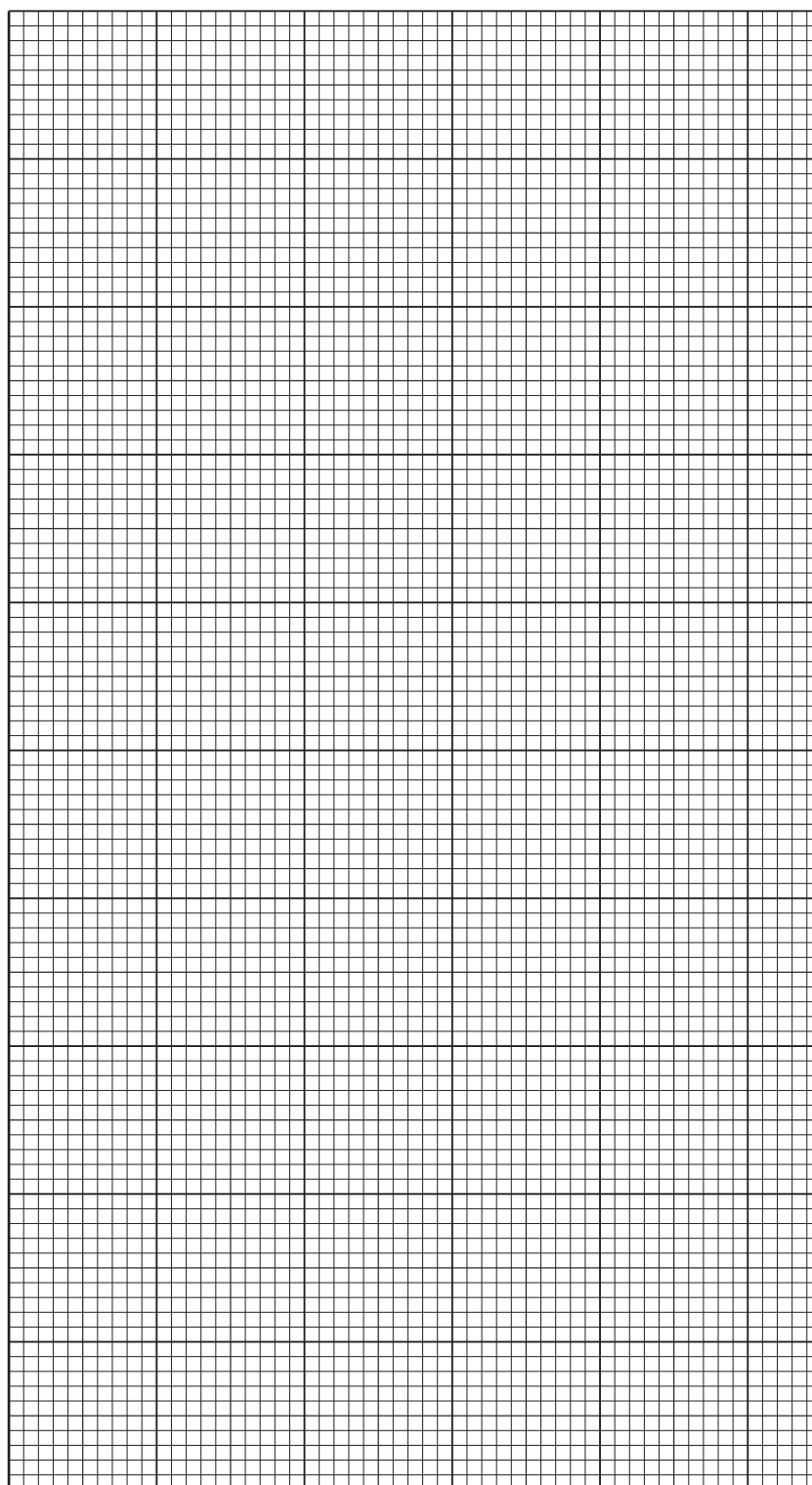
Use the equation shown.

$$e = r_l - r_0$$

Record the extension in Table 4.1.

[1]

- (c) (i) Plot a graph of extension e (vertical axis) against mass m .



- (ii) Draw the best-fit straight line.

[3]

[1]

- (d) Next, the student uses the spring to determine the mass of the object **U**.

The teacher states that the student should check that the reading r_0 is still 44.5 cm before suspending object **U** from the spring.

- (i) Explain why the student checks this reading.

.....
 [1]

- (ii) The student suspends object **U** from the spring.

Fig. 4.3 shows the new position r_l of the bottom of the spring.

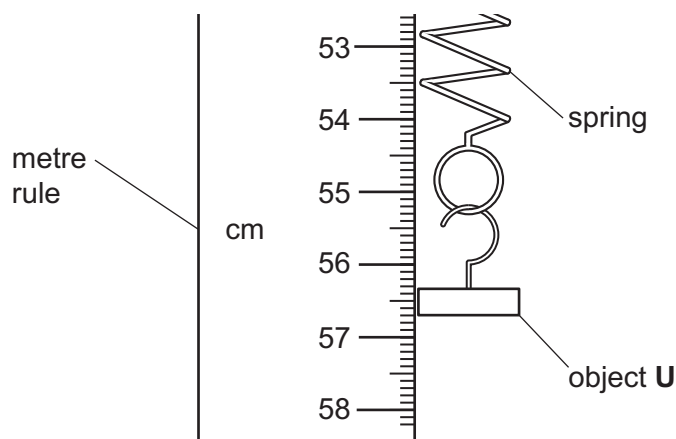


Fig. 4.3

Use Fig. 4.3 to determine the value of r_l .

$r_l =$ cm [1]

- (iii) Calculate the extension e with object **U** suspended from the spring.

$e =$ cm [1]

- (iv) Use your graph to find the mass of object **U**.

Show on your graph how you found the mass.

mass of **U** = ... g [2]

[Total: 13]

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 Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

Cambridge IGCSE™

CANDIDATE
NAME

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

COMBINED SCIENCE

0653/62

Paper 6 Alternative to Practical

May/June 2022

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- 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.

INFORMATION

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

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

- 1 (a) Water moves into a cell by osmosis.

A student investigates the effect of temperature on the movement of water by osmosis.

A dialysis tubing bag is used as a model cell.

Procedure

The student:

Step 1 Puts 10 cm^3 of glucose solution into each of two dialysis tubing bags.

Step 2 Ties a knot in the end of each bag, as shown in Fig. 1.1.

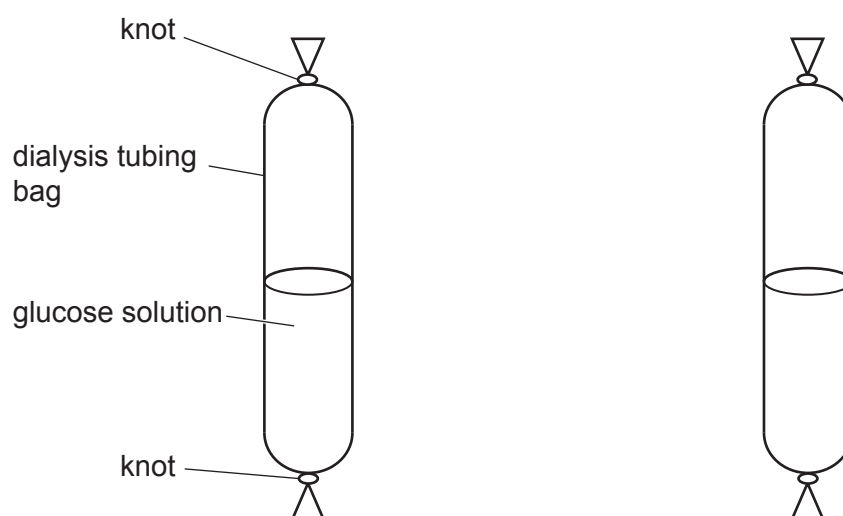


Fig. 1.1

Step 3 Records in Table 1.1 the **initial** mass of each dialysis tubing bag.

Step 4 Puts one dialysis tubing bag into a beaker of **cold** water, as shown in Fig. 1.2.

Step 5 Puts the other dialysis tubing bag into a beaker of **hot** water, as shown in Fig. 1.2.

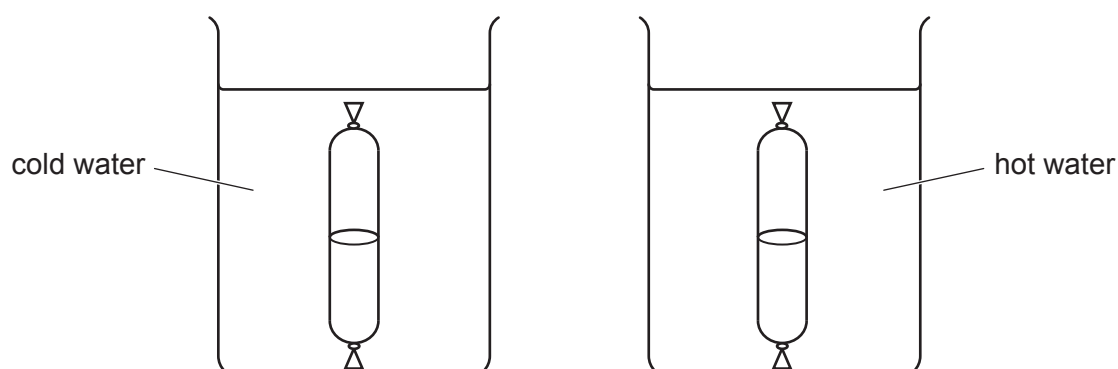


Fig. 1.2

Step 6 After 10 minutes, removes both dialysis tubing bags from the beakers and dries them with paper towels.

Step 7 Measures the **final** mass of each dialysis tubing bag.

- (i) Fig. 1.3 shows the readings on the balances for the two dialysis tubing bags in **Step 7**.

dialysis tubing bag from **cold** water

dialysis tubing bag from **hot** water



Fig. 1.3

Record in Table 1.1 the **final** mass of each dialysis tubing bag to **one** decimal place. [2]

Table 1.1

dialysis tubing bag	initial mass /g	final mass /g	change in mass /g
cold	10.9		
hot	11.3		

- (ii) Calculate the **change in mass** for each dialysis tubing bag. Record your answers in Table 1.1. [1]
- (iii) Describe the effect of temperature on the mass of water entering the dialysis tubing bags.

.....

..... [1]

- (iv) Explain why the dialysis tubing bags are dried before measuring the **final** mass.

.....

..... [1]

- (v) The student thinks that the reducing sugar glucose may have leaked out of one of the bags.

State the reagent used to test for the presence of glucose.

..... [1]

- (b) Fig. 1.4 shows a photograph of a slice of lemon (a citrus fruit). The slice of lemon has an inner flesh part and an outer skin part.

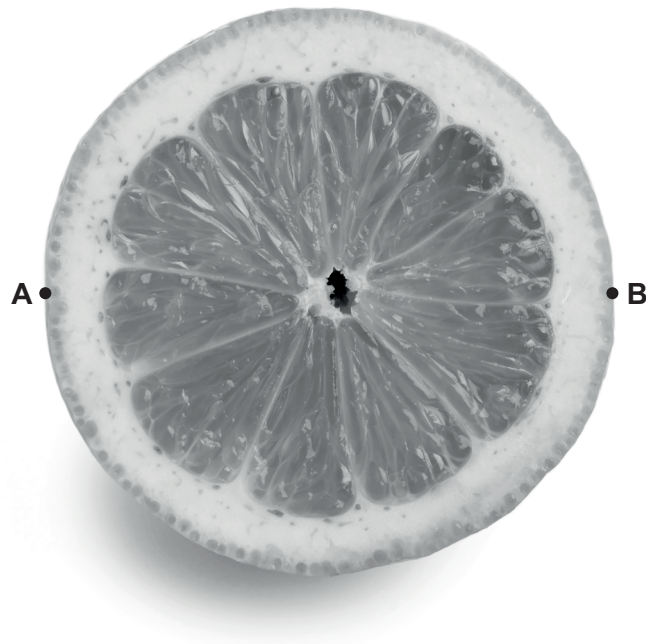


Fig. 1.4

- (i) In the box provided, make a large, clear pencil drawing of the slice of lemon.

- (ii) Draw a line to join points **A** and **B** on Fig. 1.4.

Record the length **AB** in millimetres to the nearest millimetre.

length of line **AB** on Fig. 1.4 = ... mm [1]

- (iii) Draw line **AB** on your drawing in (b)(i).

Record the length **AB** of your drawing, in millimetres to the nearest millimetre.

length of line **AB** on your drawing = ... mm [1]

- (iv) Calculate the magnification of your drawing.

Use the equation shown.

$$\text{magnification} = \frac{\text{length of line AB on your drawing}}{\text{length of line AB on Fig. 1.4}}$$

magnification = ... [1]

- (v) Iodine solution is added to the slice of lemon. The inner flesh part stains brown and the outer skin part stains blue-black.

State a conclusion for these results.

.....

..... [1]

[Total: 13]

- 2 A student investigates the solubility in water of some substances, **L**, **M**, **N**, **P** and **Q**.

(a) **Procedure**

The student:

- adds solid **L** to water
- stirs the mixture of **L** and water
- records their observations in Table 2.1.

The student repeats the procedure with solids **M**, **N** and **P**.

Table 2.1

solid	observations
L	dissolves and makes a colourless solution
M	does not dissolve and stays white
N	dissolves and makes a blue solution
P	green solid in a colourless liquid

- (i) State which solids, **L**, **M**, **N** or **P** are insoluble in water.

..... [1]

- (ii) A mixture of **M** and water is separated using filtration.

Draw a labelled diagram of the assembled apparatus used to separate this mixture.

Include labels for the filtrate and residue.

[3]

- (iii) The blue solution formed from solid **N** contains copper(II) ions.

The student adds aqueous sodium hydroxide to this solution.

Describe the observations.

..... [1]

(b) Procedure

The student:

Step 1 Adds a sample of solid **Q** to 10.0 cm³ of distilled water in a test-tube.

Step 2 Places the test-tube into a hot water-bath and stirs the mixture until all of **Q** dissolves.

Step 3 Places the test-tube with the hot solution into a beaker of cold water to cool the solution.

Step 4 Records the temperature when the first crystals of **Q** appear in the test-tube.

The temperature when the first crystals appear is 45.0 °C.

- (i) Name a piece of apparatus suitable to measure the 10.0 cm³ of distilled water in **Step 1**.

..... [1]

- (ii) A student repeats the procedure in (b) but in **Step 3** cools the test-tube with the hot solution in **air** instead of in cold water.

Suggest why cooling the solution in air will give a more accurate temperature for when the first crystals appear.

.....

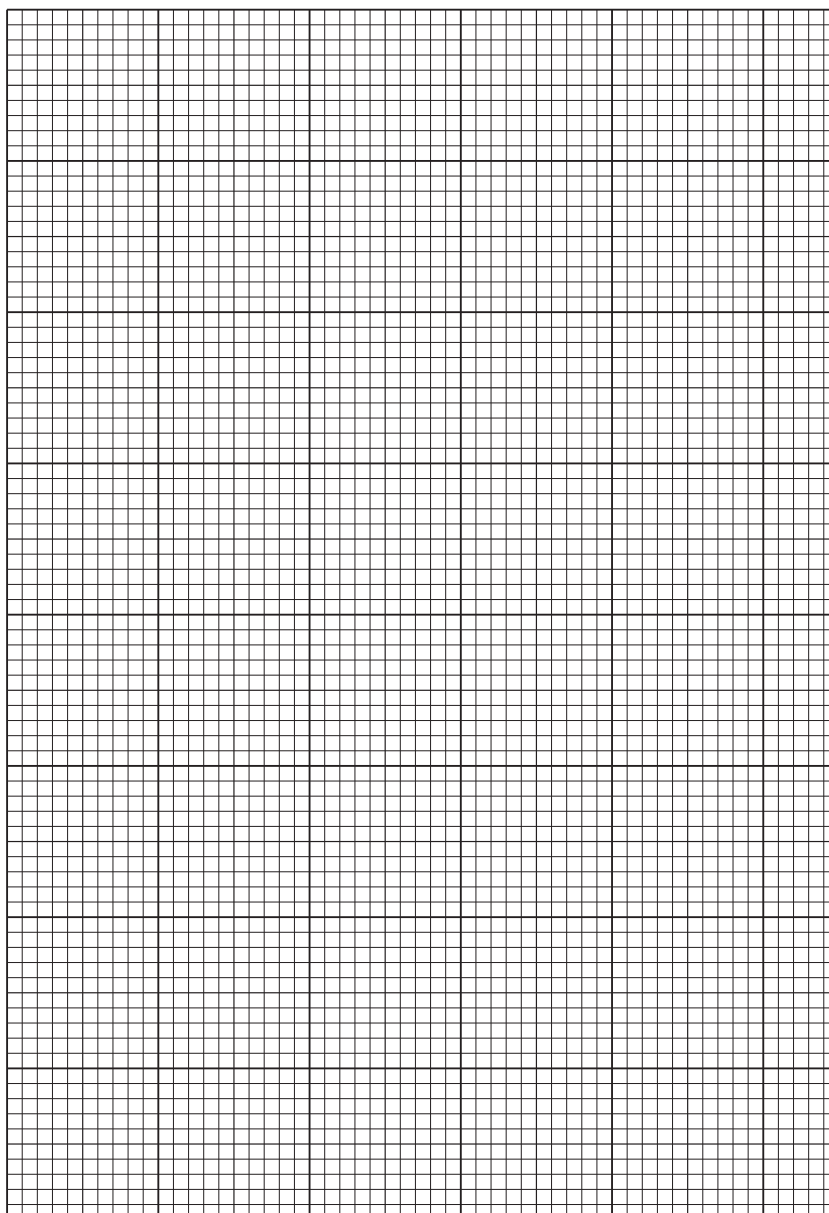
..... [1]

- (c) A student repeats the procedure in (b) using different masses of **Q**. The results are shown in Table 2.2.

Table 2.2

mass of Q in solution /g	temperature when first crystals of Q appear /°C
5	8
10	30
15	50
20	65
25	75

- (i) On the grid, plot a graph of the temperature when first crystals of **Q** appear (vertical axis) against the mass of **Q** in solution.



- (ii) Draw the curve of best-fit. [1]
- (iii) Describe the relationship between the mass of **Q** in the solution and the temperature when the first crystals appear.
-
- [1]
- (iv) Use the temperature in (b) and your graph to estimate the mass of **Q** used in the procedure in (b).

mass of **Q** = ... g [1]

[Total: 13]

3 A student investigates thermal energy changes in water.

(a) Procedure

The student:

- measures the temperature of 50 cm^3 of hot water
- measures the temperature of 150 cm^3 of water at room temperature
- pours the hot water into the water at room temperature as shown in Fig. 3.1
- stirs the mixture of water
- measures the final temperature of the mixture.

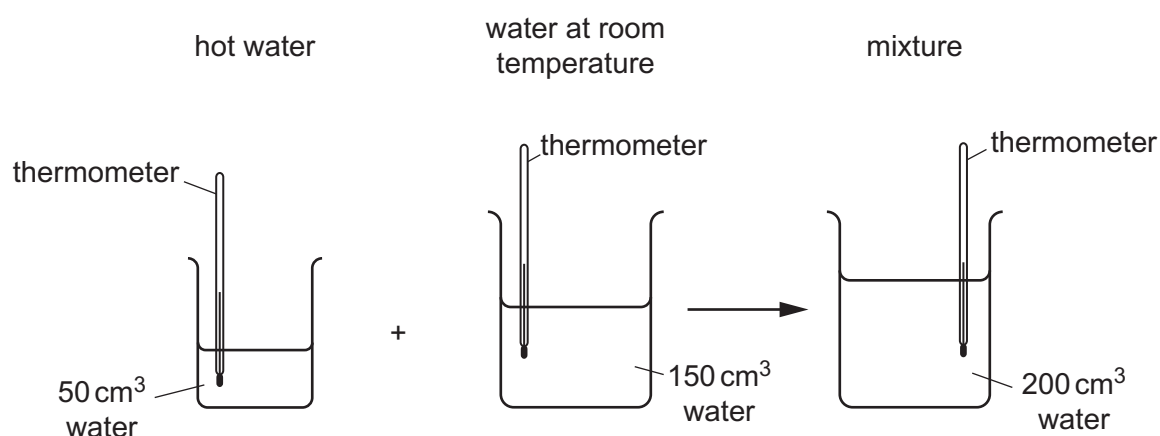


Fig. 3.1

Fig. 3.2 shows the readings on the thermometer in the hot water and the thermometer in the water at room temperature.

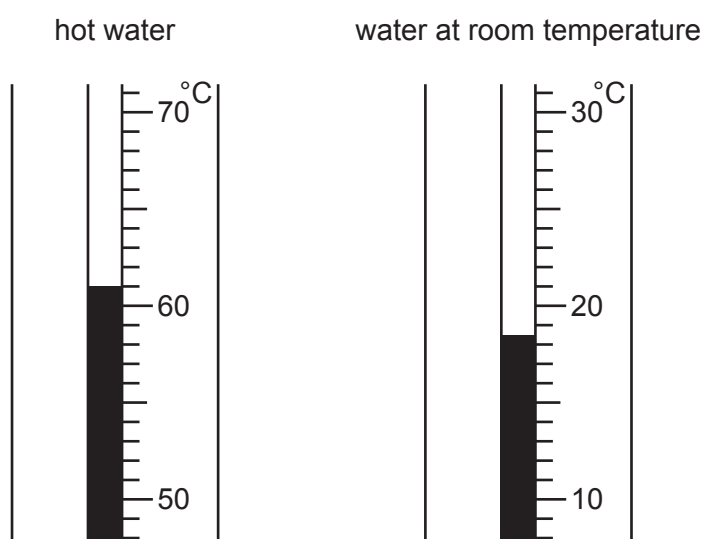


Fig. 3.2

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

Table 3.1

	volume of water /cm ³	temperature /°C
hot water	50	
water at room temperature	150	
mixture	200	28.0

[2]

(b) Explain why it is important to stir the mixture before taking the final temperature reading.

.....
 [1]

(c) (i) Calculate,

- the difference in temperature between the water at room temperature and the final mixture, ΔT_R
- the difference in temperature between the hot water and the final mixture, ΔT_H .

Record your answers in Table 3.2.

Table 3.2

$\Delta T_R / ^\circ\text{C}$	$\Delta T_H / ^\circ\text{C}$

[1]

(ii) Calculate the increase in thermal energy ΔE_R of the water at room temperature.

Use the equation shown.

$$\Delta E_R = 630 \times \Delta T_R$$

$$\Delta E_R = \dots\dots\dots \text{ J [1]}$$

(iii) Calculate the decrease in thermal energy ΔE_H of the hot water.

Use the equation shown.

Give your answer to **two** significant figures.

$$\Delta E_H = 210 \times \Delta T_H$$

$$\Delta E_H = \dots\dots\dots \text{ J [1]}$$

- (d) A student suggests that the increase in thermal energy ΔE_R of the water at room temperature should be equal to the decrease in thermal energy ΔE_H of the hot water.

Suggest **one** reason why your answers to (c)(ii) and (c)(iii) are **not** equal.

.....

..... [1]

[Total: 7]

BLANK PAGE

- 4 Fig. 4.1 shows a door, hinged at one side. The door can be pulled open by applying a force to the metal ring at any point along the bar **AB**.

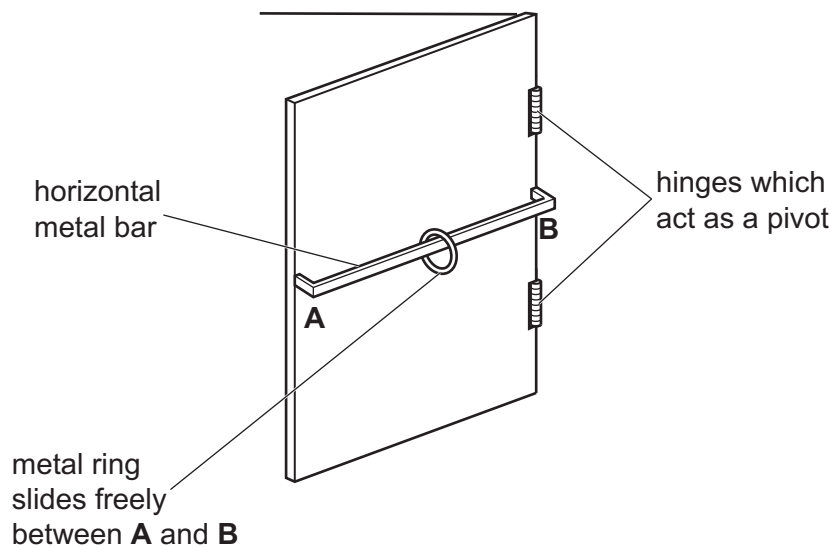


Fig. 4.1

Plan an investigation to find out how the size of the force needed to just open the door varies with the distance of the force away from **B**.

You are given the apparatus in Fig. 4.1 and you may use any common laboratory apparatus.

In your plan include:

- the apparatus needed
- a brief description of the method and an explanation of any safety precautions you will take
- what you will measure and the variables you will control
- a results table to record the measurements
- how you will process your results to draw a conclusion.

You are not required to include any results in your results table.

You may include a labelled diagram if you wish.

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 Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

Cambridge IGCSE™

CANDIDATE
NAME

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

COMBINED SCIENCE

0653/63

Paper 6 Alternative to Practical

May/June 2022

1 hour

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- 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.

INFORMATION

- 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 **12** pages. Any blank pages are indicated.

- 1 A student investigates the effect of oxygen concentration on the germination of cress seeds.

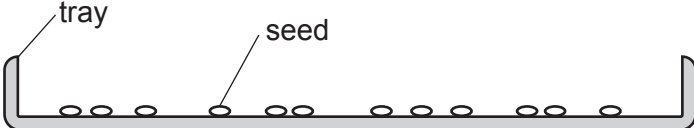
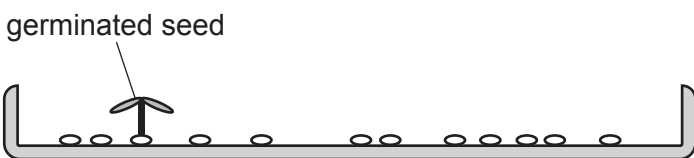
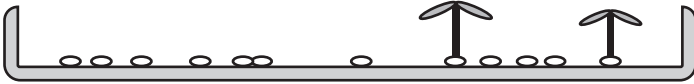
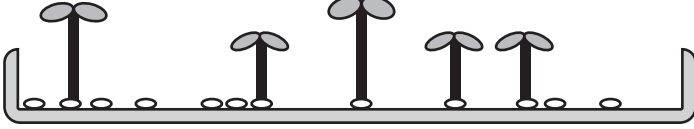
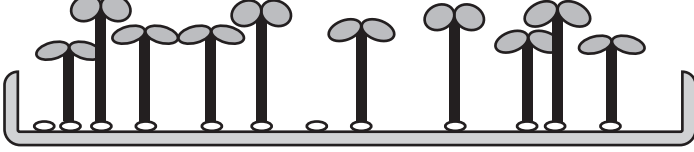
Procedure

The student:

- puts 12 cress seeds into each of five trays
- adds some water to each tray
- puts each tray into a sealed bag, each bag contains a different concentration of oxygen
- places the trays the same distance from the same lamp
- counts the number of seeds that have germinated after two weeks.

The results are shown in Table 1.1.

Table 1.1

percentage oxygen concentration in bag	tray of seeds	number of seeds germinated	percentage of seeds germinated
0		0	0
2		1	8.3
5		2	
10			41.7
20			83.3

- (a) Complete Table 1.1 by counting the number of seeds germinated at 10% and 20% oxygen concentrations. [1]

- (b) Calculate the percentage of seeds that have germinated at 5% oxygen concentration.

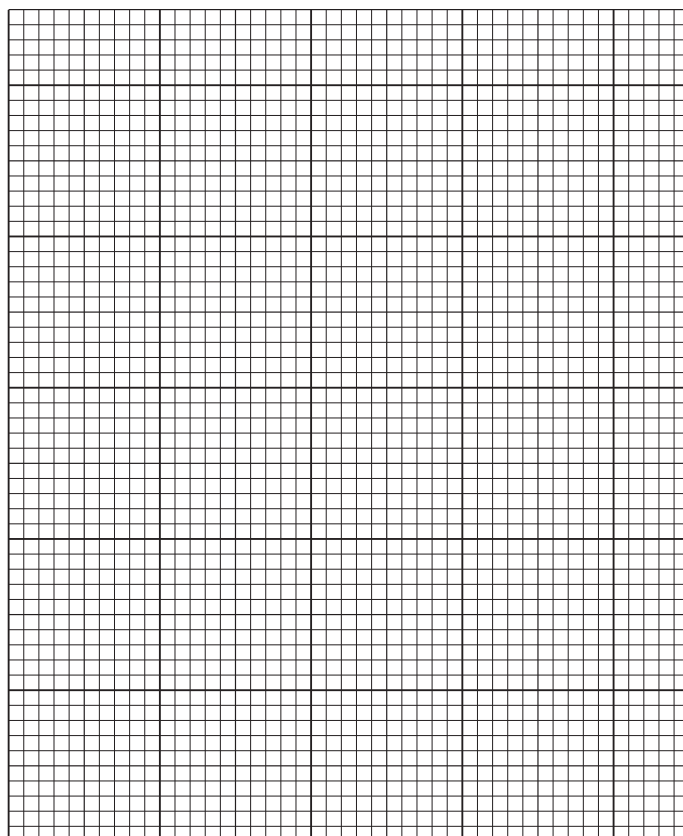
Use the equation shown.

$$\text{percentage of seeds germinated} = \frac{\text{number of seeds germinated}}{\text{total number of seeds in tray}} \times 100$$

Record your answer in Table 1.1.

[1]

- (c) (i) On the grid, plot a graph of the percentage of seeds germinated (vertical axis) against the percentage oxygen concentration.



[3]

- (ii) Draw the line of best fit.

[1]

- (iii) State the relationship between the oxygen concentration and the number of seeds germinated.

.....

..... [1]

- (d) Describe one **other** effect increasing oxygen concentration has on the seeds shown in Table 1.1.

.....

..... [1]

- (e) (i) Suggest why the student uses 12 seeds in each tray instead of just one seed.

.....
 [1]

- (ii) Suggest **two** improvements to the procedure.

Do **not** include changing the number of seeds.

1

 2
 [2]

- (f) Identify **one** factor that the student keeps constant in this investigation.

.....
 [1]

- (g) The student wants to find out if the germinating seeds make carbon dioxide.

State the test to confirm the presence of carbon dioxide and give the observation for a positive result.

test
 observation [1]

[Total: 13]

BLANK PAGE

2 A student investigates some reactions of zinc metal.

Procedure

The student:

- sets up the apparatus shown in Fig. 2.1

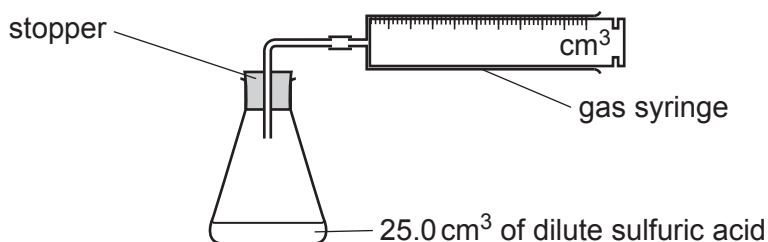


Fig. 2.1

- removes the stopper and adds 1.0 g of zinc powder to the flask
- quickly replaces the stopper and immediately starts a stop-watch
- measures the total volume of gas collected in the gas syringe during the first 20 seconds of the reaction.

The student repeats the procedure using 1.0 g of zinc powder mixed with 0.1 g of iron powder.

(a) Fig. 2.2 shows the readings on the gas syringe for each experiment.

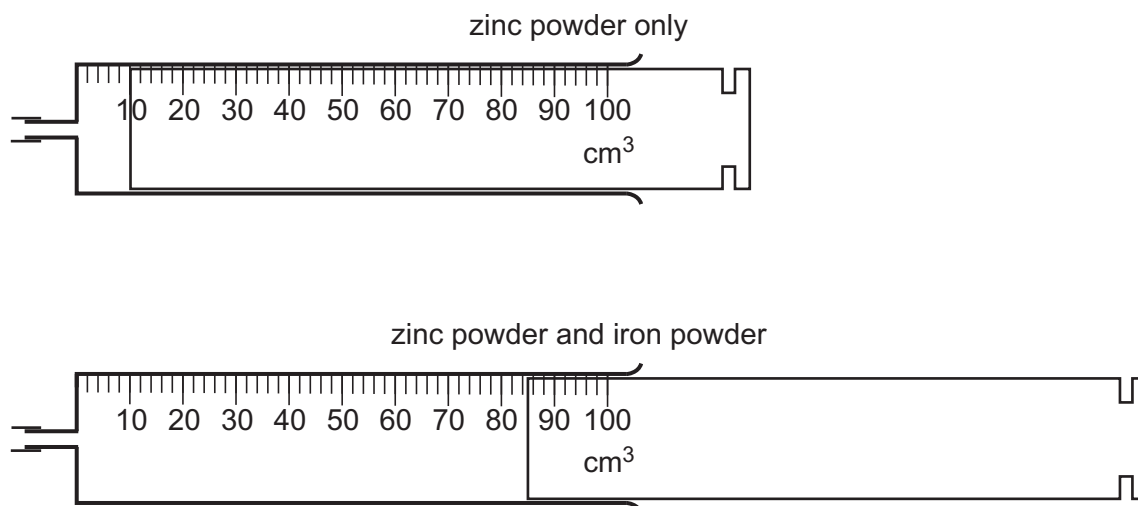


Fig. 2.2

(i) Record the volume of gas collected in each experiment in cm^3 , to the nearest cm^3 .

zinc powder only cm^3
 zinc powder and iron powder cm^3
 [2]

- (ii) The rate of this reaction is calculated using the equation shown.

$$\text{rate} = \frac{\text{volume of gas collected}}{20}$$

Calculate the rate of reaction in each experiment.

rate of reaction with zinc powder only = ... cm^3/s

rate of reaction with zinc powder and iron powder = ... cm^3/s
[2]

- (iii) Identify which experiment has the fastest rate of reaction.

Explain your answer.

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

- (iv) Suggest why the student is **not** able to collect all the gas made in the first 20 seconds.

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

- (b) The student places a lighted splint into the gas made in this experiment.

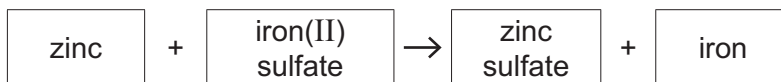
The gas makes a squeaky pop.

Name the gas.

..... [1]

[Total: 7]

- 3 Zinc reacts with aqueous iron(II) sulfate as shown in the word equation.



The reaction is exothermic because it releases energy and makes the temperature of the reaction mixture increase.

Plan an investigation to find the relationship between the mass of zinc added to aqueous iron(II) sulfate and the temperature increase of the reaction mixture.

You are provided with:

- aqueous iron(II) sulfate
- zinc powder.

You may use any common laboratory apparatus in your plan.

In your plan, include:

- the apparatus needed
- a brief description of the method and an explanation of any safety precautions you will take
- what you will measure
- which variables you will keep constant
- how you will process your results to draw a conclusion.

You may include a labelled diagram if you wish.

You may include a table that can be used to record the results if you wish.

- 4 A student investigates the resistance of two identical lamps connected in series. The student assembles the circuit shown in Fig. 4.1.

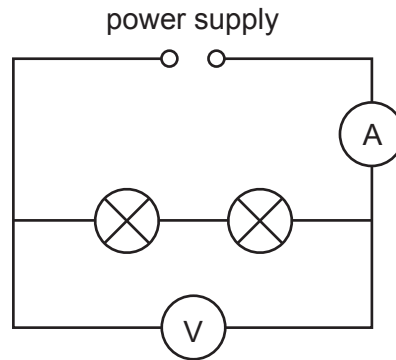


Fig. 4.1

- (a) (i) Fig. 4.2 shows the voltmeter and ammeter readings.

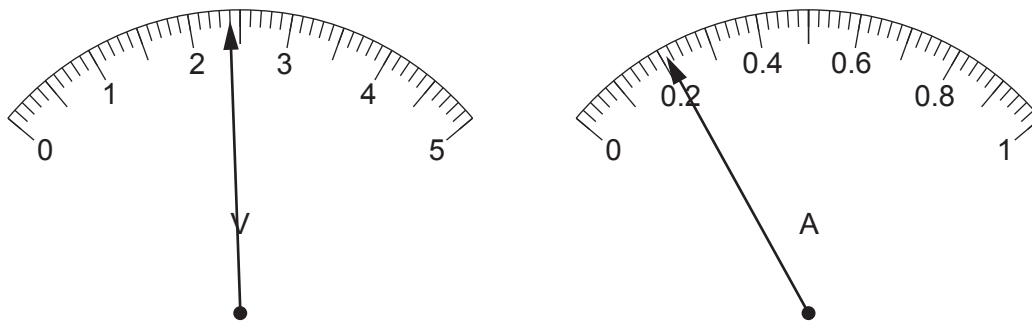


Fig. 4.2

Record the potential difference (p.d.) V_1 across both lamps and the current I_1 in the circuit.

$V_1 = \dots\dots\dots$ V

$I_1 = \dots\dots\dots$ A
[2]

- (ii) Calculate the total resistance R_s of the two identical lamps.

Use the equation shown.

$$R_s = \frac{V_1}{I_1}$$

$R_s = \dots\dots\dots$ Ω [1]

(b) After a few minutes one of the lamps breaks.

(i) State what the student observes.

.....
 [1]

(ii) Describe how the student uses some of the components in Fig. 4.1 to find out which lamp still works.

.....

 [2]

(c) The student replaces the broken lamp and rearranges the circuit in Fig. 4.1 so that:

- the lamps are connected in parallel
- the ammeter still measures the total current in the circuit
- the voltmeter measures the p.d. across both lamps.

(i) Complete Fig. 4.3 to show this new circuit.

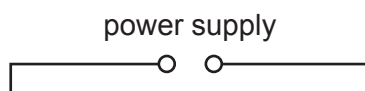


Fig. 4.3

[3]

(ii) A switch can be added to the circuit in (c)(i) to control both lamps. Mark with an **X** on your circuit in (c)(i) the position of a switch that controls both lamps. [1]

(d) In the parallel circuit in (c)(i) the meter readings are:

$$V_2 = 2.4 \text{ V}$$

$$I_2 = 0.84 \text{ A}$$

(i) Calculate the total resistance R_p of the lamps in this circuit.

Give your answer to **two** significant figures.

$$R_p = \dots\dots\dots \Omega \quad [2]$$

(ii) Describe how the brightness of the lamps in the parallel circuit is different from the lamps in the series circuit in Fig. 4.1.

.....
 [1]

[Total: 13]

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 Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.