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COMBINED SCIENCE

0653/61

Paper 6 Alternative to Practical

May/June 2014

1 hour

Candidates answer on the Question paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

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

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

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

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

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

- 1 A student is investigating the vitamin C content of a fruit juice.

DCPIP is a dark blue chemical that is decolourised by vitamin C. A solution containing a higher concentration of vitamin C will take fewer drops to decolourise DCPIP.

The student is provided with a set of four standard solutions of vitamin C and a fruit juice of unknown vitamin C content.

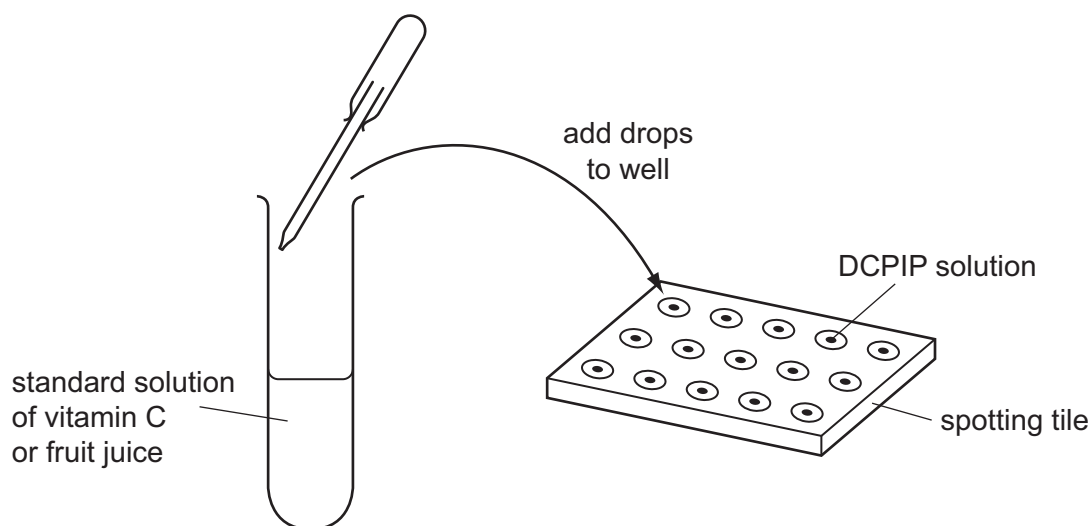


Fig. 1.1

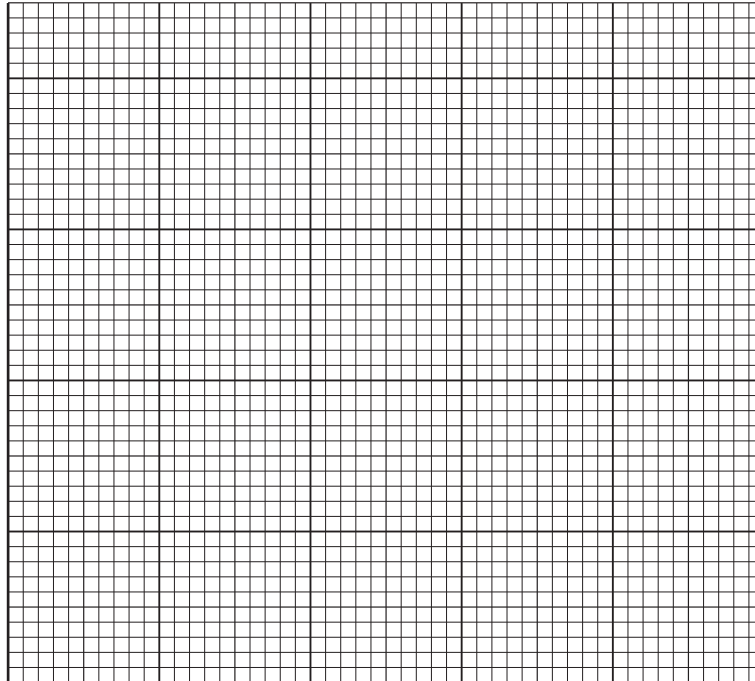
- Using a dropping pipette, the student places two drops of DCPIP into each of five wells of a white spotting tile.
- She adds drops of the 0.25% vitamin C solution into one of the wells as shown in Fig. 1.1.
- She counts the number of drops needed to decolourise the DCPIP.
- She repeats the process for the remaining vitamin C solutions and the fruit juice.
- The results are shown in Table 1.1.

Table 1.1

concentration of vitamin C (%)	number of drops needed to decolourise DCPIP
0.25	20
0.50	17
0.75	10
1.00	5
fruit juice	12

- (a) Plot a graph of vitamin C concentration on the horizontal axis against number of drops needed to decolourise DCPIP.

Draw the best fit straight line.



[3]

- (b) Use your graph to estimate the concentration of the vitamin C content of the fruit juice and mark on the graph how you worked this out.

vitamin C content = ... % [2]

- (c) The student suggested that drops of distilled water are added to two drops of DCPIP in another well.

Give a reason why this further test should be used.

.....
 [1]

(d) Suggest **two** ways in which the experiment may be changed to give more accurate results.

1

.....

2

.....

[2]

(e) Suggest **one** way to improve the reliability of this experiment.

.....

..... [1]

(f) Vitamin C is an important component of our diet. What are the consequences of a diet that lacks vitamin C?

..... [1]

Please turn over for Question 2.

2 A student is investigating some reactions of sodium hydrogencarbonate, (NaHCO_3) and sodium carbonate, (Na_2CO_3). They are both white powders.

(a) She places some sodium hydrogencarbonate in a test-tube and attaches a delivery tube. She half fills a second test-tube with limewater and places the other end of the delivery tube into the limewater. She heats the first test-tube.

(i) Draw a labelled diagram of the apparatus.

[2]

(ii) She heats the test-tube of sodium hydrogencarbonate until there is no further change in the limewater. Carbon dioxide is given off.

Describe the **two** changes to the limewater.

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

(iii) The student also observes droplets of liquid in the delivery tube.

Describe a test that will show that these droplets are water.

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

- (b)** The student makes a solution of sodium hydrogencarbonate by dissolving some of it in distilled water.

She divides the solution into two test-tubes.

- (i)** To the first test-tube she adds a few drops of Universal (full range) Indicator solution. Sodium hydrogencarbonate solution is slightly alkaline.

Describe the colour change.

colour change to [1]

- (ii)** She adds a colourless liquid to the second test-tube. Bubbles of carbon dioxide are given off.

Suggest a name for the colourless liquid.

..... [1]

- (c)** She places some sodium carbonate in another test-tube and attaches a delivery tube. As in part **(a)** she half fills a second test-tube with limewater and places the other end of the delivery tube into the limewater.

She heats the test-tube containing sodium carbonate and records her observations.

- (i)** Suggest a difference between these observations and those made in **(a)(ii)**.

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

She makes a solution of sodium carbonate by dissolving some of it in distilled water.

She divides the solution into two test-tubes.

- (ii)** To the first test-tube she adds a few drops of Universal Indicator solution.

Sodium carbonate solution is more alkaline than sodium hydrogencarbonate.

How does the final colour of the Universal Indicator differ from the colour seen in **(b)(i)**?

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

- (iii)** To the second test-tube she adds an equal volume of copper(II) sulfate solution.

A blue precipitate is formed.

Suggest the name of this precipitate.

..... [1]

3 A student is finding the density of plasticine (modelling clay).

(a) She moulds the piece of plasticine into a block as shown in Fig. 3.1.

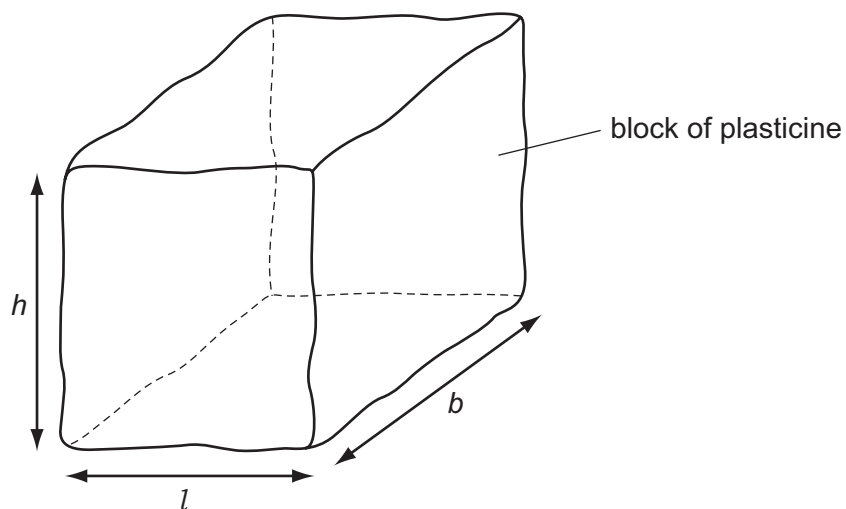


Fig. 3.1

(i) Measure the length, (l), breadth, (b), and height, (h), of the arrows in Fig. 3.1 to the nearest 0.1 cm and record your results below.

$l =$ cm

$b =$ cm

$h =$ cm [3]

(ii) Calculate the volume of the block using the equation:

$$V = l \times b \times h$$

$V =$ cm³ [1]

(b) The student sets up some apparatus as shown in Fig. 3.2.

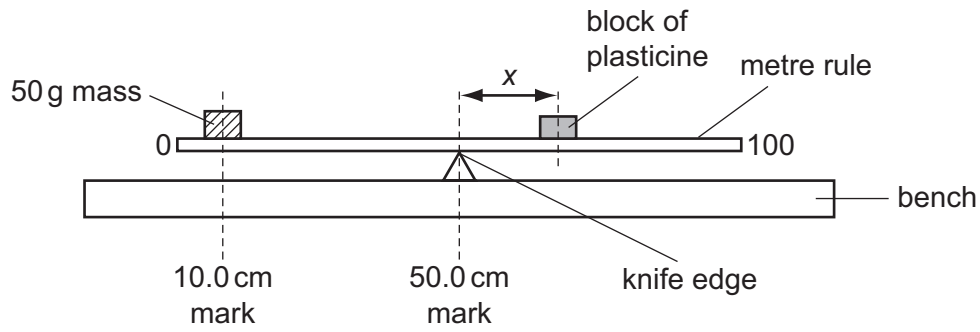


Fig. 3.2

A 50 g mass has been secured to the metre rule. Its position is fixed with its centre over the 10.0 cm mark.

She takes the block of plasticine and places it on the metre rule.

She moves it until the rule is just balanced with the knife edge directly under the 50.0 cm mark.

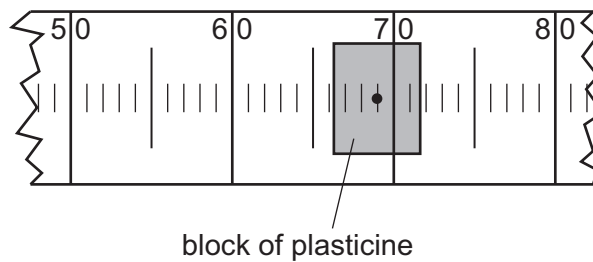


Fig. 3.3

- (i) Use Fig. 3.3 to find the distance, x , between the centre of the plasticine and the 50 cm mark.

$x = \dots\dots\dots$ cm [1]

- (ii) Calculate the mass, m , of the block of plasticine using the equation:

$$m = \frac{2000}{x}$$

$m = \dots\dots\dots$ g [1]

- (iii) Calculate the density, d , of the plasticine using the equation:

$$d = \frac{m}{V}$$

$d = \dots\dots\dots$ g/cm³ [2]

- (c) Suggest **two** reasons why the data you have used to calculate the density of plasticine may be inaccurate.

reason 1

.....

reason 2

..... [2]

Please turn over for Question 4.

- 4 A student is studying cells using a light microscope.

She prepares cells from an onion and stains them using iodine solution.

Fig. 4.1 shows a group of onion cells as seen under the microscope.

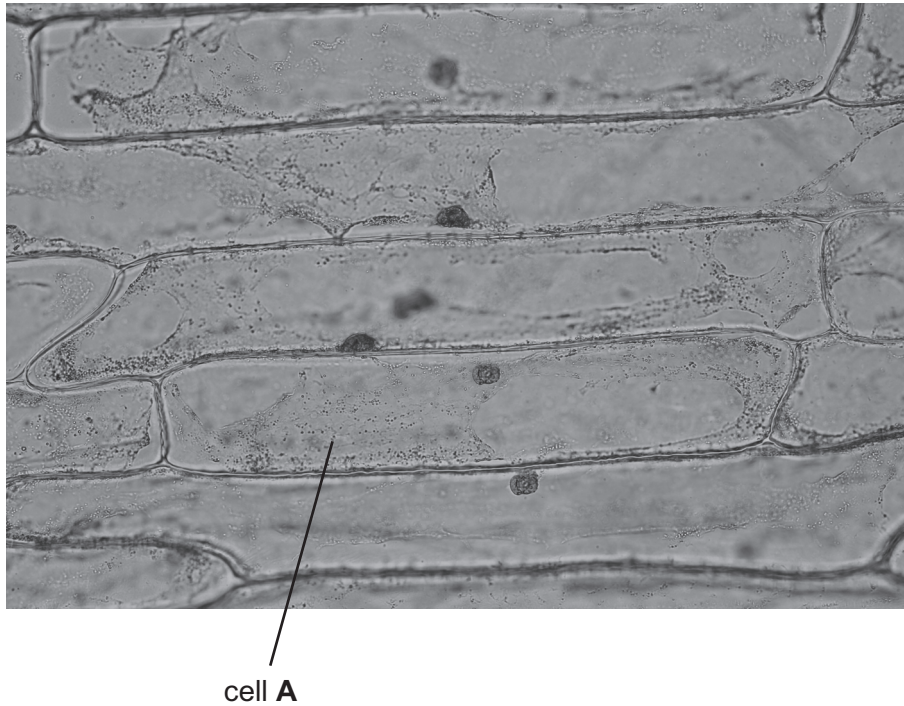
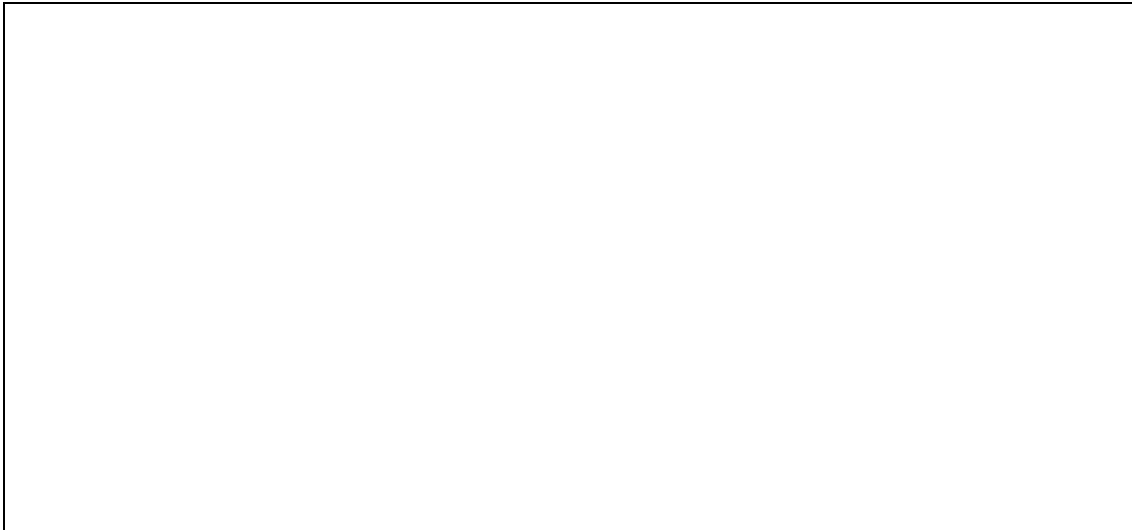


Fig. 4.1

- (a) Make a large pencil drawing of cell **A** in the box provided. **Label** the nucleus and cell wall.



[3]

The student wants to measure the average length of these cells. She places a ruler with a millimetre scale on the stage of the microscope to find the diameter of the field of view. She looks down the microscope and sees the field of view shown in Fig. 4.2.

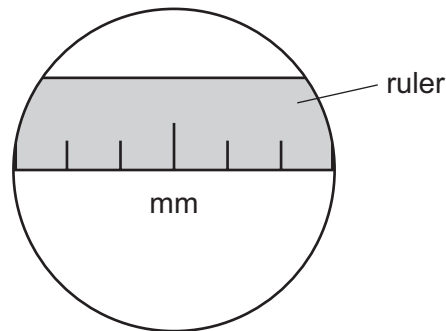


Fig. 4.2

- (b) (i)** Using the ruler in Fig. 4.2 state the width of the field of view of the microscope.

..... mm [1]

- (ii)** She then replaces her slide and counts 15 cells across the field of view.

Calculate the average length of an onion cell using your answer from part **(b)(i)**.

Show your working.

average length of cell = ... mm [1]

- (iii)** On your drawing in part **(a)** measure the length of cell **A** at the longest part.

length of cell **A** on the drawing = ... mm [1]

- (iv)** Using the value for the average cell length from part **(b)(ii)** and the length of cell **A** on your drawing, calculate the magnification of your drawing.

magnification = ... [2]

- (c) Name **one** structure normally present in a plant cell that is **not** visible in these onion cells.

..... [1]

- (d) Another student uses a microscope to look at some cells in iodine solution. Some parts of the cell stain blue-black.

Explain this observation.

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

Please turn over for Question 5.

- 5 (a) A student is investigating how the temperature changes as a hot liquid cools.

He starts with some waxy solid in a test-tube and heats it until it melts.

He removes the heat and takes the temperature of the liquid as it cools.

He starts a stopclock and measures the temperature every minute for 10 minutes and records the values in Table 5.1.

Table 5.1

time / min	temperature / °C
0	
1	74
2	69
3	69
4	
5	55
6	42
7	32
8	28
9	22
10	

- (i) Read the thermometers in Fig. 5.1 which show the temperatures at 0, 4 and 10 minutes.

Record the value in Table 5.1.

[3]

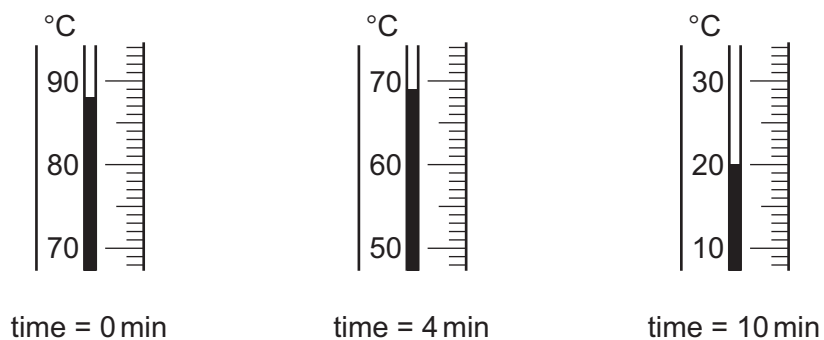
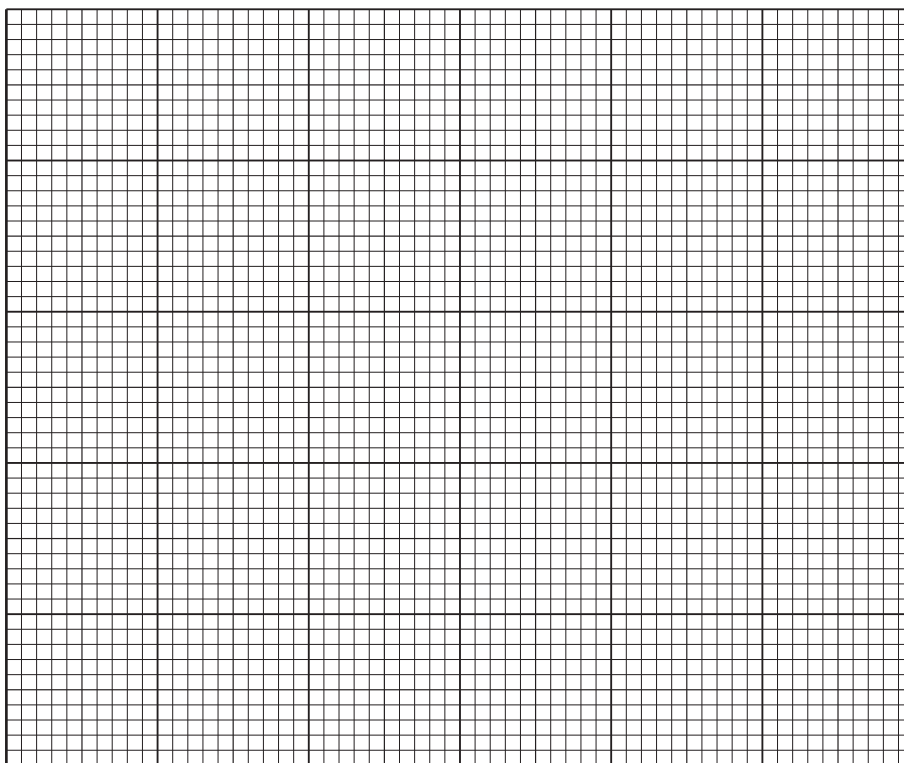


Fig. 5.1

- (ii) Use the grid provided to plot a graph of temperature (vertical axis) against time. Draw the best fit smooth curve.



[3]

- (iii) Use the graph to suggest a value for the melting point of the waxy solid.

..... °C [1]

- (b) Describe the movement and arrangement of the molecules of the substance at

time = 1 minute,

movement

arrangement

time = 7 minutes.

movement

arrangement

[3]

6 (a) A student is investigating how the length of a wire affects its electrical resistance.

(i) Name a piece of apparatus that can be used to measure

potential difference, ...

current. [2]

(ii) State the formula used to calculate the resistance of the wire using data obtained from these two pieces of apparatus.

[1]

(iii) Draw a circuit diagram to show how the student would carry out the investigation. Include the two pieces of apparatus you have named, the piece of wire and a power source.

[4]

- (b) (i) Use the axes in Fig. 6.1 to sketch the line you would expect if resistance is plotted against length.

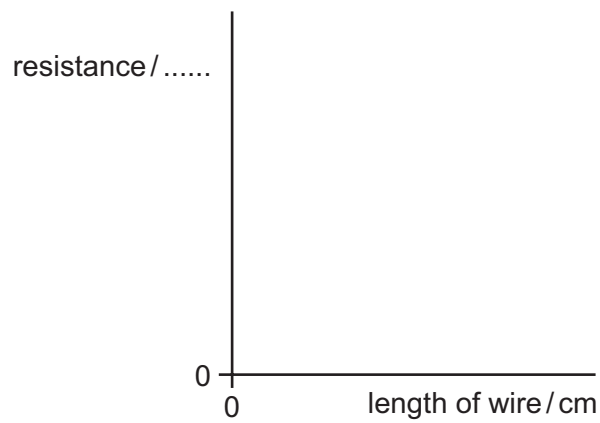


Fig. 6.1

[2]

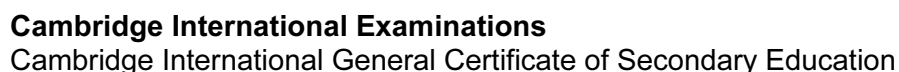
- (ii) State the unit for resistance.

unit = ... [1]

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- 1 A student investigates the movement of acid into different sized blocks of agar. The agar contains the indicator phenolphthalein. This indicator is purple in a pH of greater than 8 and colourless in a pH of less than 8.

Two agar blocks of dimensions $2\text{ cm} \times 2\text{ cm} \times 2\text{ cm}$ and $1\text{ cm} \times 1\text{ cm} \times 1\text{ cm}$ are labelled **A** and **B** respectively and placed in separate beakers as shown in Fig. 1.1.

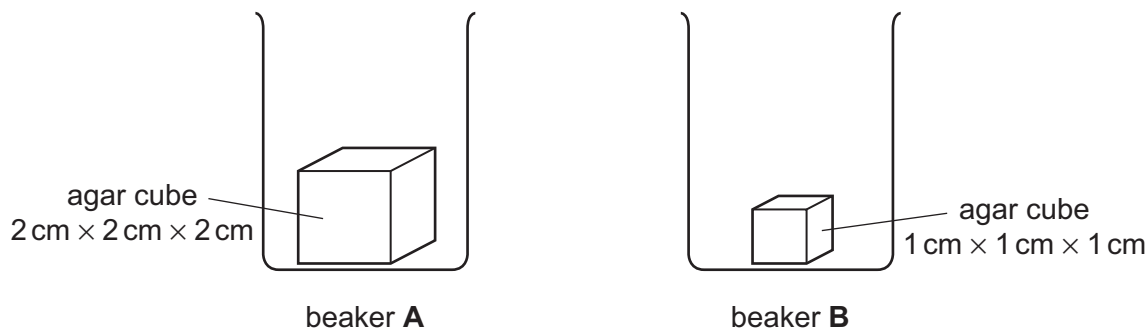


Fig. 1.1

- (a) At the beginning of the experiment the colour of the indicator in the agar was purple.

Explain what this colour indicates.

..... [1]

The student adds 10 cm^3 hydrochloric acid to each of the beakers to cover the blocks and then starts the stopclock. She records the time taken for the blocks to become colourless.

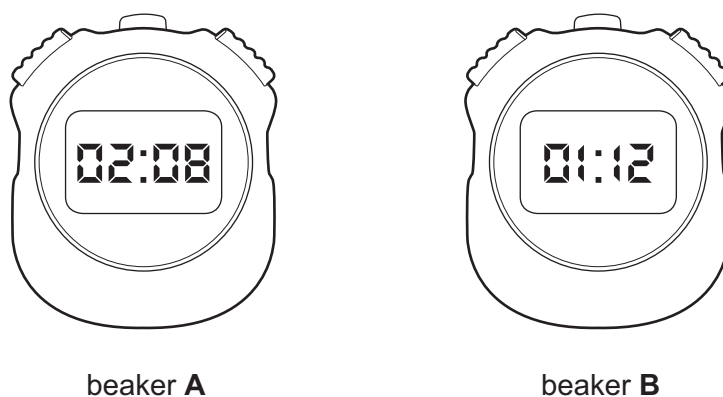


Fig. 1.2

- (b) In the space below, use a ruler to construct a table for the results.

Your table should show the dimensions of each block and the time taken, **in seconds**, for each block to go colourless.

Read the stopclocks shown in Fig. 1.2. Record the time taken, in seconds to complete your table.

[3]

- (c) (i) Name the process by which the acid moves into the agar from the solution.

..... [1]

- (ii) Explain the colour change of the agar.

.....
 [1]

- (d) (i) Explain the difference between the times taken for the colour changes in blocks **A** and **B**.

.....

 [1]

- (ii) Suggest the significance of this for gas exchange in the lungs.

.....
 [1]

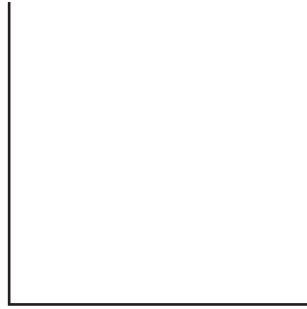
(e) The teacher says that the experiment should be extended to allow a more confident explanation of the results.

(i) Suggest a suitable extension.

.....

..... [1]

(ii) Label the axes to show how you would represent the results of this extended experiment.



[1]

Please turn over for Question 2.

- 2 Solid **X** is a mixture of two salts which have the same anion. A student carries out a series of tests to identify the two salts.

(a) Identification of the anion

A student dissolves a sample of solid **X** in distilled water. He divides the resulting solution into three test-tubes.

- (i) Into the first test-tube the student adds some nitric acid. There is no reaction.

State which anion is **not** present in solid **X**.

..... [1]

- (ii) In the second test-tube the student tests for the presence of chloride ions. The result is negative.

Name the reagents used in this test.

reagent 1

reagent 2 [2]

- (iii) To the third test-tube the student adds barium chloride solution and observes a white precipitate.

This proves a sulfate is present.

The student observes that this test-tube gets hot.

State the term for this type of reaction.

..... [1]

(b) Identification of the two cations

The student dissolves another sample of solid **X** in distilled water. To this he adds an excess of ammonia solution. A precipitate forms.

He separates the precipitate from the solution and records the colours in Table 2.1.

Table 2.1

	colour	cation present
solution	dark blue	
precipitate	green	

- (i) Complete Table 2.1 to show the cation present in the solution and the cation present in the precipitate. [2]

- (ii) Draw a labelled diagram to show how the student can separate the precipitate and solution.

[2]

- (iii) After standing in air for a short time the student notices that the colour of the precipitate has changed.

Describe the colour change and the process that is occurring.

colour change

process [2]

- 3 A student is finding out how the potential difference (p.d.) across a lamp and the power of the lamp vary with the length of resistance wire in series with it.

She sets up the circuit as shown in Fig. 3.1.

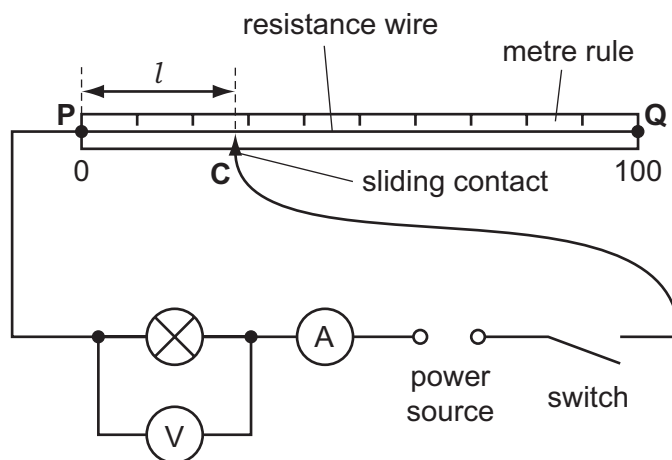


Fig. 3.1

- (a) She closes the switch and places the sliding contact **C** on the resistance wire at a distance, l of 10.0 cm from end **P**. She records in Table 3.1 the current, I , flowing through the lamp and the p.d. V , across it.

She moves the contact **C** on the resistance wire until distance l is 20.0 cm. She records in Table 3.1 the new values of I and V .

She continues with further values of l as shown in Table 3.1.

Table 3.1

length l /cm	current I /A	p.d. V /V	power P /W
10.0	0.21	1.81	
20.0	0.17	1.72	
40.0	0.15	1.52	
60.0			
80.0	0.13	1.17	

- (i) Fig. 3.2 shows the ammeter and voltmeter readings when the length, l , equals 60.0 cm.

Record, in Table 3.1, the values of I and V .

[2]

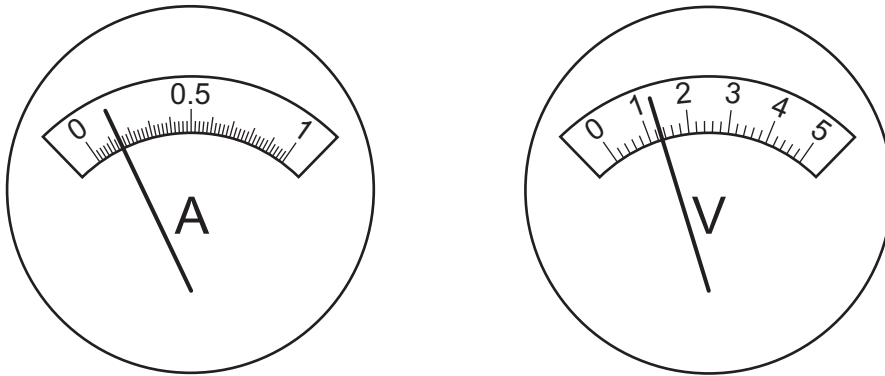


Fig. 3.2

- (ii) Calculate the power, P , produced by the lamp for each length of wire, using the equation

$$P = V \times I$$

Record your values of P in Table 3.1 to an appropriate number of significant figures. [2]

- (iii) What observation of the apparatus shows that the power produced by the lamp decreases as the length of resistance wire increases?

.....
 [1]

- (b) The teacher makes the following suggestion.

‘The potential difference across the lamp is directly proportional to the length of the resistance wire in the circuit.’

- (i) In Table 3.2, transfer the values of V that are recorded in Table 3.1. For each pair of readings of l and V , calculate the ratio $\frac{V}{l}$. Record your results in Table 3.2. [2]

Table 3.2

length l /cm	p.d. V /V	$\frac{V}{l}$ in V/cm
10.0		
20.0		
40.0		
60.0		
80.0		

- (ii) On Fig. 3.3 sketch the graph you would expect to obtain if the teacher's suggestion is correct.

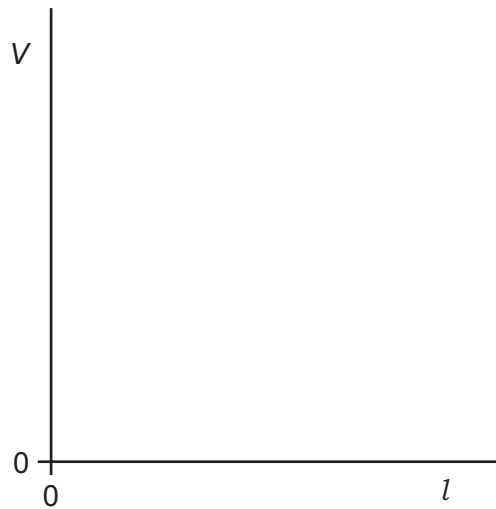


Fig. 3.3

[2]

- (iii) Use your values of $\frac{V}{l}$ from Table 3.2 to state whether you agree with the suggestion made by the teacher.

.....

Justify your statement by referring to the values you have calculated.

.....

..... [1]

Please turn over for Question 4.

- 4 A student investigates water uptake by a plant. The apparatus, called a potometer, is set up as shown in Fig. 4.1.

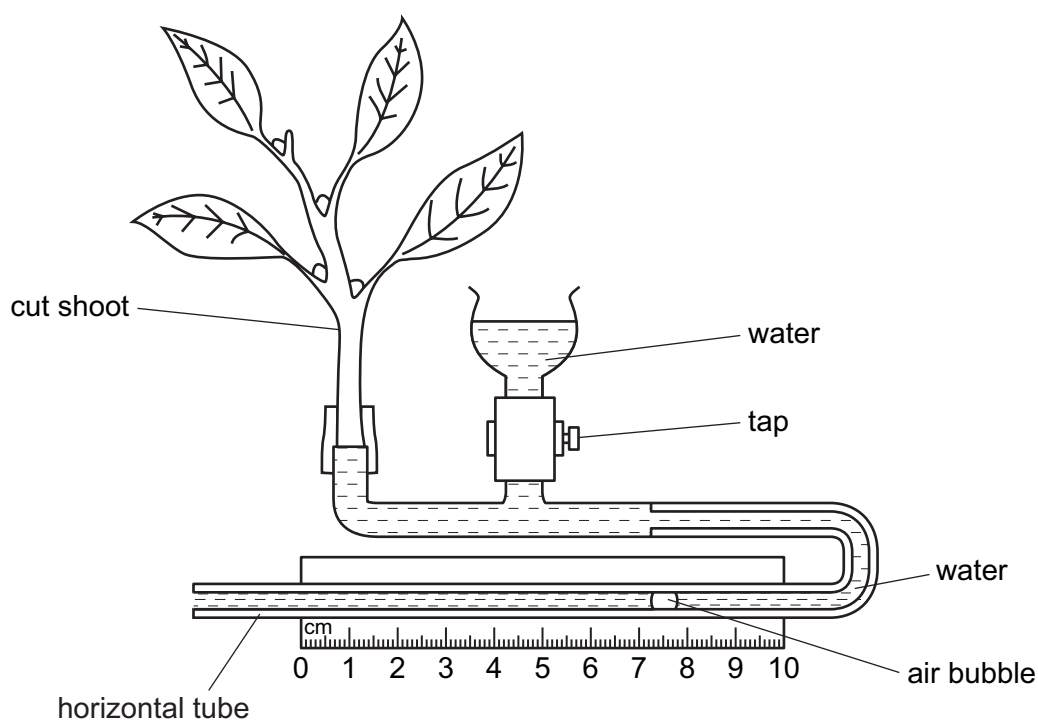


Fig. 4.1

The potometer is filled with water and an air bubble is introduced. The scale is used to measure the distance the bubble moves in a set time period.

- (a) Name and explain the process, in the leaves, causing the bubble in the horizontal tube to move from left to right.

process

explanation

..... [2]

- (b) Describe how the student can use the potometer to investigate the effect of wind on the rate of water uptake.

.....

.....

.....

.....

..... [4]

The student investigates the effect of light intensity on the rate of water uptake.

Table 4.1 shows the results he obtained with the shoot in high light intensity:

Table 4.1

light intensity	start point (cm)	end point (cm)	distance moved (cm)
high	2.5	7.0	
low			

- (c) (i) Using Fig. 4.2, read the positions of the air bubble in low light intensity and record the values in Table 4.1. [1]

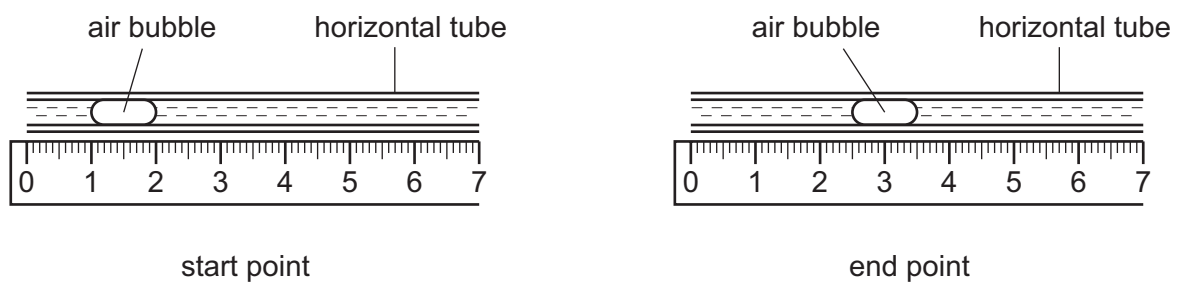


Fig. 4.2

- (ii) Calculate the distances moved by the air bubbles for both light intensity conditions. Record these values in the final column of Table 4.1.

[2]

- (d) State **one** environmental condition, other than wind or light intensity, that will affect the rate of water uptake of a plant.

..... [1]

- 5 (a) A student has three solutions, labelled **A**, **B** and **C**. These are barium chloride, hydrochloric acid and sodium carbonate.

The teacher says that:

A is hydrochloric acid

B is sodium carbonate and

C is barium chloride.

Using only solutions **A**, **B** and **C** and no other reagents explain how the student could show that the teacher is correct.

State clearly what she can do and the observations expected.

.....

.....

.....

.....

..... [3]

- (b) (i) Which **two** solutions from **A**, **B** and **C** could the student add together to make sodium chloride solution, without a precipitate being formed.

solution and solution [1]

- (ii) Sodium chloride solution needs to be heated gently to produce sodium chloride crystals.

Name the process that must take place for crystallisation to occur.

..... [1]

- (iii) Draw a labelled diagram of how she would carry out the procedure described in (b)(ii).

[2]

- (c) The teacher provides the student with another solution, labelled **D**.

Describe a test and state the result that shows it contains a zinc cation.

.....

.....

.....

..... [3]

- 6 (a) A student wishes to find the efficiency of a heating element.

He sets up the circuit as shown in Fig. 6.1.

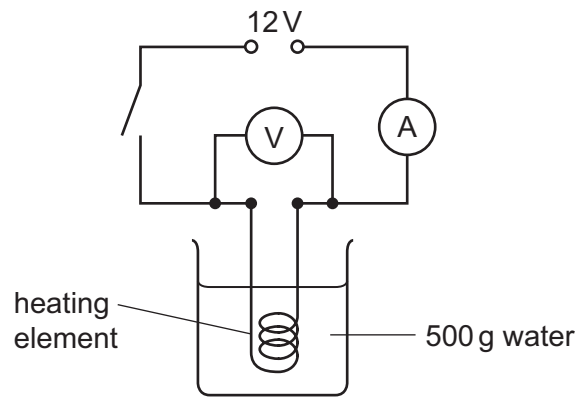


Fig. 6.1

He closes the switch and leaves it for one hour. The ammeter reading is shown in Fig. 6.2.

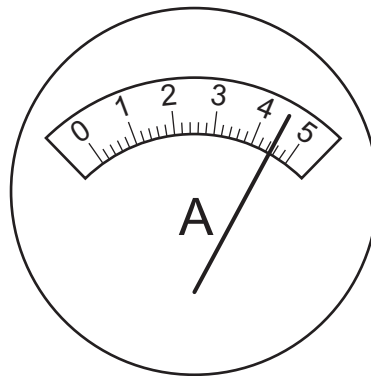


Fig. 6.2

- (i) Read the ammeter and record the value in Table 6.1.

Table 6.1

ammeter reading / A	voltmeter reading / V	time / s
	12	

[1]

- (ii) Complete the final column of Table 6.1 by calculating the number of seconds the switch was closed.

[1]

- (iii) Calculate the **energy input** using the equation,

$$\text{energy input} = I \times V \times t$$

where I = ammeter reading, V = voltmeter reading and t = time in seconds.

energy input = ... J [2]

- (b) The student calculates the amount of energy used to heat the water.

- (i) The original temperature of the water was 20 °C.

Read the thermometer shown in Fig. 6.3 to find the final temperature of the water after heating and calculate the temperature rise.

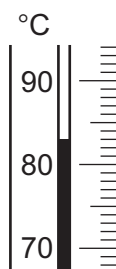


Fig. 6.3

thermometer reading = ... °C

temperature rise = ... °C [2]

- (ii) Calculate the **useful energy** transferred to heat the water using the equation,

$$\text{useful energy} = m \times 4200 \times t$$

where m = mass of water in kg and t = temperature rise in $^{\circ}\text{C}$.

useful energy = ... J [2]

- (c) Use your values from (a)(iii) and (b)(ii) to calculate the efficiency of the heater.

Show clearly the formula you use.

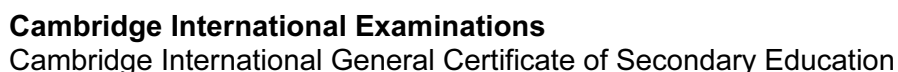
efficiency = ... % [2]

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COMBINED SCIENCE

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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.

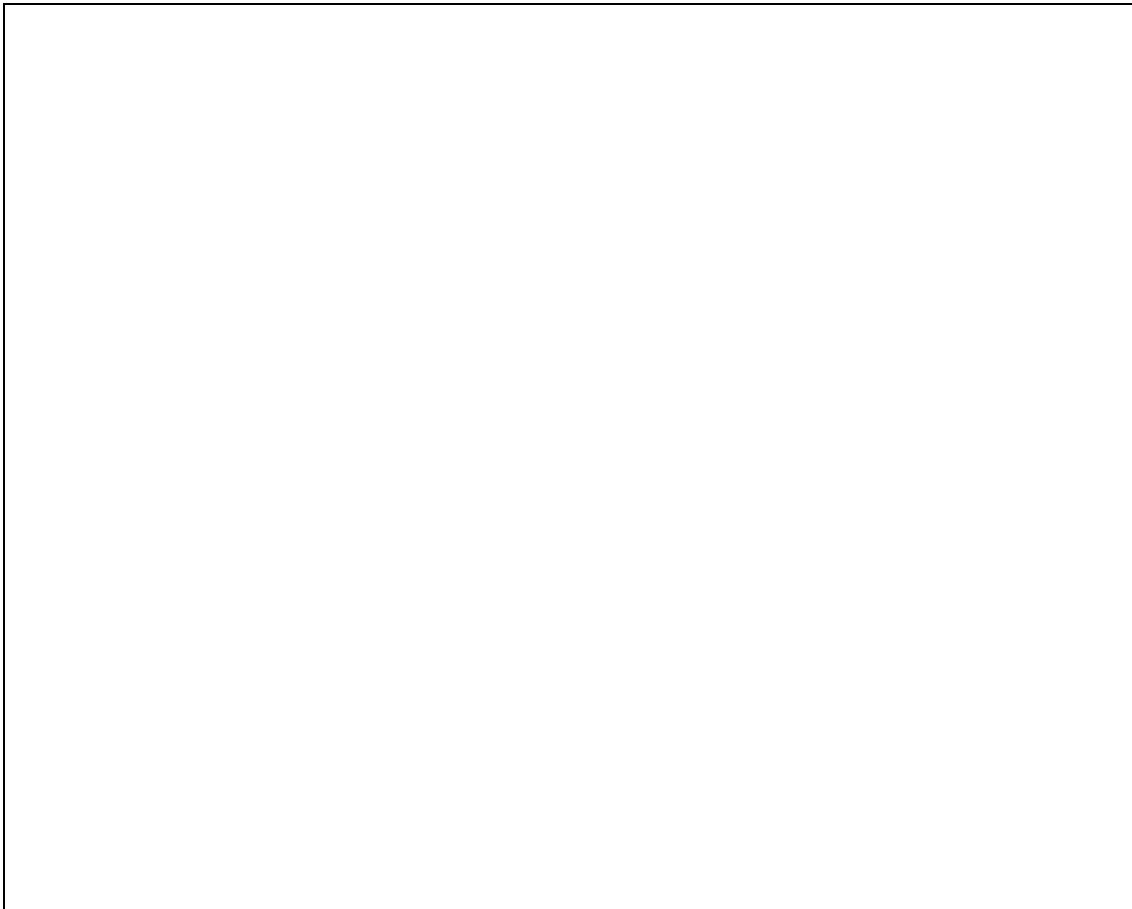
This document consists of **20** printed pages.

- 1 Fig. 1.1 is a photograph of a flower in section.



Fig. 1.1

- (a) (i) In the box below make a pencil drawing of this flower to show the male and female parts and the petals. [2]



- (ii) On your drawing, **label** a carpel and a stamen.

[2]

(b) (i) Measure the line X – Y on Fig. 1.1 in mm.

length = ... mm [1]

(ii) Measure the length of the same part on your drawing in mm.

length = ... mm [1]

(c) Use these two measurements to calculate the magnification of your drawing.

Show your working in the space below.

magnification = ... [1]

(d) On your drawing, mark with a **Z** the structure that receives pollen during pollination. [1]

(e) Describe the procedure you would use if you wanted to examine a sample of pollen from this flower.

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

- 2 A student is given three solutions labelled **A**, **B** and **C**. He knows they are copper(II) chloride, sodium carbonate and zinc sulfate, but does not know which is which.

A second student has three more solutions, **D**, **E** and **F**. She knows they are barium chloride, hydrochloric acid and sodium hydroxide, but does not know which is which.

They place 2 cm³ solution **A** into a test-tube. Then they slowly add 2 cm³ solution **D**. They record their observations in Table 2.1.

They repeat this procedure with the other combinations and their results are shown in Table 2.1.

Table 2.1

	solution A	solution B	solution C
solution D	white precipitate	white precipitate	no reaction
solution E	no reaction	white precipitate	blue precipitate
solution F	bubbles given off	no reaction	no reaction

- (a) (i) Using the results in Table 2.1, deduce which two solutions are sodium carbonate and hydrochloric acid.

Sodium carbonate and hydrochloric acid are solutions

and [1]

- (ii) To identify which solution is which, the students add a little dilute sulfuric acid to separate samples of the solutions named in (a)(i).

Describe the observations when sulfuric acid is added to

sodium carbonate, ...

hydrochloric acid. [2]

- (b) The students study Table 2.1 again and deduce that solutions **C** and **E** must be copper(II) chloride and sodium hydroxide.

To identify which solution is which, one of the students slowly adds excess aqueous ammonia, to separate samples of the solutions.

State the expected observations of both solutions.

observations of excess aqueous ammonia with copper(II) chloride

.....

observations of excess aqueous ammonia with sodium hydroxide

.....

[3]

- (c) The other two solutions must be zinc sulfate and barium chloride.

One student suggests using hydrochloric acid to distinguish between zinc sulfate and barium chloride.

- (i) Explain why this would not distinguish between zinc sulfate and barium chloride.

.....
 [1]

- (ii) Name another acid that would distinguish between zinc sulfate and barium chloride.

Record the expected observations for each solution.

acid used

observation with zinc sulfate

.....

observation with barium chloride

.....

[3]

- 3 A student is finding out how the rate of cooling of hot water depends upon the temperature of the water.

He has a beaker of hot water and a thermometer as shown in Fig. 3.1.

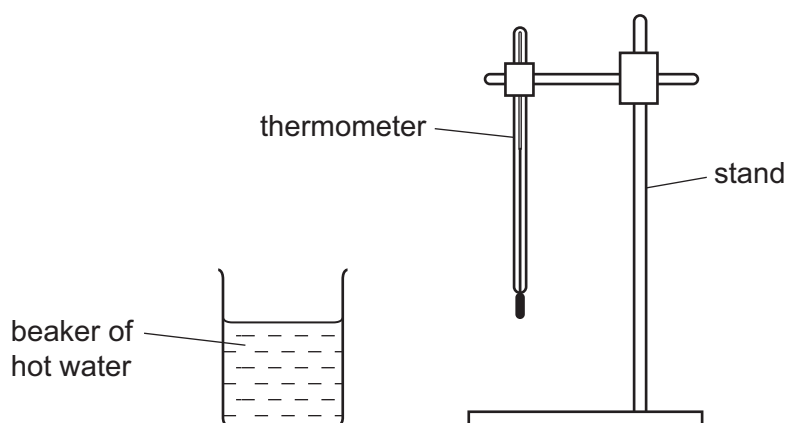


Fig. 3.1

- (a) He carefully places the thermometer into the hot water and measures the temperature, T , of the hot water. He records this value of T in Table 3.1 at time $t = 0$ s and starts the stopwatch.

He records in Table 3.1 the temperature of the water every 60 s until he has a total of nine values, up to a time of 480 s.

Table 3.1

time t /s	temperature T /°C
0	87.0
60	83.0
120	78.0
180	
240	
300	69.0
360	65.5
420	63.0
480	60.5

Read the thermometers in Fig. 3.2 on page 7, which show the temperatures of the water at $t = 180$ s and $t = 240$ s, and record the values in Table 3.1. [2]

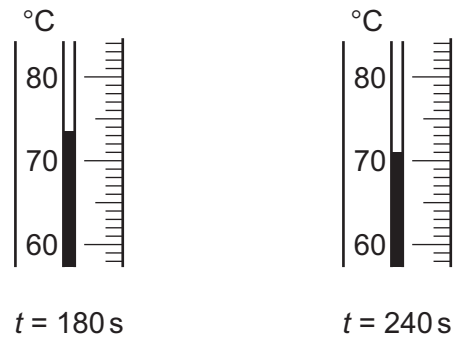
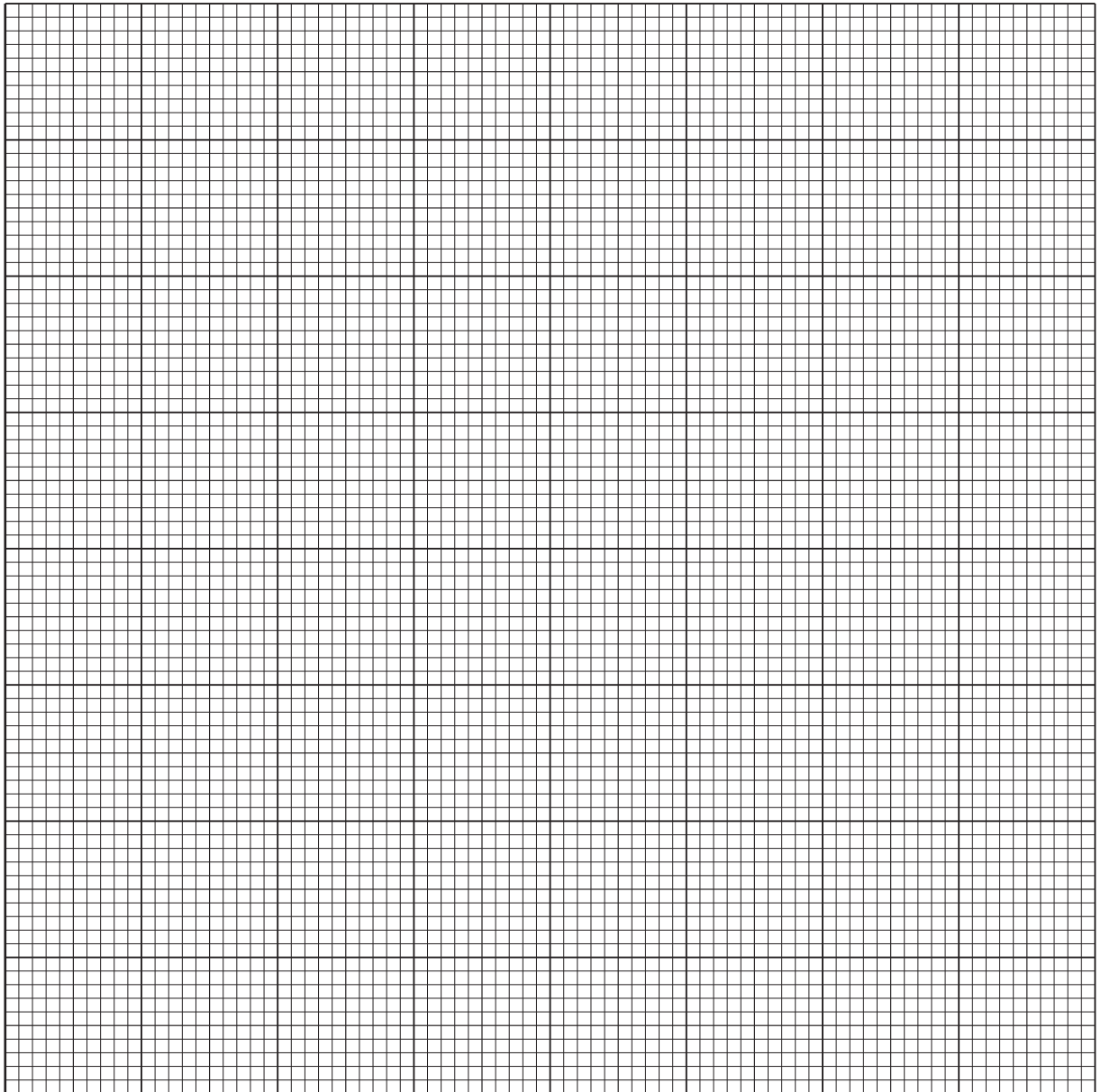


Fig. 3.2

(b) On the grid provided, plot a graph of T (vertical axis) against t .

The vertical axis does not need to start from 0. Draw the best fit curve.



[3]

- (c) (i) Use your graph to calculate the average rate of cooling of the water during the **first** 90 s of cooling. Give your answer to an appropriate number of significant figures.

Use the equation

$$\text{average rate of cooling} = \frac{\text{temperature fall}}{\text{time taken}}$$

average rate of cooling during the **first** 90 s = ... °C/s [2]

- (ii) Use your graph to calculate the average rate of cooling of the water during the **last** 90 s of cooling. Use the same equation that you used in (c)(i). Give your answer to an appropriate number of significant figures.

average rate of cooling during the **last** 90 s = ... °C/s [1]

- (d) Suggest **two** factors, other than a different initial temperature, which would change the rate of cooling of the water in the experiment.

factor 1

.....

factor 2

..... [2]

Please turn over for Question 4.

- 4** A teacher asked the class to investigate the effect of exercise on pulse rate. Their instructions are shown in Fig. 4.1.

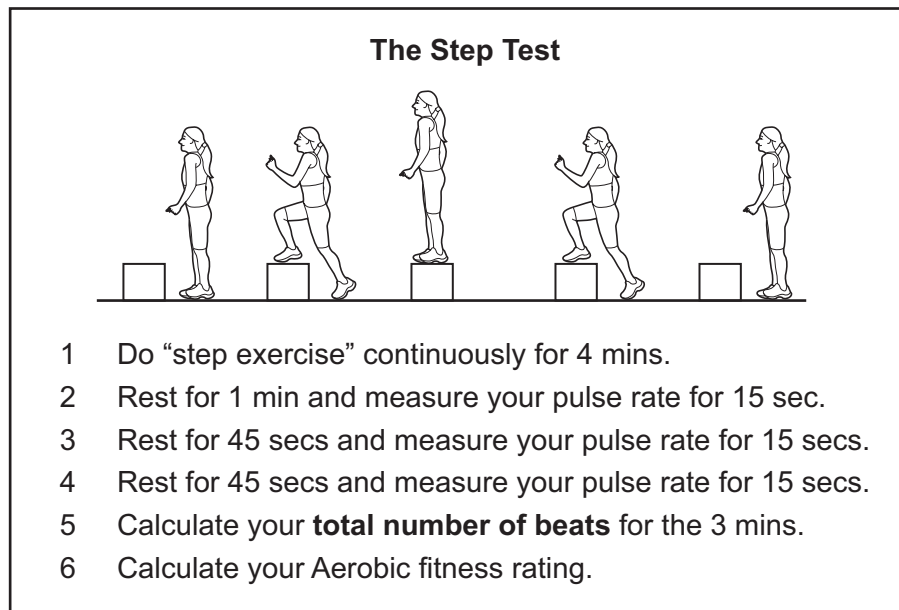


Fig. 4.1

- (a)** What is the effect of exercise on heart rate?

 [1]

- (b)** A student filled in her results in Table 4.1.

Table 4.1

time after exercise / min	number of beats in 15 seconds	pulse rate / beats per min
1	26	
2	20	
3	18	

- (i) For each pulse measurement, calculate the pulse rate in beats per minute and record these values in Table 4.1. [2]
- (ii) The pulse rate calculation can be used to estimate the 'total beats' over the three minute period. This is done by adding together the values in the final column of Table 4.1.

Estimate the 'total beats' in this student's experiments.

estimated 'total beats' = ... [1]

(c) The aerobic fitness, **F**, of a person can be determined using the formula below

$$\mathbf{F} = \frac{24000}{\text{'total beats'}}$$

Fitness ratings are linked to values of **F**, as shown in Table 4.2.

Table 4.2

F	fitness rating
60 or less	poor
61 to 70	average
71 to 80	very good
greater than 81	excellent

Use the formula to calculate **F** for this student and hence give her a fitness rating.

F = ...

fitness rating = ... [2]

(d) In an experiment with identical twins the results in Table 4.3 were obtained.

Table 4.3

	pulse rates / beats per min twin A	pulse rates / beats per min twin B
1 min	157	151
2 min	126	129
3 min	117	113

(i) Calculate the 'total number of beats' for each twin over the three minutes.

'total number of beats' for twin **A** = ...

'total number of beats' for twin **B** = ... [1]

(ii) Using your values for the 'total number of beats' and the equation for **F** from part (c), deduce the fitness rating for each of the twins.

fitness rating for twin **A** = ...

fitness rating for twin **B** = ... [1]

(iii) Twin **B** says to twin **A** 'I'm fitter than you'.

Twin **A** replies 'You're not really fitter than I am'.

Comment on these statements.

.....

 [2]

Please turn over for Question 5.

5 A student is investigating the solubility of potassium nitrate.

- She places 100 cm^3 water into a beaker.
- She measures out a number of 20 g portions of potassium nitrate.
- She places one 20 g portion of potassium nitrate into the water and stirs.
- She looks carefully and sees that all the potassium nitrate has dissolved.
- She adds another 20 g portion of potassium nitrate and stirs. Not all the potassium nitrate dissolves, so she gently warms the beaker.
- When all the potassium nitrate has dissolved, she stops heating and allows the beaker to cool. She measures the temperature when the first crystals appear and records this temperature in Table 5.1.
- She adds another 20 g portion of potassium nitrate to the beaker, stirs and warms until it has all dissolved. She stops heating and allows it to cool, recording, in Table 5.1, the temperature when the first crystals appear.

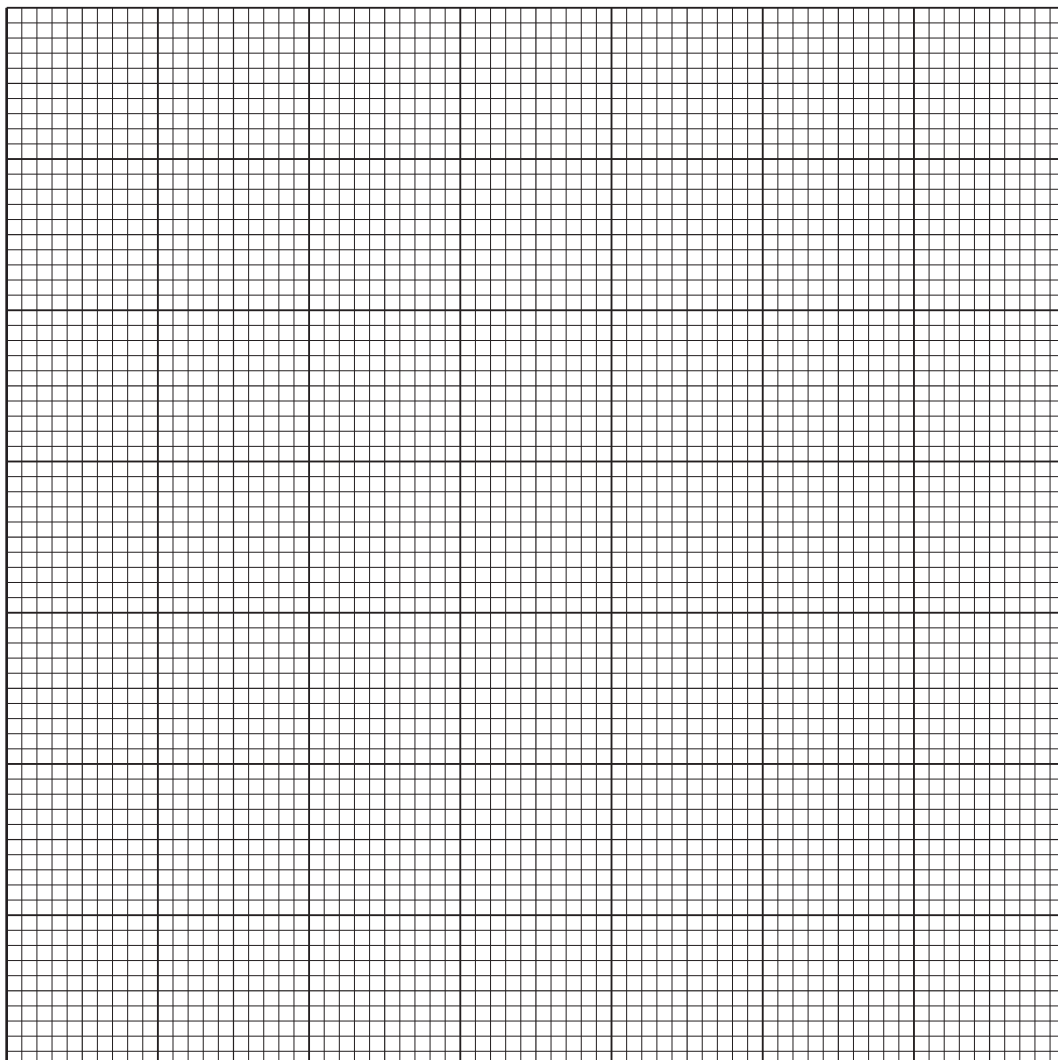
Table 5.1

mass of potassium nitrate added / g per 100 cm^3 water	temperature when first crystals appear / $^{\circ}\text{C}$
40	24
60	37
80	48
100	55
120	62
140	67

- (a) (i) Use the grid provided to plot a graph of **mass of potassium nitrate dissolved** (vertical axis) against **temperature**.

Start both axes at zero.

Draw the best fit curve.



[4]

- (ii) Extend your curve until it cuts the vertical axis and predict how much potassium nitrate would remain dissolved in 100 cm^3 water when it is cooled to 0°C .

Show how you do this on the graph.

.....g [2]

- (iii) The solution of potassium nitrate at 0°C is still a liquid. Suggest the effect that dissolving potassium nitrate has on the freezing point of water.

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

- (iv) Use your graph to calculate the mass of potassium nitrate that will be precipitated if the saturated solution was cooled from 65°C to 25°C .

Show your working on the graph.

..... g [2]

- (b) In carrying out the experiment the student warmed the mixture to dissolve the potassium nitrate and recorded the temperature at which the first crystals appeared as it cooled down.

Suggest a reason why the student does not record the temperature at which the potassium nitrate dissolves as she warms the beaker up.

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

Please turn over for Question 6.

- 6 A student is using a variable resistor to see how the current and potential difference in a circuit and the brightness of a lamp changes when the resistance changes.

He sets up a circuit as shown in Fig. 6.1.

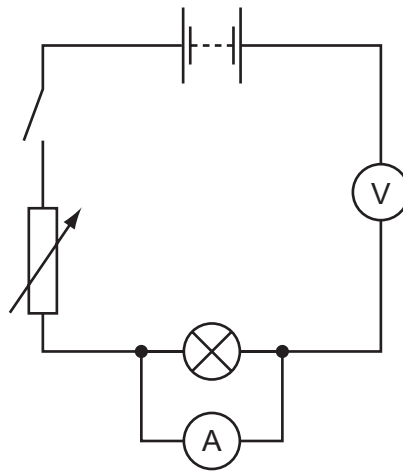


Fig. 6.1

The teacher points out that the student has made three mistakes in setting up the circuit and corrects the circuit for him.

- (a) (i)** Draw the diagram showing the teacher's circuit.

[3]

- (ii) Using the correct circuit he turns the variable resistor to a medium setting. He closes the switch and reads the values on the ammeter and voltmeter.

Use the diagrams in Fig. 6.2 to read and record in Table 6.1 the current and potential difference shown. Record your answers to two decimal places.

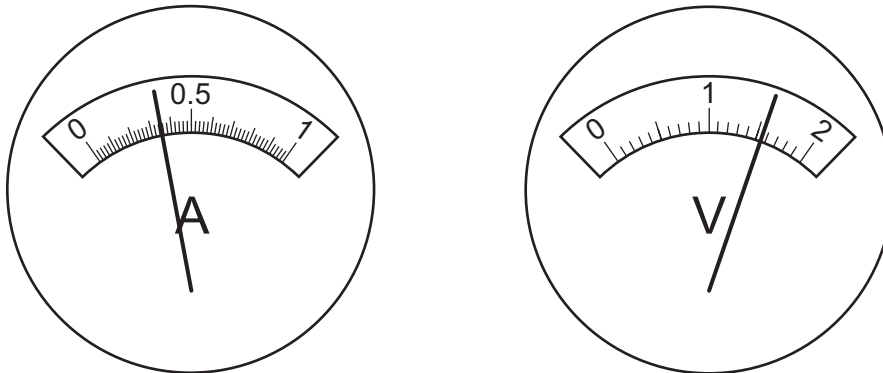


Fig. 6.2

[2]

Table 6.1

ammeter reading / A	voltmeter reading / V

- (iii) Use your values in Table 6.1 to calculate the resistance of the lamp. State the correct unit.

resistance unit [2]

- (b) (i)** The student changes the setting on the variable resistor to the highest resistance.

State what will happen to the ammeter reading and the brightness of the lamp.

ammeter reading

brightness of the lamp [1]

- (ii)** The student slowly changes the setting on the variable resistor to the lowest resistance.

He sees the lamp getting brighter and brighter and then suddenly going out.

Suggest explanations for these observations.

.....

.....

..... [2]