Cambridge Assessment International Education

# Cambridge IGCSE™ (9–1)

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| CANDIDATE NAME | | | | | | | | | |
| CENTRE NUMBER | | | | | | CANDIDATE NUMBER | | | | |

*0582051719*

**CO-ORDINATED SCIENCES** **0973/61**

Paper 6 Alternative to Practical **May/June 2024**

**1 hour 30 minutes**

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 60.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

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[Turn over

**1** Fig. 1.1 is a photograph of a slice of an orange shown actual size.

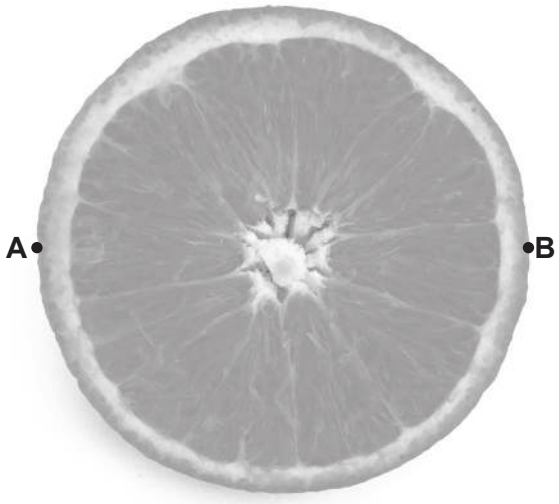



**Fig. 1.1**

**(a)** In the box, make a large, detailed, pencil drawing of the slice of the orange shown in Fig. 1.1.

[3]

**(b) (i)** Draw a line to join points **A** and **B** on Fig. 1.1.

Record the length of this line **AB** in millimetres to the nearest millimetre.

length of line **AB** on Fig. 1.1 = ..... mm [1]

**(ii)** Draw the line **AB** on your drawing in **(a)**.

Record the length of this line in millimetres to the nearest millimetre.

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

**(iii)** Calculate the magnification $m$ of your drawing.

Use your measurements in **(b)(i)** and **(b)(ii)** and the equation shown.

$$m = \frac{\text{length of line } \mathbf{AB} \text{ on your drawing}}{\text{length of line } \mathbf{AB} \text{ on Fig. 1.1}}$$

Record your value to **two** significant figures.

magnification $m$ = ..... [2]

**(c)** Fig. 1.2 is a photograph of a slice of a kiwi fruit shown actual size.

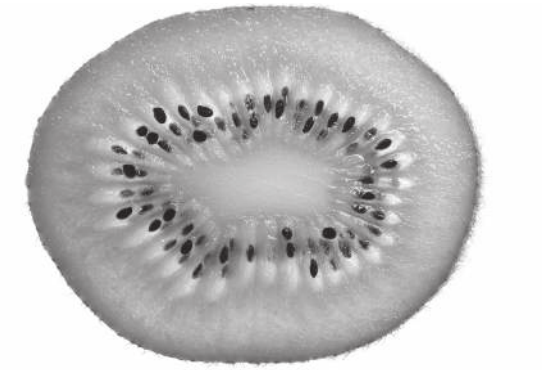


**Fig. 1.2**

State **two visible** differences between the slice of orange shown in Fig. 1.1 and the slice of kiwi fruit shown in Fig. 1.2.

difference 1 .....

.....

difference 2 .....

.....

[2]

**(d)** Suggest how the mean diameter of the kiwi fruit is determined.

.....

..... [1]

[Total: 10]





**[Turn over**

**2** A student compares the vitamin C concentration of orange juice with three other fruit juices, **D**, **E** and **F**.

DCPIP is a blue solution that decolourises (goes colourless) when vitamin C is added to it.

DCPIP is used as an indicator for vitamin C concentration as shown in Fig. 2.1.

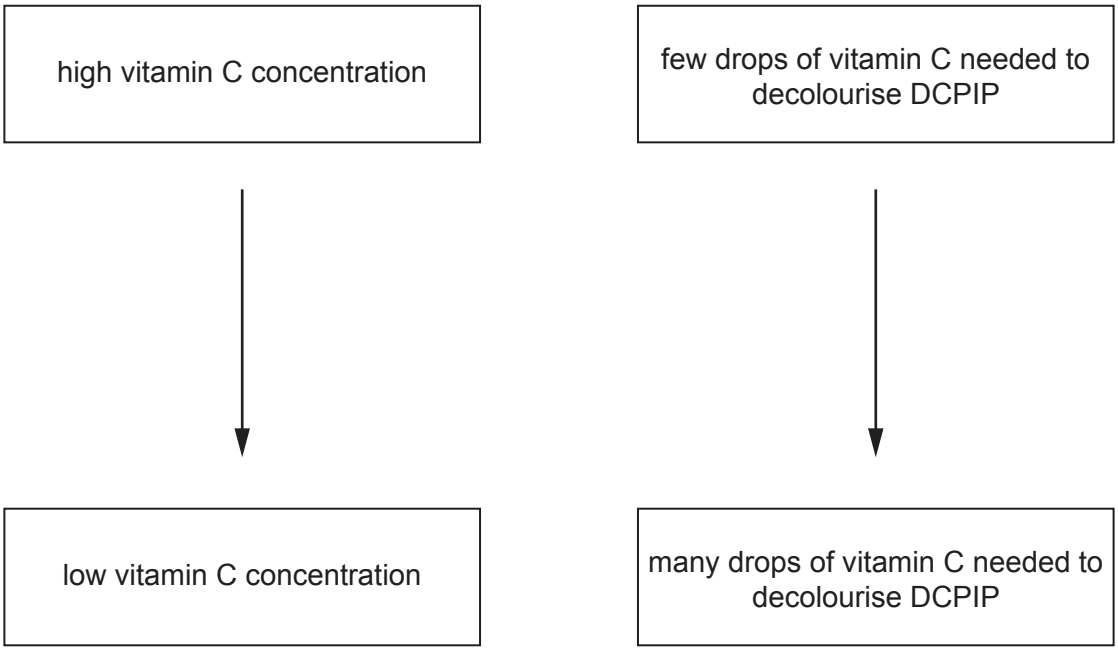



**Fig. 2.1**

**(a) Procedure**

The student:

- places two drops of DCPIP into a well of a spotting tile
- adds drops of orange juice to the well of DCPIP
- records how many drops of orange juice are needed to decolourise the DCPIP.

The student repeats the procedure with the other fruit juices.

**(i)** Name a piece of equipment suitable for putting the DCPIP in the well.

..... [1]

**(ii)** Suggest a suitable colour for the spotting tile.

Explain your answer.

colour .....

explanation .....

.....

[1]

**(iii)** Fig. 2.2 shows part of the student's notebook.

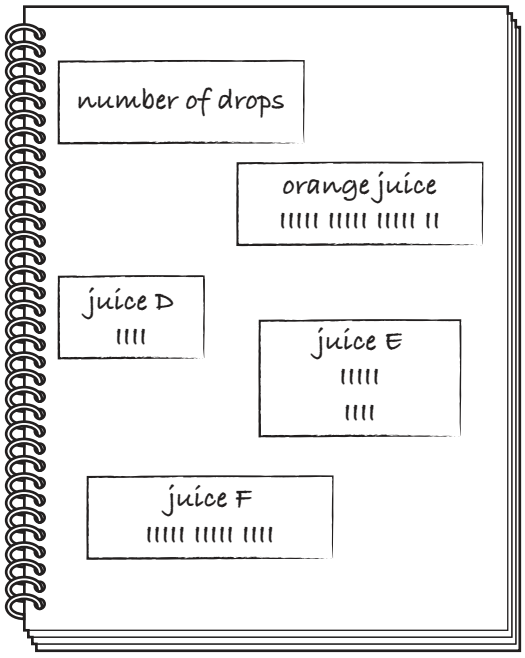


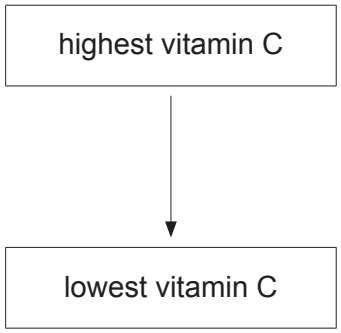

**Fig. 2.2**

Draw a table for the student's results shown in Fig. 2.2.

Record the student's results in your table.

[3]

**(iv)** Use the student's results and Fig. 2.1 to place the juices in order of their vitamin C concentration.




.....

.....

.....

.....

[1]

**(b) (i)** Explain why repeating the procedure allows the student to have more confidence in their results.

.....

..... [1]

**(ii)** Counting the number of drops is **one** source of error in this procedure.

Explain why this is a source of error.

Suggest **one** improvement. Do **not** include repeating the procedure.

explanation .....

.....

improvement .....

.....

[2]

**(c)** Scurvy is a disease caused by a lack of vitamin C in the diet.

A student does **not** drink orange juice or fruit juices **D**, **E** and **F**.

Suggest why the student does **not** get scurvy.

.....

..... [1]

[Total: 10]

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**3** A student investigates the reaction between magnesium and aqueous copper sulfate.

More reactive metals displace less reactive metals from solutions of their salts.

magnesium + copper sulfate → magnesium sulfate + copper

The unit M is used to measure the concentration of a solution.

The higher the value of M, the more concentrated the solution.

A 1 M solution is two times more concentrated than a 0.5 M solution.

**(a) Procedure**

The student:

- places a polystyrene cup into a beaker
- uses a measuring cylinder to add 25 $cm^3$ of 1.00 M aqueous copper sulfate to the polystyrene cup as shown in Fig. 3.1

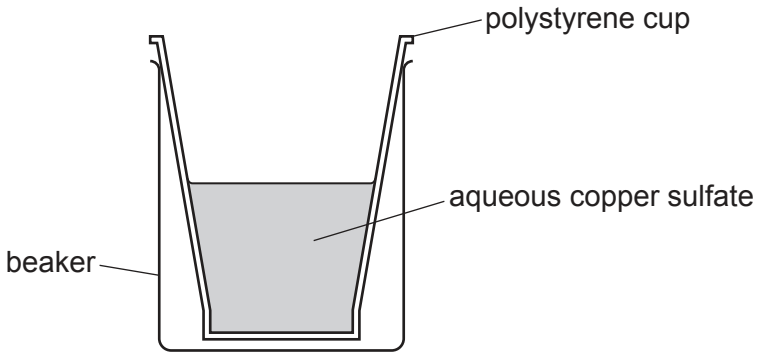



**Fig. 3.1**

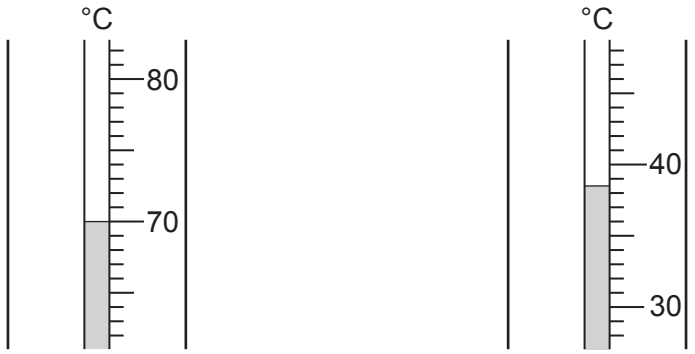
- places a thermometer into the polystyrene cup and records in Table 3.1 the temperature of the aqueous copper sulfate to the nearest 0.5 °C
- adds magnesium powder to the aqueous copper sulfate in the cup
- stirs the mixture and records in Table 3.1 the highest temperature reached to the nearest 0.5 °C.

The student repeats the procedure using the concentrations of aqueous copper sulfate shown in Table 3.1.

**Table 3.1**

| concentration of aqueous copper sulfate / M | initial temperature of aqueous copper sulfate / °C | highest temperature of the mixture / °C | temperature increase $\Delta T$ / °C |
|---|---|---|---|
| 1.00 | 21.5 | 85.5 | 64.0 |
| 0.75 | 22.0 | | |
| 0.50 | 22.5 | 54.0 | 31.5 |
| 0.25 | 21.0 | | |
| 0.00 | 21.5 | 21.5 | 0.0 |

Fig. 3.2 shows the thermometer readings for the highest temperatures for 0.75 M aqueous copper sulfate and 0.25 M aqueous copper sulfate.




0.75 M aqueous copper sulfate  0.25 M aqueous copper sulfate

**Fig. 3.2**

Record in Table 3.1 these temperatures to the nearest 0.5 °C. [2]

**(b)** The student observes that the mixture left at the end of the reaction is a colourless solution with pieces of grey solid and pink solid.

**(i)** Explain how this observation shows that the magnesium powder is in excess.

.....

..... [1]

**(ii)** Suggest the identity of the pink solid.

..... [1]

**(c)** **(i)** Explain why the polystyrene cup is placed in the beaker.

.....

..... [1]

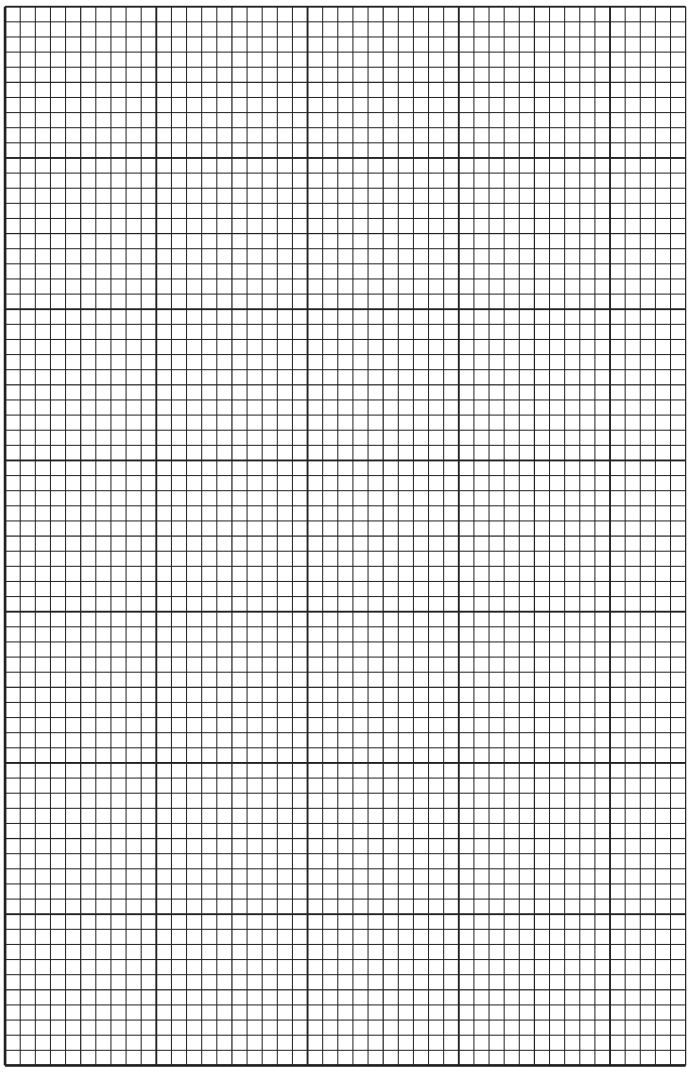
**(ii)** State the name of a piece of apparatus suitable for measuring the 25 $cm^3$ of aqueous copper sulfate more accurately than the measuring cylinder.

..... [1]

**(d) (i)** Calculate the temperature increase $\Delta T$ for 0.75 M aqueous copper sulfate and 0.25 M aqueous copper sulfate.

Record these values in Table 3.1. [1]

**(ii)** On the grid, plot a graph of temperature increase $\Delta T$ (vertical axis) against concentration of aqueous copper sulfate.



[3]

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

**(iv)** A teacher says that the temperature increase is proportional to the concentration of aqueous copper sulfate.

Suggest if this is supported by the student's data.

Explain your answer.

.....

..... [1]

**(v)** Use your graph to estimate the temperature increase $\Delta T$ when 0.35 M aqueous copper sulfate is used in the procedure.

$\Delta T$ = ..... °C [1]

**(e)** Suggest **one** improvement to the procedure which will give more confidence in the values of $\Delta T$.

Do **not** include repeating the procedure.

Explain your answer.

improvement .....

.....

explanation .....

.....

[1]

[Total: 14]

**4** A student identifies a solution labelled **H**.

**(a)** The student puts solution **H** into five test-tubes and does the tests in Table 4.1.

The student identifies **H** as aqueous potassium chloride.

Complete Table 4.1 with the student's observations.

**Table 4.1**

| test | observation |
|---|---|
| add dilute nitric acid followed by a few drops of aqueous silver nitrate | |
| add dilute nitric acid followed by aqueous barium nitrate | |
| flame test | |
| add aqueous ammonia | |
| add aqueous sodium hydroxide | |

[5]

**(b)** Explain why a flame test uses a blue Bunsen burner flame instead of a yellow one.

.....

..... [1]

[Total: 6]

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**5** A student investigates how the resistance $R$ of a lamp changes as the current $I$ flowing through the lamp changes.

The student assembles the circuit shown in Fig. 5.1.

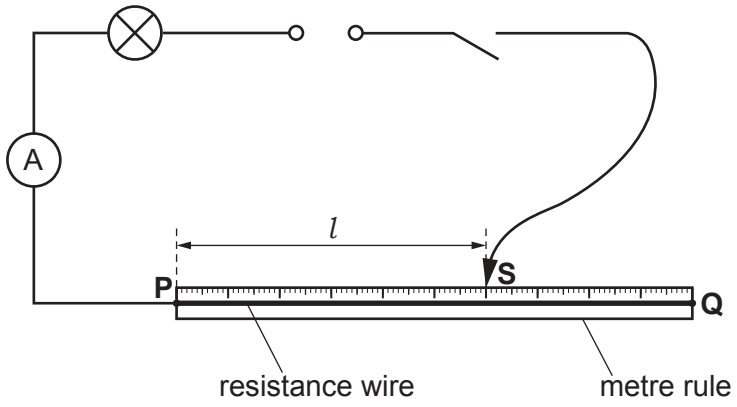


**Fig. 5.1**

**(a) Procedure**

The student:

- connects a voltmeter to measure the potential difference across the lamp
- closes the switch
- places the sliding contact **S** on the resistance wire at a distance $l$ = 20.0 cm from end **P**
- records in Table 5.1 the current $I$ in the lamp and the potential difference $V$ across the lamp
- opens the switch.

**(i)** Using the correct circuit symbol, add a voltmeter to Fig. 5.1 to measure the potential difference across the lamp. [2]

**(ii)** The ammeter and voltmeter readings are shown in Fig. 5.2.

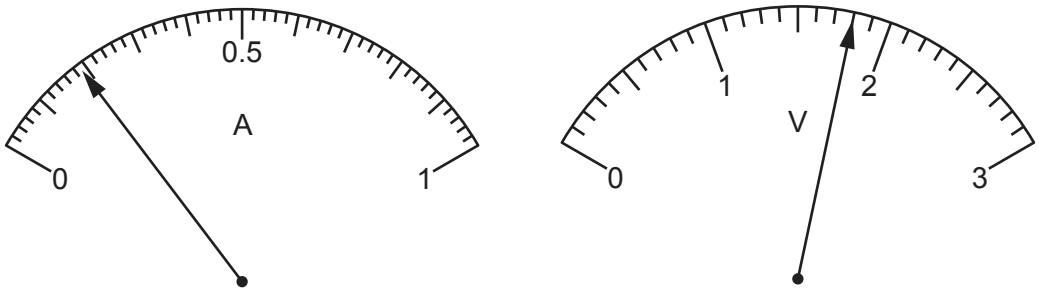


**Fig. 5.2**

Record in Table 5.1 the current $I$ in the lamp and the potential difference $V$ across the lamp.

**Table 5.1**

| length of resistance wire $l$ / cm | current $I$ / A | potential difference $V$ / V | resistance $R$ / Ω |
|---|---|---|---|
| 20.0 | | | 9.5 |
| 40.0 | 0.17 | 1.4 | 2.8 |
| 60.0 | 0.15 | 1.2 | |
| 80.0 | 0.13 | 1.0 | 7.7 |

[2]

**(b)** The student repeats the procedure in **(a)** for values of $l$ = 40.0 cm, 60.0 cm and 80.0 cm.

Suggest why the student opens the switch after taking each pair of readings of the current $I$ and the potential difference $V$.

.....

..... [1]

**(c)** **(i)** Calculate the resistance $R$ of the lamp when $l$ = 60.0 cm.

Use the equation shown.

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

Record your value of $R$ in Table 5.1. [1]

**(ii)** One of the values of resistance $R$ in Table 5.1 is incorrect.

State which value of $R$ is incorrect.

Suggest the error the student makes to get this value.

value .....

error .....

.....

[2]

**(d)** **(i)** Describe how the resistance $R$ of the lamp changes as the length $l$ of resistance wire changes.

..... [1]

**(ii)** Describe how the resistance $R$ of the lamp changes as the current $I$ flowing through the lamp changes.

..... [1]

**(e)** A student suggests that the resistance $R$ of the lamp is proportional to the potential difference $V$ across it.

State if the values of $R$ and $V$ in Table 5.1 support the student's suggestion.

Use values from Table 5.1 to explain your answer.

.....

.....

.....

..... [2]

**(f)** As the length $l$ of the resistance wire increases, the brightness of the lamp decreases.

A student finds that when $l$ is greater than 80.0 cm, the lamp does **not** glow.

Suggest how the student checks that the lamp is **not** broken.

.....

..... [1]

[Total: 13]

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**6** A student investigates the cooling of hot water in a beaker.

Plan an experiment to investigate the relationship between the thickness of the cardboard insulation wrapped around a beaker and the rate of cooling of hot water in the beaker.

You are provided with:

- a supply of hot water
- a beaker
- a measuring cylinder
- thin sheets of cardboard.

You may use any other common laboratory apparatus.

In your plan include:

- any other apparatus needed
- a brief description of the method, including what you will measure and how you will make sure your measurements are accurate
- the variables you will control
- a results table to record your measurements (you are **not** required to enter any readings in the table)
- how you will process your results to draw a conclusion.

You may include a labelled diagram if you wish.

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..... [7]

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