Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

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.

DC (WW) 342192

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.

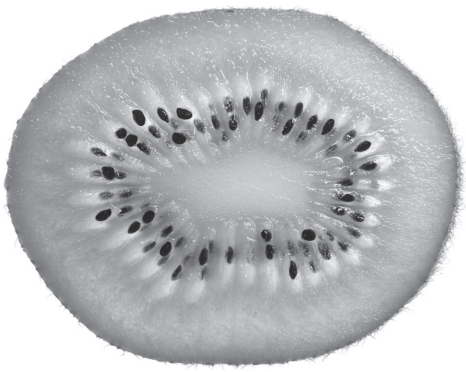

Fig. 1.2

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]

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.

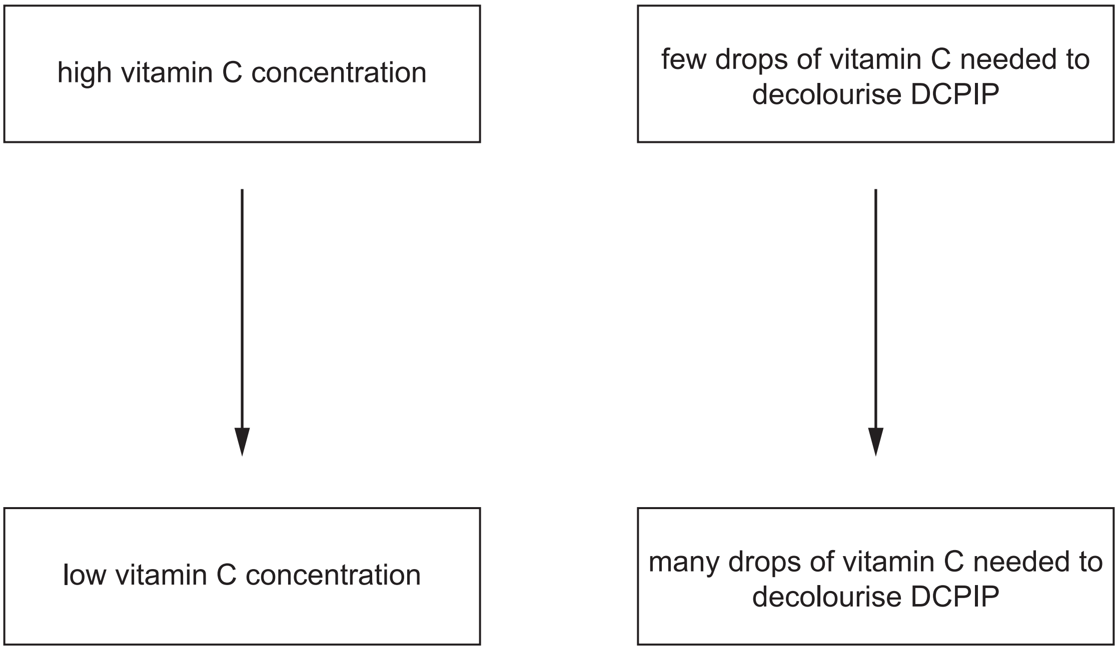

Fig. 2.1

(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.

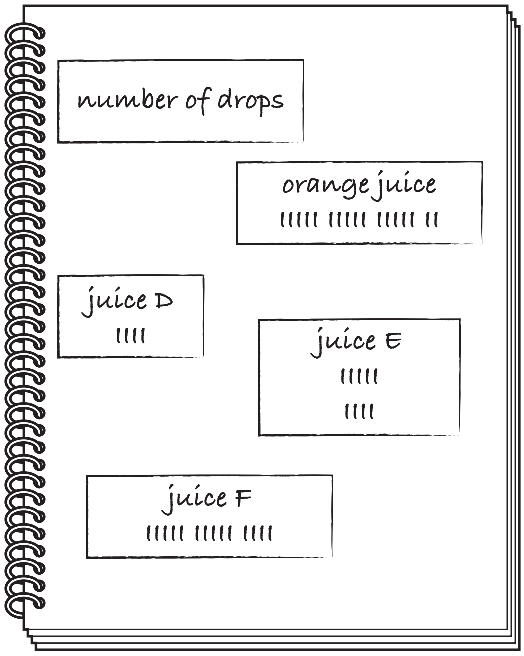

Fig. 2.2

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.

highest vitamin C ....

↓ ....

....

lowest vitamin C ....

[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

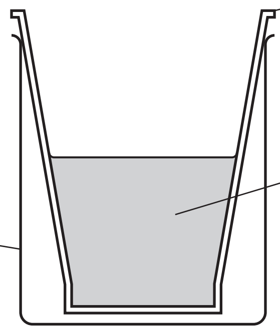

Fig. 3.1

- 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 ΔT / °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.

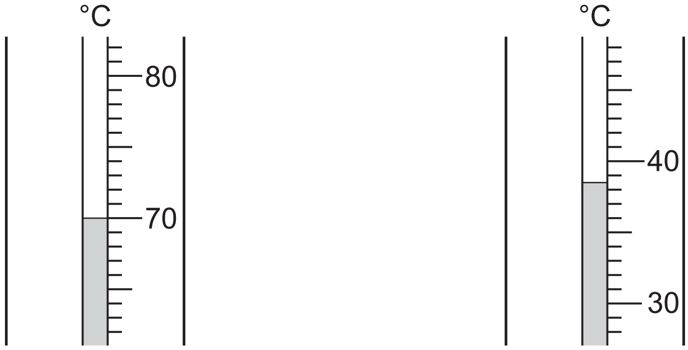

Fig. 3.2

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 ΔT 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 ΔT (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 ΔT when 0.35 M aqueous copper sulfate is used in the procedure.

ΔT = ... °C [1]

(e) Suggest **one** improvement to the procedure which will give more confidence in the values of ΔT.

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.

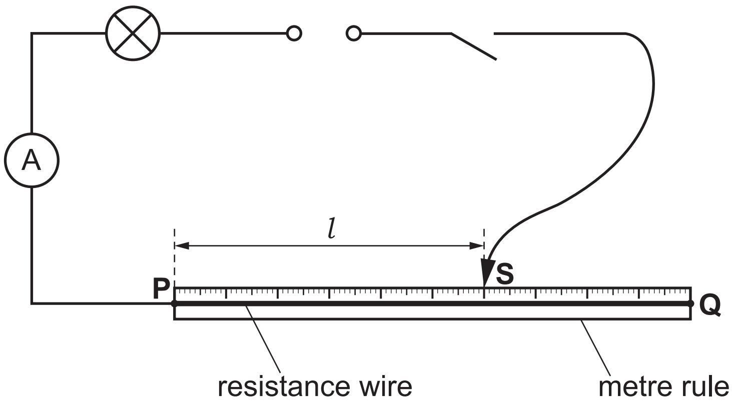

Fig. 5.1

(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.

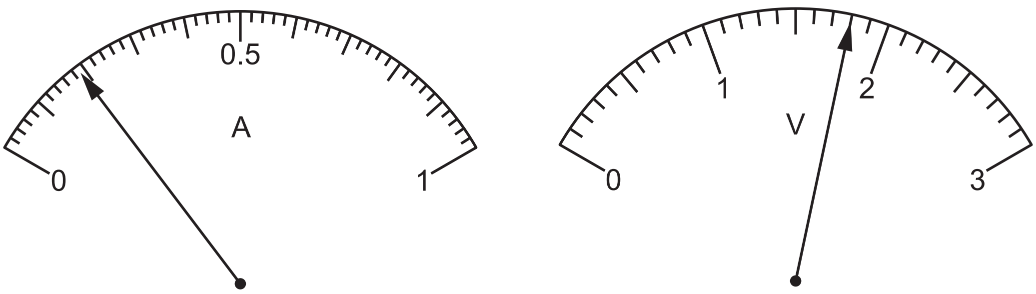

Fig. 5.2

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.

[7]

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