Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

9022109615

CO-ORDINATED SCIENCES **0654/51**

Paper 5 Practical Test **May/June 2024**

2 hours

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

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 [ ].
- Notes for use in qualitative analysis are provided in the question paper.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
Total	

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

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1 You are provided with a slice of a citrus fruit.

(a) In the box, make a large, detailed, pencil drawing of the slice of fruit.

[3]

(b) **(i)** Record the diameter of the slice of fruit in millimetres.

diameter of the slice of fruit = ... mm [1]

(ii) Draw a line to show the diameter of the slice of fruit on your drawing in **(a)**.

Record the length of this line in millimetres.

diameter of the slice of fruit on drawing = ... mm [1]

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

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

$$m = \frac{\text{diameter of the slice of fruit on drawing}}{\text{diameter of the slice of fruit}}$$

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

magnification m = ... [2]

(c) Fig. 1.1 is a photograph of a slice of a kiwi fruit shown actual size.

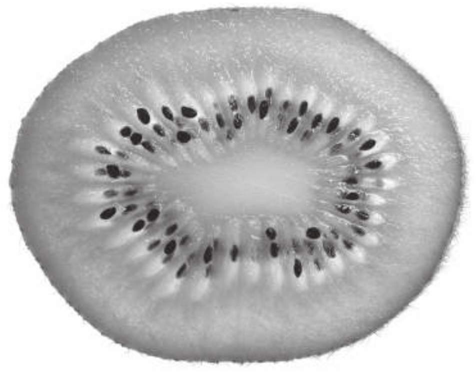


Fig. 1.1

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

difference 1 ....

....

difference 2 ....

....
[2]

[Total: 9]

2 You are going to compare the vitamin C concentration of orange juice with other fruit juices.

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.

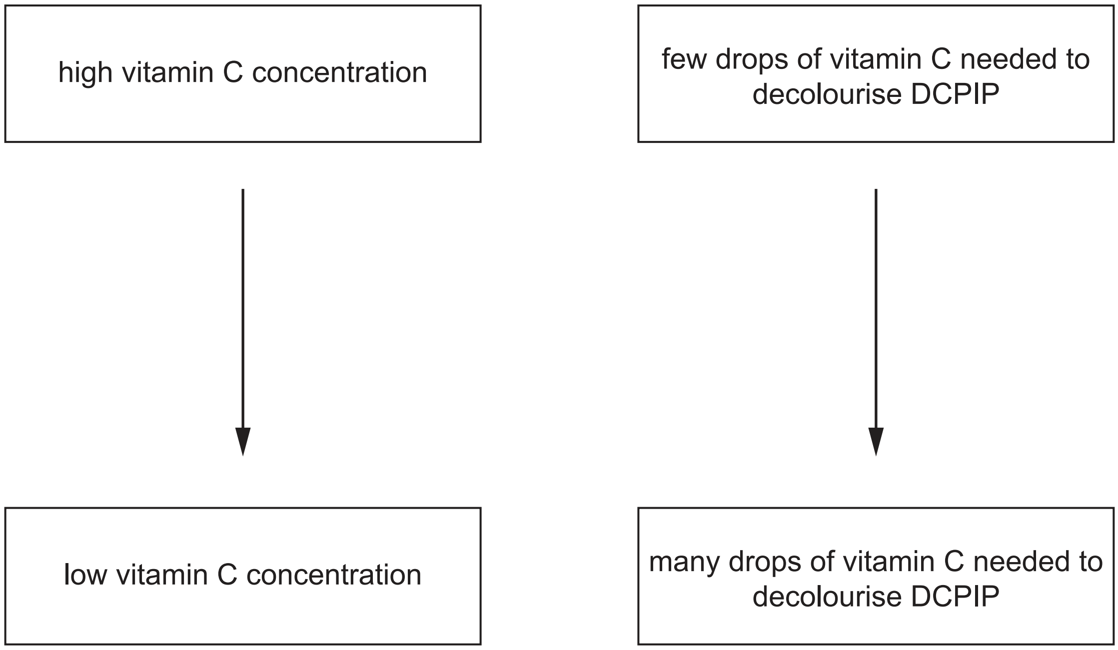


Fig. 2.1

You are provided with samples of orange juice and three other fruit juices, **D**, **E** and **F**.

(a) Read through the procedure in **(b).**

Draw a table to record your results.

[2]

(b) **Procedure**

- Use a dropping pipette to place two drops of DCPIP into a clean well of the white spotting tile.
- Use a clean dropping pipette to add drops of orange juice into the well containing DCPIP.
- Count how many drops are needed to decolourise DCPIP and record the result in your table.

  If the DCPIP does **not** decolourise, stop when the well is full.

  Record the number of drops and add "full" next to the number.

Repeat the procedure with juice **D**, juice **E** and juice **F**, instead of orange juice.

[4]

(c) Use your results table and Fig. 2.1 to place the juices in order of their vitamin C concentration.

highest vitamin C ....

↓ ....

....

lowest vitamin C ....

[2]

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

Explain why this is a source of error and suggest **one** improvement.

explanation ....

....

improvement ....

....

[2]

(e) 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: 11]

3 You are going to investigate 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) (i) Procedure

- Place the polystyrene cup in the empty beaker.
- Use the measuring cylinder to add 25 cm^3 of 1.00 M aqueous copper sulfate to the polystyrene cup as shown in Fig. 3.1.

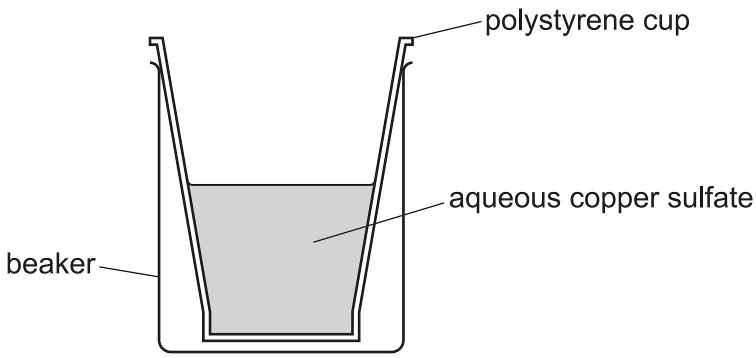


Fig. 3.1

- Record in Table 3.1 the initial temperature of the aqueous copper sulfate in the cup to the nearest 0.5 °C.
- Add one spatula load of magnesium powder to the aqueous copper sulfate in the cup.
- Stir the mixture and record in Table 3.1 the highest temperature reached to the nearest 0.5 °C.
- Place the reaction mixture into the container labelled waste.
- Rinse the cup with water to remove all the reaction mixture. Pour this rinsing water into the waste container.

Repeat 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			
0.75			
0.50			
0.25			
0.00	21.5	21.5	0.0

[4]

(ii) Look at the mixture in the waste container.

State the colour of the solid.

Suggest the identity of this solid.

colour ....

identity ....
[2]

(iii) Explain why the polystyrene cup is placed in the beaker.

....

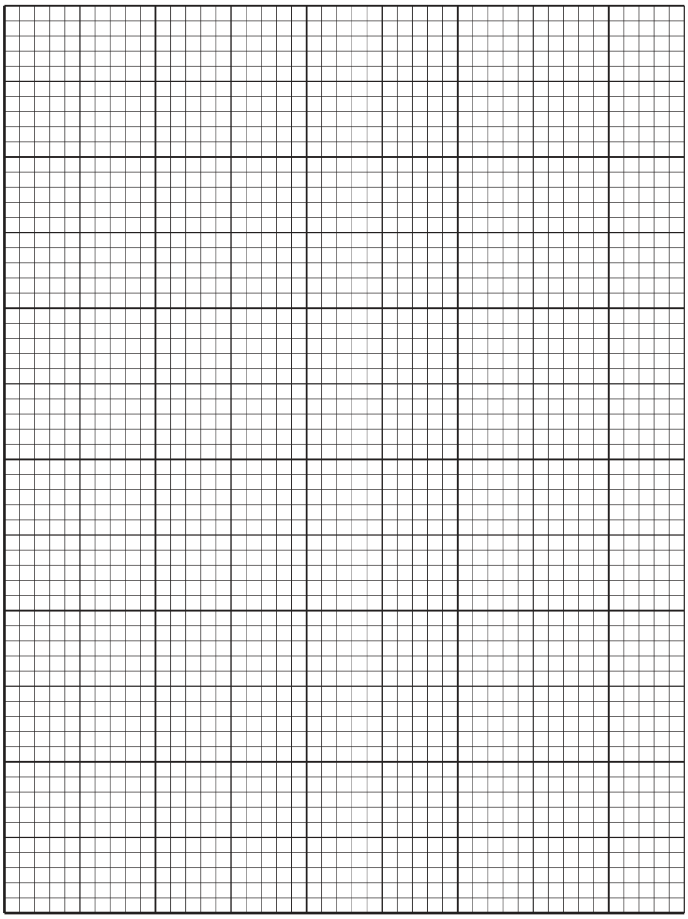
.... [1]

(b) **(i)** Calculate the temperature increase ΔT for each concentration.

The results for 0.00 M aqueous copper sulfate are already in Table 3.1.

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 your 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 this procedure.

ΔT = ... °C [1]

(vi) 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: 15]

4 You are going to identify the ions in solution **H**.

(a) Procedure

- Add approximately 2 cm depth of solution **H** into each of five clean test-tubes.
- Soak a wooden splint in one test-tube and leave for the last test in Table 4.1.
- Do the tests in Table 4.1 on separate test-tubes of solution **H** and record your observations.

Table 4.1

test	observation
add approximately 3 cm depth of aqueous ammonia	
add approximately 3 cm depth of aqueous sodium hydroxide	
add approximately 1 cm depth of dilute nitric acid and approximately 1 cm depth of barium nitrate	
add approximately 1 cm depth of dilute nitric acid and a few drops of aqueous silver nitrate	
place the wooden splint into the top of a blue Bunsen burner flame note the initial colour, if you do not see a colour repeat the test	

[3]

(b) Identify the ions present in solution **H**.

....

.... [2]

[Total: 5]

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5 You are going to investigate how the resistance R of a lamp changes as the current I flowing through the lamp changes.

Fig. 5.1 shows a circuit using a lamp. The circuit is assembled for you.

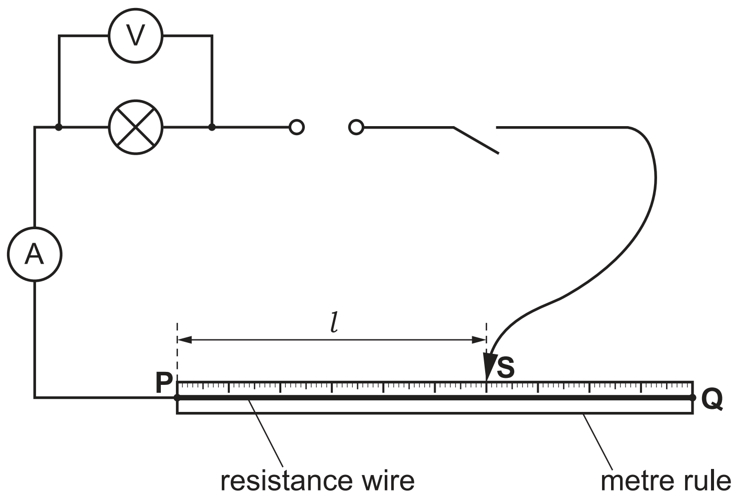

Fig. 5.1

(a) Procedure

- Close the switch.
- Place the sliding contact **S** on the resistance wire at a distance l = 20.0 cm from end **P**.
- Record in Table 5.1 the current I in the lamp and the potential difference V across the lamp.
- Open the switch.

Table 5.1

length of resistance wire l/cm	current I /A	potential difference V /V	resistance R /Ω
20.0			
40.0			
60.0			
80.0			

[2]

(b) Repeat the procedure in **(a)** for values of l = 40.0 cm, 60.0 cm and 80.0 cm. [3]

(c) Suggest why it is important to open the switch after taking each pair of readings of the current I and the potential difference V.

....

.... [1]

(d) Calculate the resistance R of the lamp for each length of wire.

Use the equation shown.

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

Record your values of R in Table 5.1. [2]

(e) **(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]

(f) 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]

(g) A student finds that when the length l of the resistance wire 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]

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.

You are not required to do this investigation.

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]

NOTES FOR USE IN QUALITATIVE ANALYSIS

Tests for anions

anion	*test*	*test result*
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
bromide (Br^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify, then add aqueous barium nitrate	white ppt.

Tests for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
ammonium (NH_4^+)	ammonia produced on warming	–
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt., or very slight white ppt.
copper(II) (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess, giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess, giving a colourless solution	white ppt., soluble in excess, giving a colourless solution

Tests for gases

gas	*test and test result*
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	'pops' with a lighted splint
oxygen (O_2)	relights a glowing splint

Flame tests for metal ions

metal ion	*flame colour*
lithium (Li^+)	red
sodium (Na^+)	yellow
potassium (K^+)	lilac
copper(II) (Cu^{2+})	blue-green