Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CO-ORDINATED SCIENCES **0654/62**

Paper 6 Alternative to Practical **October/November 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 **24** pages. Any blank pages are indicated.

DC (DE/FC) 337877/4

[Turn over

1 Fig. 1.1 shows a photograph of a shark's tooth.

Fig. 1.1

(a) In the box, make a large, detailed, pencil drawing of the tooth in Fig. 1.1.

[3]

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

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

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

(ii) Draw a line on your drawing in **(a)** in the same place as **AB** on Fig. 1.1.

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

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

(iii) Use your measurements in **(b)(i)** and **(b)(ii)** to calculate the magnification *m* of your drawing.

Use 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 = ... [2]

(c) Fig. 1.2 is a photograph of a dog's tooth.

Fig. 1.2

Describe **one** observable similarity and **one** observable difference between the tooth in Fig. 1.1 and the tooth in Fig. 1.2.

similarity .....

.....

difference .....

.....

[2]

[Total: 9]

2 **(a)** Plaque is a layer of bacteria which forms on teeth.

Plaque causes dental decay by producing acid that reduces the pH of the saliva in the mouth.

Some students investigate the changes in the pH of saliva.

The pH of the saliva from the mouth of two students, **C** and **D**, is measured during a day.

(i) Saliva is removed and mixed with water in a test-tube.

Describe how the pH of the saliva in the test-tube is measured.

.....

.....

..... [2]

(ii) Fig. 2.1 shows the results for each student.

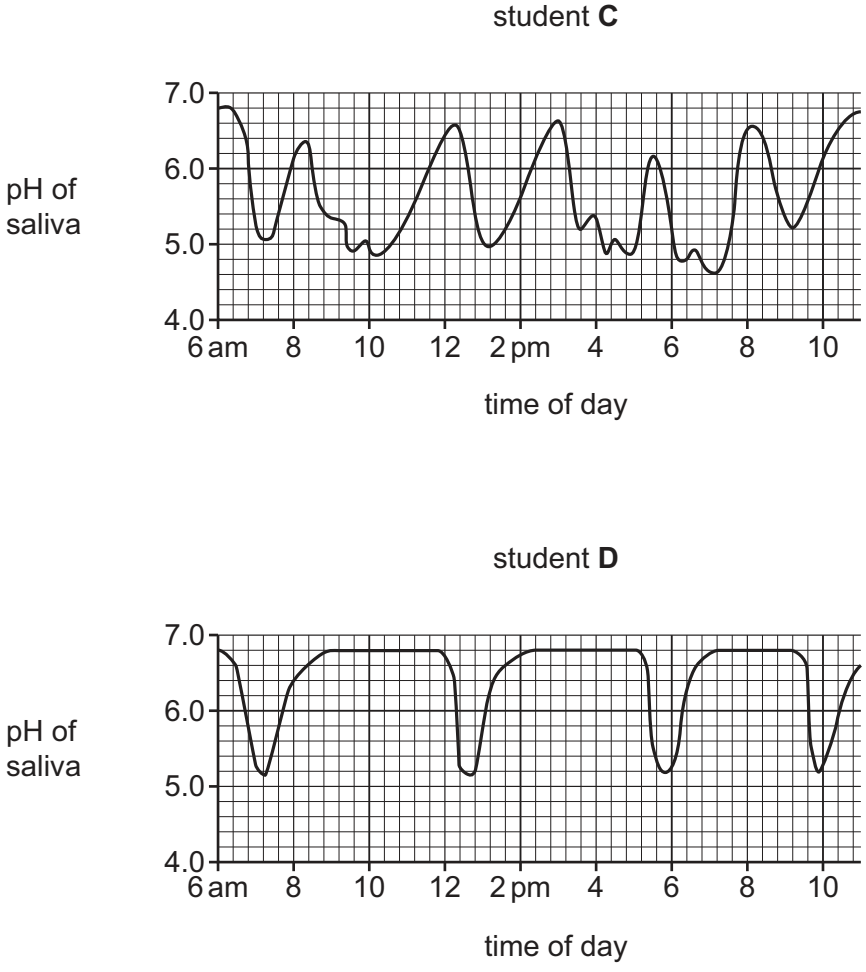

Fig. 2.1

Dental decay starts to occur when the pH of saliva falls below 5.5.

Draw a horizontal line from 6 am to 11 pm on each graph at pH 5.5. [1]

(iii) Use Fig. 2.1 to explain why student **C** is more likely to have dental decay than student **D**.

.....

.....

.....

..... [2]

(b) Suggest **two** reasons why repeating the investigation on different days produces different results.

1 .....

.....

2 .....

.....

[2]

(c) Amylase is an enzyme found in saliva. It breaks down starch into reducing sugar.

Starch solution is added to a sample of saliva.

Describe how to measure the rate of increase in the concentration of reducing sugar in this saliva sample.

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 11]

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3 A student investigates the effect of temperature on the volume of a gas.

(a) Procedure

The student:

- pulls approximately 50 cm^3 of air into a glass syringe
- seals the end of the syringe with a rubber stopper
- puts the syringe into a large beaker of cool water so that the air in the syringe is under the level of the water in the beaker as shown in Fig. 3.1

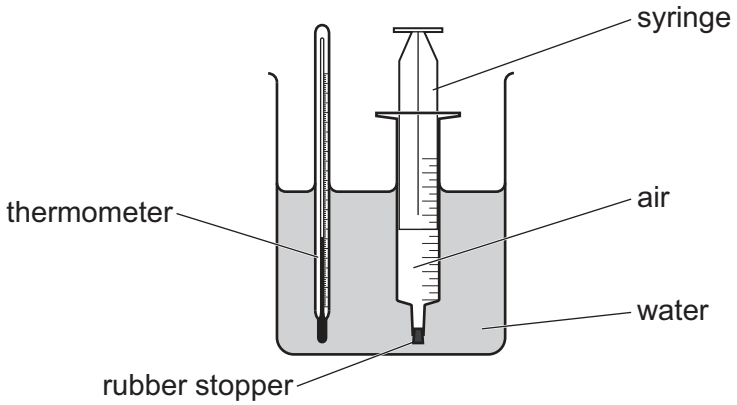

Fig. 3.1

- leaves the syringe for 5 minutes
- stirs the water in the beaker and records its temperature in Table 3.1
- records in Table 3.1 the volume of air in the syringe
- heats the water
- leaves the syringe in the water for 5 minutes
- records in Table 3.1 the temperature of the water and the volume of air in the syringe.

The student continues to raise the temperature of the water and measure the volume of the air.

Table 3.1

temperature of the water / °C	volume of the air in the syringe / cm^3
10.0	50.0
24.5	
37.0	55.0
44.0	56.0
	56.5
65.5	60.0
73.0	
86.0	63.5

Fig. 3.2 shows the thermometer for the missing temperature reading in Table 3.1.

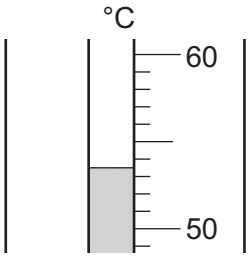

Fig. 3.2

(i) Record this temperature in Table 3.1. [1]

(ii) Explain why the syringe is left in the water for 5 minutes before the volume of air is recorded.

.....

..... [1]

(iii) Suggest why a glass syringe is used in this experiment rather than a plastic syringe.

.....

..... [1]

(iv) Fig. 3.3 shows the readings on the syringe at 24.5 °C and 73.0 °C.

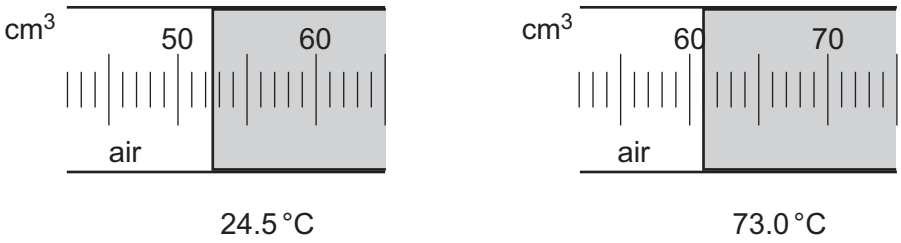

Fig. 3.3

Record these volumes in Table 3.1. [2]

(b) (i) On the grid, plot a graph of volume of air (vertical axis) against temperature.

Do **not** start the graph from the origin (0, 0).

[3]

(ii) Draw a circle around the anomalous point. [1]

(iii) Draw the line of best fit. [1]

(iv) Describe the relationship between the temperature of the water and the volume of the air in the syringe.

.....

..... [1]

(v) Estimate the volume of the air in the syringe at 81 °C.

Show on your graph how you arrived at your answer.

volume = ... cm^3 [1]

(c) Suggest why this method **cannot** be used to find the volume of air at 120 °C.

.....

..... [1]

[Total: 13]

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4 A student investigates the identity of a metal **H**.

Procedure

The student:

step **1** adds metal **H** to a beaker of cold water
step **2** tests to identify the gas given off
step **3** does a flame test on the solution formed
step **4** bubbles carbon dioxide gas into the solution formed in step **1** and uses filtration to separate the white precipitate formed
step **5** adds dilute hydrochloric acid to the precipitate formed in step **4**
step **6** tests to identify the gas given off.

(a) The gas given off in step **1** is hydrogen.

State the test for hydrogen gas. Give the observation for a positive result.

test .....

observation .....
[1]

(b) When the solution formed in step **1** has carbon dioxide bubbled into it, a white precipitate is formed.

Suggest the identity of the solution formed in step **1**.

..... [1]

(c) Describe how the flame test in step **3** is done.

.....

.....

..... [1]

(d) In step **5** the precipitate bubbles when hydrochloric acid is added and a colourless solution is formed.

(i) The gas made is carbon dioxide.

State the test for carbon dioxide. Give the observation for a positive result.

test .....

observation .....
[1]

(ii) State the name of the anion (negative ion) in the precipitate.

..... [1]

(iii) The solution formed in step **5** contains chloride ions.

State the test for chloride ions. Give the observation for a positive result.

test .....

.....

observation .....

.....

[2]

[Total: 7]

5 A student investigates the combined resistance of different combinations of identical resistors.

The student assembles the circuit shown in Fig. 5.1. This is circuit **1**.

circuit **1**

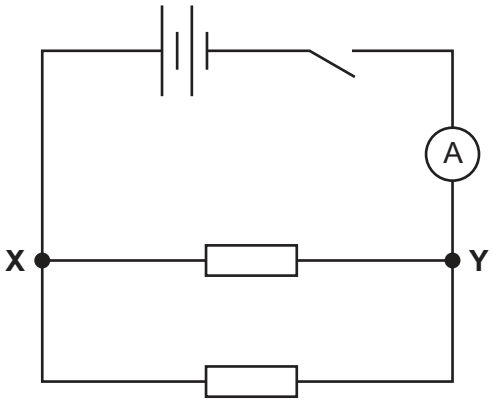


Fig. 5.1

(a) Procedure

The student:

- connects a voltmeter to measure the potential difference V between **X** and **Y**
- closes the switch
- measures the potential difference V
- measures the current I
- disconnects the voltmeter
- opens the switch.

(i) On Fig. 5.1 draw the symbol for a voltmeter connected to measure the potential difference V between **X** and **Y**. [2]

(ii) Fig. 5.2 shows the readings on the voltmeter and ammeter.

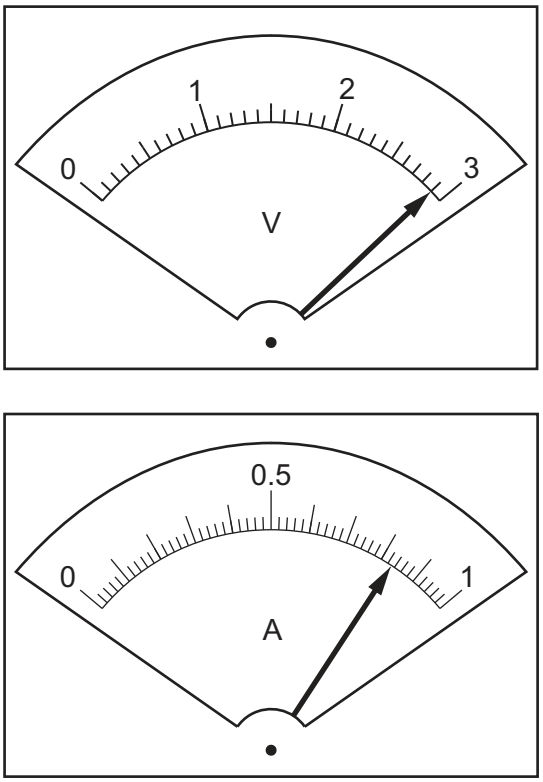


Fig. 5.2

Record the meter readings in Table 5.1. [2]

Table 5.1

circuit	potential difference V /V	current I /A	resistance R /.....
1			
2	2.9	0.42	
3	2.8	0.20	14

(b) (i) Calculate the total resistance R in circuit **1**.

Use the equation shown.

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

Record your value in Table 5.1. [1]

(ii) Add the unit of resistance to the column heading in Table 5.1. [1]

(c) Procedure

The student removes one resistor from circuit **1** as shown in Fig. 5.3.

circuit **2**

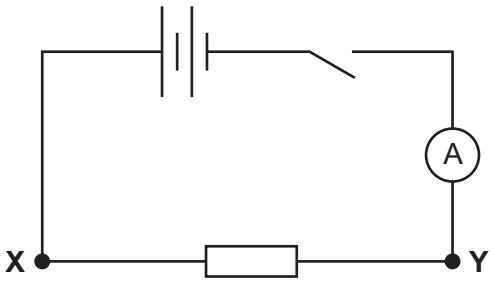


Fig. 5.3

This is circuit **2**.

The student:

- reconnects the voltmeter between **X** and **Y**
- closes the switch
- measures the potential difference V
- measures the current I
- disconnects the voltmeter
- opens the switch.

The student's results are shown in Table 5.1.

(i) Explain why the student opens the switch each time after taking readings of potential difference and current.

.....

..... [1]

(ii) Calculate the total resistance R in circuit **2**.

Use the equation shown.

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

Record your value in Table 5.1. [1]

(d) Procedure

The student adds a resistor to circuit **2** as shown in Fig. 5.4.

circuit **3**

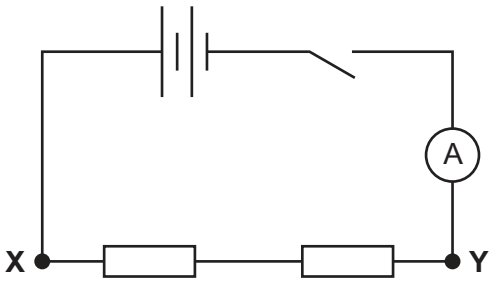


Fig. 5.4

This is circuit **3**.

The student:

- reconnects the voltmeter between **X** and **Y**
- closes the switch
- measures the potential difference V
- measures the current I
- disconnects the voltmeter
- opens the switch.

The student's results are shown in Table 5.1.

As the resistance between **X** and **Y** is changed, the current in the circuit changes.

Use the results in Table 5.1 to state how the change in current affects:

(i) the potential difference between **X** and **Y**

.....

..... [1]

(ii) the resistance of the circuit.

.....

..... [1]

(e) Circuit **1** and circuit **3** show two different methods of connecting two resistors.

State how the resistors are connected in:

circuit **1** .....

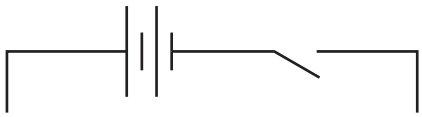
circuit **3** .....

[1]

(f) The student extends the investigation and constructs another circuit using a third identical resistor.

Complete the circuit diagram to show **one** possible way of connecting the three resistors to the battery.

Include an ammeter to measure the current supplied by the battery and a voltmeter to measure the potential difference across the combination of three resistors.



[2]

[Total: 13]

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6 A student investigates the oscillations (swings) of a pendulum.

A pendulum consists of a bob supported by thin thread or string.

The period T of a pendulum is the time taken for one oscillation of the pendulum.

Plan an experiment to investigate the relationship between the length l of a pendulum and its period T.

The pendulum is assembled as shown in Fig. 6.1.

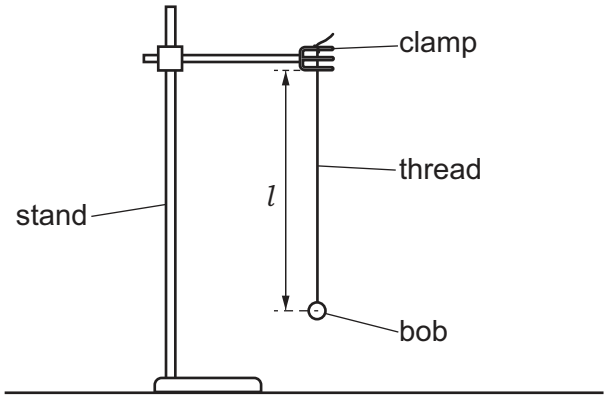

Fig. 6.1

You may use any other common laboratory apparatus.

In your plan include:

- any **other** apparatus needed
- a brief description of the method **after** the apparatus in Fig. 6.1 is assembled. Include 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.

[7]

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