Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME		
CENTRE NUMBER		CANDIDATE NUMBER

6225543622

CO-ORDINATED SCIENCES **0654/52**

Paper 5 Practical Test **October/November 2023**

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 **20** pages. Any blank pages are indicated.

DC (AP) 332535

1 You are going to test milk and rice for their nutrient content.

In order to test the rice, water has been added and it is in a beaker labelled 'rice water'.

(a) **(i)** Read through the procedure in **(a)(ii)**.

Draw a table to record the results.

[2]

(ii) **Procedure**

Step **1** Pour approximately 1 cm depth of milk into a clean test-tube.

Step **2** Add a similar depth of biuret solution to the test-tube.

Step **3** Put a few drops of milk into a clean well in the spotting tile.

Step **4** Add a few drops of iodine solution to the milk in the spotting tile.

Step **5** Stir the rice and water mixture and leave to settle. The liquid above the rice is the rice water and needs to be carefully poured out so no residue goes into the test tube in step **1**.

Step **6** Repeat steps **1–4** with the rice water instead of the milk.

Record the final colours observed in your results table in **(a)(i)**.

[4]

(iii) Use your results table in **(a)(i)** to state the nutrients that the milk and rice water contain.

milk contains

....

rice water contains

....

[2]

(b) **(i)** Suggest why it is important to soak the rice in water before testing for the nutrients.

....

....

.... [1]

(ii) Suggest why iodine solution is used to determine the presence of the nutrient but **not** the concentration of the nutrient in the investigation.

....

....

.... [1]

[Total: 10]

2 Fig. 2.1 shows a photomicrograph of a single celled organism called Euglena.

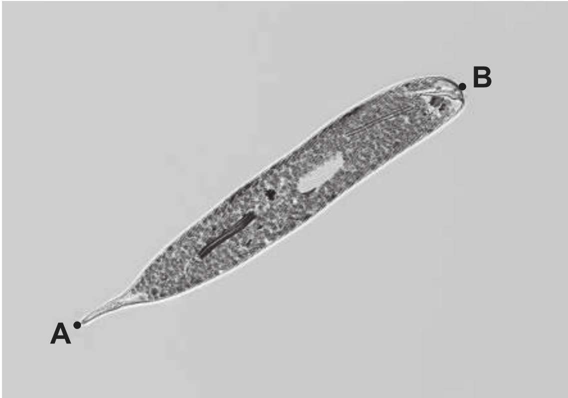
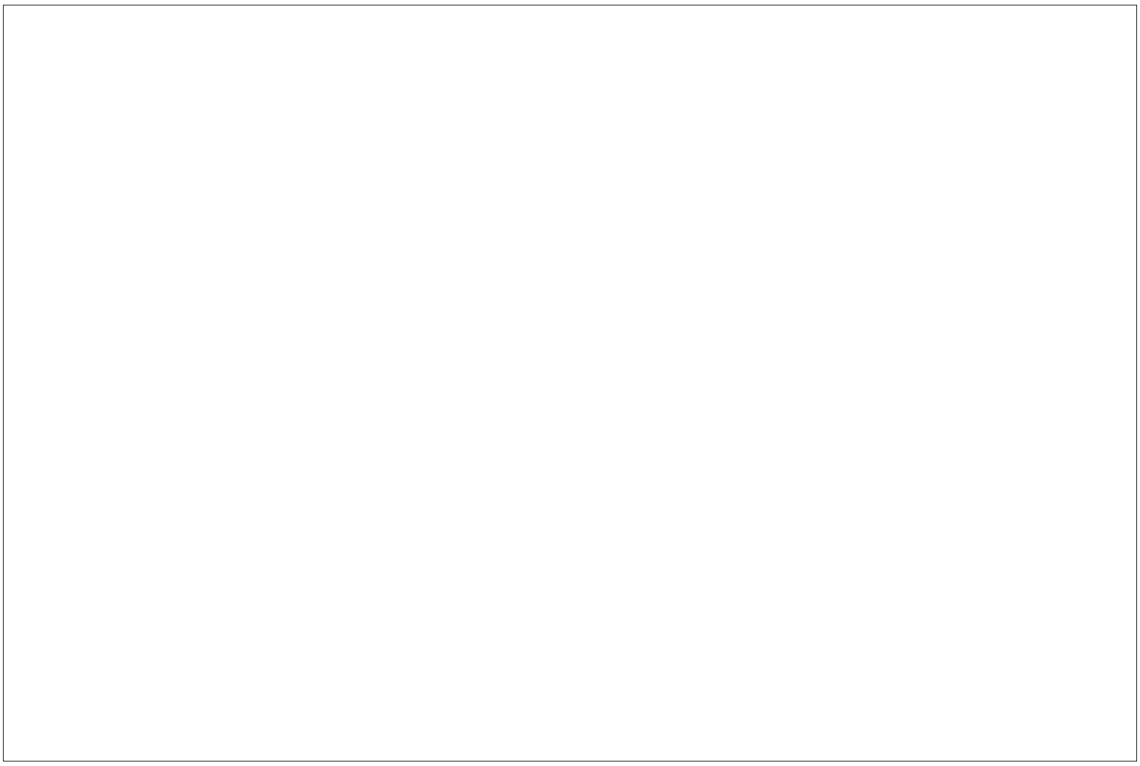


Fig. 2.1

(a) In the box below, make a large detailed pencil drawing of the Euglena cell in Fig. 2.1.



[3]

(b) **(i)** Measure the length **AB** of the Euglena cell in Fig. 2.1 in millimetres to the nearest millimetre.

length of Euglena cell in Fig. 2.1 = ... mm [1]

(ii) Draw a line to show this length on your drawing in **(a)**.

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

length of Euglena cell 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.

$$m = \frac{\text{length of Euglena cell on your drawing}}{\text{length of Euglena cell in Fig. 2.1}}$$

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

magnification = ... [2]

(c) Fig. 2.2 shows a photomicrograph of a single celled organism called Chlamydomonas.

Fig. 2.1 and Fig. 2.2 are shown at the same magnification.

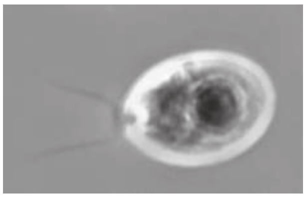


Fig. 2.2

Describe **two** visible differences and **one** visible similarity between the Euglena cell and the Chlamydomonas cell.

difference 1

....

....

....

difference 2

....

....

....

similarity

....

....

....

[3]

[Total: 10]

3 You are going to investigate the effect of light on three silver salts.

(a) Procedure

- Put approximately 1 cm depth of aqueous potassium chloride into a clean test-tube.
- Add approximately 1 cm depth of aqueous silver nitrate to the test-tube.
- Record your immediate observations in Table 3.1.
- Keep the test-tube and its contents for part **(b)**.

Repeat the procedure using aqueous potassium bromide and then aqueous potassium iodide instead of aqueous potassium chloride.

Table 3.1

substance	observations	
	immediately after adding aqueous silver nitrate	at least 10 minutes after adding aqueous silver nitrate
aqueous potassium chloride		
aqueous potassium bromide		
aqueous potassium iodide		

[3]

(b) Leave the test-tubes in the light for at least 10 minutes.

Complete Question **4** whilst you are waiting.

After at least 10 minutes, record in Table 3.1 the appearance of each test-tube. [1]

(c) The contents of the test-tubes may be separated by filtration.

Draw a labelled diagram of the assembled apparatus used in this filtration.

Label the residue and the filtrate.

Do **not** do this separation.

[2]

[Total: 6]

4 You are going to investigate the neutralisation of dilute hydrochloric acid with aqueous sodium hydroxide. This happens when just enough acid is added to neutralise an alkali.

The neutralisation reaction between dilute hydrochloric acid and aqueous sodium hydroxide is exothermic. Thermal (heat) energy is given out and the temperature of the mixture increases.

When the reaction is finished, no more thermal energy is given out.

(a) Procedure

- Put the polystyrene cup into the glass beaker.
- Using a measuring cylinder, measure 25 cm^3 of aqueous sodium hydroxide and keep for later.
- Using a clean measuring cylinder, add 25 cm^3 of dilute hydrochloric acid into the polystyrene cup.
- Measure the initial temperature of the dilute hydrochloric acid and immediately start the stop-watch, do not stop the stop-watch until the whole experiment has been completed.
- Record in Table 4.1 the temperature to the nearest 0.5 °C.
- Record the temperature of the dilute hydrochloric acid every 0.5 minutes for 1.5 minutes.
- At time t = 2.0 minutes, do **not** take the temperature but add the 25 cm^3 of aqueous sodium hydroxide to the polystyrene cup.
- Stir the mixture continuously and record in Table 4.1 the temperature of the mixture every 0.5 minutes for a further 5.0 minutes.

Table 4.1

time t / min	temperature / °C
0.0	
0.5	
1.0	
1.5	
2.0	
2.5	
3.0	
3.5	
4.0	
4.5	
5.0	
5.5	
6.0	
6.5	
7.0	

[4]

(b) (i) On the grid, plot temperature on the vertical axis against time on the horizontal axis.

Do **not** start the temperature axis at 0 °C.

The highest temperature on the vertical axis needs to be at least 5 °C above the highest temperature recorded in Table 4.1.

[3]

(ii) Draw the best-fit straight line through the temperatures for times t = 0 to t = 1.5 minutes. Extend this line as far as t = 2.0 minutes.

Draw the best-fit straight line through the temperatures for times t = 2.5 minutes to t = 7.0 minutes. Extend this line back to t = 2.0 minutes.

[2]

(iii) Draw a vertical line at t = 2.0 minutes.

Record the **two** temperatures where this vertical line crosses the two lines of best fit you have drawn.

highest temperature T_H = ... °C

lowest temperature T_L = ... °C

(If you have not drawn a graph, use the highest and lowest temperatures from Table 4.1. These values may **not** be the correct values.)

[2]

(iv) Measure the change in temperature ΔT for the reaction.

Use the equation shown.

$$\Delta T = T_H - T_L$$

ΔT = ... °C [1]

(c) Calculate the thermal energy Q given out during the reaction.

Use the equation shown.

$$Q = 210 \times \Delta T$$

Q = ... J [1]

(d) Thermal energy is lost to the air during the experiment.

Suggest **one** change to the apparatus that reduces the amount of thermal energy lost.

....

.... [1]

[Total: 14]

Remember to go back and complete Question **3**.

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5 You are going to investigate the resistance of different lamp combinations.

The circuit shown in Fig. 5.1 has been set up for you. This is circuit **1**.

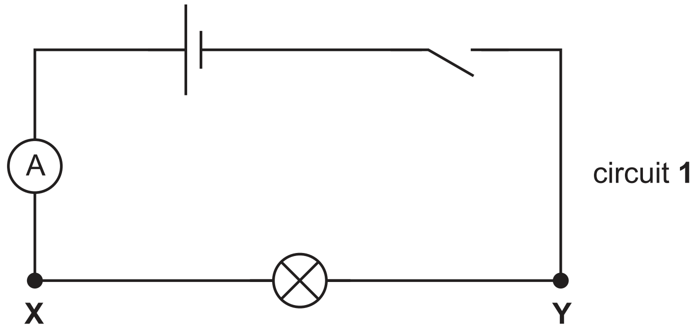

Fig. 5.1

(a) On Fig. 5.1, draw the symbol for a voltmeter connected to measure the potential difference between point **X** and point **Y**. [1]

(b) **Procedure**

- Connect the voltmeter into circuit **1** to measure the potential difference between **X** and **Y**.
- Close the switch.

Record in Table 5.1, the potential difference V and the current I.

The brightness of the lamp has been recorded for you.

- Open the switch.

Table 5.1

circuit	V/V	I/A	R/Ω	brightness of lamp(s)
1				bright
2				
3				

[2]

(c) Procedure

- Leave the voltmeter connected between **X** and **Y**.
- Connect a second lamp between **X** and **Y** as shown in Fig. 5.2. This is circuit **2**.
- Close the switch.

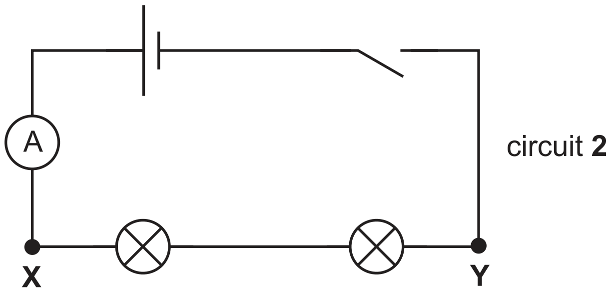

Fig. 5.2

Record in Table 5.1 the potential difference V, the current I and also if the lamps are bright or dim.

[2]

(d) Procedure

- Leave the voltmeter connected between **X** and **Y**.
- Reconnect the two lamps in parallel as shown in Fig. 5.3. This is circuit **3**.
- Close the switch.

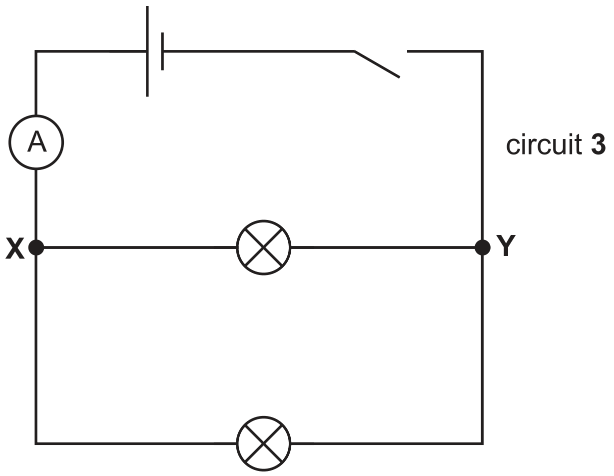

Fig. 5.3

Record in Table 5.1, the potential difference V, the current I and also if the lamps are bright or dim.

[2]

(e) Calculate the total resistance R measured between points **X** and **Y** for circuits **1**, **2** and **3**.

Use the equation shown.

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

Record your answers in Table 5.1. [1]

(f) **(i)** State what you would observe if one of the lamps in circuit **2** breaks while you are taking the measurements of *V* and *I*.

.... [1]

(ii) Describe how you can use this apparatus to find out which lamp has broken.

....

.... [1]

(g) State in which circuit the total power of the lamps is greatest.

Use your results in Table 5.1 to explain your answer.

circuit ....

explanation ....

....
[1]

(h) Two values are considered to be equal within the limits of experimental accuracy if they are within 10% of each other.

The teacher makes the following statement.

'If each lamp has the same resistance, the total resistance between points **X** and **Y** in circuit **1** should be half the total resistance between **X** and **Y** in circuit **2**.'

State if your results support the teacher's statement, within the limits of experimental accuracy.

Justify your statement by using the values of *R* you have calculated in Table 5.1.

statement ....

explanation ....

....

....
[2]

[Total: 13]

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6 Plan an experiment to investigate whether the material a wire is made from, affects the mass required to break the wire.

One end of the wire is securely held by a clamp and masses can be attached to the other end, as shown in Fig. 6.1. Masses are added until the wire breaks.

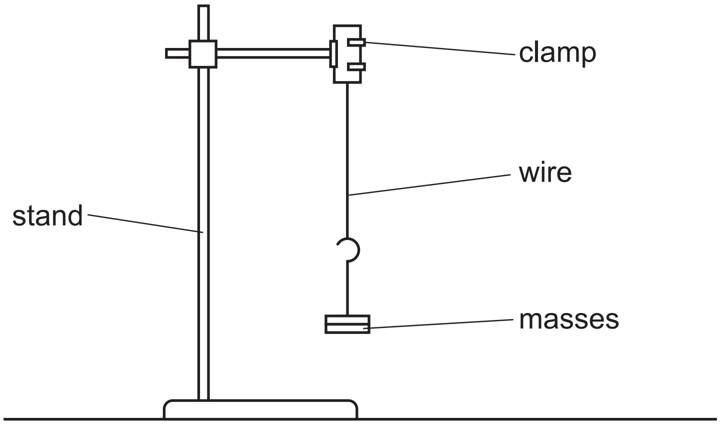

Fig. 6.1

You are provided with:

- wires of different lengths and diameters, made from different metals
- a set of masses, together with a hanger
- boss, stand and clamp.

You may use any other common laboratory apparatus.

You are not required to do this investigation.

In your plan include:

- a brief description of the method, including what you will measure and how you will make sure your measurements are accurate
- any safety precautions you will take
- 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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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