Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

3346040549

CO-ORDINATED SCIENCES **0654/63**

Paper 6 Alternative to Practical **October/November 2020**

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 **16** pages. Blank pages are indicated.

DC (NF/FC) 194603/3

1 A student uses a potato cylinder cut into slices to investigate the action of the enzyme catalase.

Catalase is an enzyme found in living cells such as potato cells. It speeds up the breakdown of hydrogen peroxide into water and oxygen. The oxygen is released as oxygen bubbles.

The student cuts a 5 mm thick slice from one end of a cylinder of potato and places it at the bottom of a beaker containing hydrogen peroxide solution.

The slice of potato begins to rise to the surface as it gets covered with bubbles as shown in Fig. 1.1.

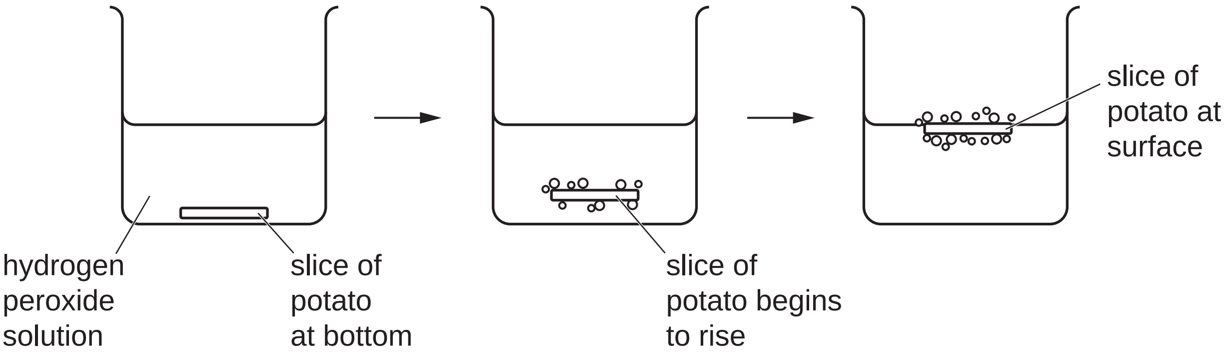


Fig. 1.1

The student records the time, to the nearest second, for the slice to rise to the surface of the hydrogen peroxide solution.

The student repeats the procedure with the same beaker of hydrogen peroxide solution using potato slices of thickness 4 mm, 3 mm, 2 mm and 1 mm.

(a) Some of her results are shown in Table 1.1.

Fig. 1.2 shows the stop-watch reading for the 1 mm slice of potato.

Record this time in Table 1.1.

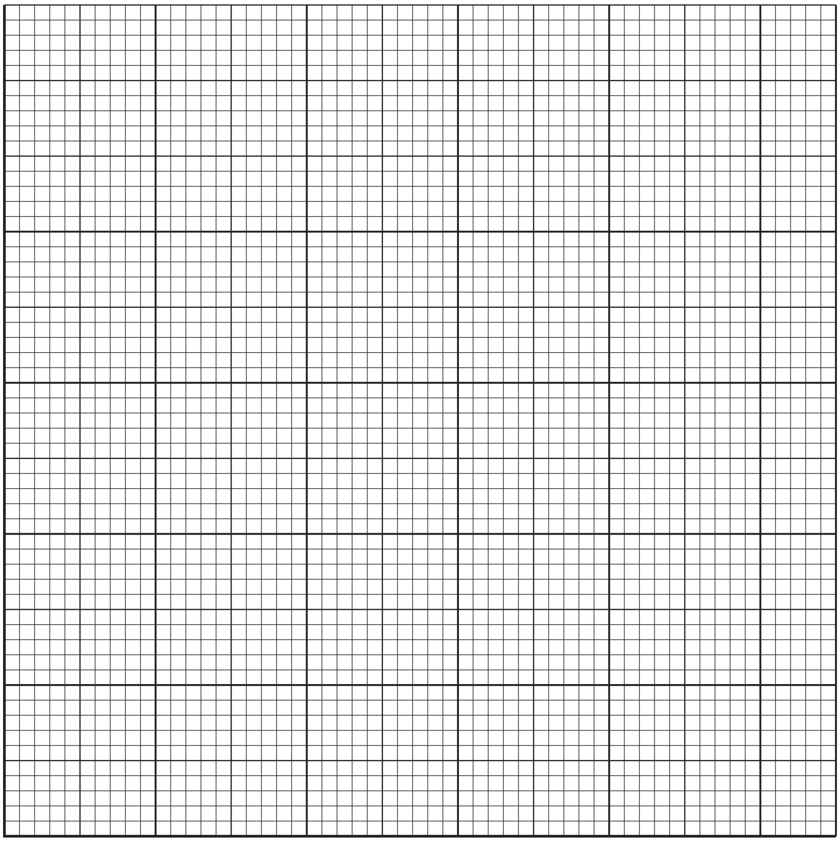
Fig. 1.2

Table 1.1

size of potato slice / mm	time / s
5	92
4	84
3	71
2	52
1	

[1]

(b) **(i)** On the grid provided, plot a graph of time (vertical axis) against size of potato slice. [3]



(ii) Draw the best-fit curve. [1]

(c) Use your graph to estimate the time that a 3.5 mm slice of potato would take to rise to the surface.

Indicate on your graph how you arrived at your answer.

time .... s [2]

(d) **(i)** Identify **one** source of inaccuracy in the student's procedure.

....

.... [1]

(ii) Identify **two** variables that need to be controlled in this investigation.

1. ....

....

2. ....

....
[2]

(e) Describe how you could confirm that the gas produced is oxygen. Include the observation for a positive result.

test ....

observation ....
[2]

[Total: 12]

2 A student tests some potato for its nutrient content using iodine solution and biuret solution.

(a) **(i)** The potato tests positive with the iodine solution and negative with the biuret solution.

State the colours the student observes.

colour observed with iodine solution ....

colour observed with biuret solution .... [2]

(ii) State the nutrient that these two solutions test for.

iodine solution tests for ....

biuret solution tests for .... [2]

(b) A student wants to test some potato using Benedict's solution.

(i) Name the nutrient that Benedict's solution tests for.

.... [1]

(ii) State the colour the student observes if the potato contains:

a small amount of this nutrient

....

a large amount of this nutrient.

.... [2]

(c) State which of the test solutions in **(a)** and **(b)** requires the use of heat.

.... [1]

[Total: 8]

3 A student is provided with solid **J**, which is a mixture of **two** compounds.

One compound is soluble in water and the other is insoluble in water.

The student does a series of experiments to identify some of the ions in **J**.

The student:

- places some of solid **J** into a beaker
- adds some distilled water to **J** and stirs
- filters the mixture.

(a) Suggest why the mixture is stirred.

....

.... [1]

(b) The student places a small sample of the residue from the filter paper into a test-tube.

(i) The student adds some dilute nitric acid into this test-tube.

The mixture fizzes and produces a colourless solution.

The gas given off is carbon dioxide.

State the test used to identify carbon dioxide and give the observation for a positive result.

test ....

observation ....

....
[1]

(ii) As soon as the mixture in **(b)(i)** stops fizzing, the student adds aqueous sodium hydroxide until it is in excess.

The student observes a white precipitate that is soluble in excess.

Circle the cation shown to be present in the residue.

copper ion **iron(II) ion** **iron(III) ion** **zinc ion**

[1]

(c) The student adds some of the liquid filtrate to a test-tube.

The student adds some dilute nitric acid and aqueous silver nitrate to the filtrate.

No precipitate is observed.

Name **one** anion that **cannot** be present in the filtrate.

.... [1]

(d) The student adds some of the liquid filtrate to a clean test-tube.

The student adds some dilute nitric acid and aqueous barium nitrate to the filtrate.

The student observes a white precipitate.

State if the results in **(b)** and **(d)** support the conclusion that **J** contains both carbonate and sulfate ions.

Justify your answer using information from these results.

J contains carbonate ions yes / no

justification ....

....

J contains sulfate ions yes / no

justification ....

....
[2]

[Total: 6]

4 A student is provided with solid sodium hydrogencarbonate labelled **K**.

When heated, solid **K** decomposes to give off carbon dioxide and steam.

The student does an experiment to find the total mass of carbon dioxide and steam given off by solid **K** as it decomposes on heating.

(a) The student:

- records in Table 4.1 the mass of an empty hard-glass test-tube
- places **K** into the hard-glass test-tube
- records in Table 4.1 the mass of the hard-glass test-tube and **K**.

Table 4.1

	mass / g
mass of hard-glass test-tube and **K**	23.2
mass of empty hard-glass test-tube	22.18
mass of **K**	

(i) State how Table 4.1 shows that the student has been inconsistent in recording the readings on the balance.

....

.... [1]

(ii) Calculate the mass of **K** and record your answer in Table 4.1. [1]

(b) The student:

- holds the hard-glass test-tube with a test-tube holder
- holds the test-tube into the top of a blue Bunsen burner flame with the test-tube tilted slightly downwards as shown in Fig. 4.1
- heats the sample of **K** for five minutes.

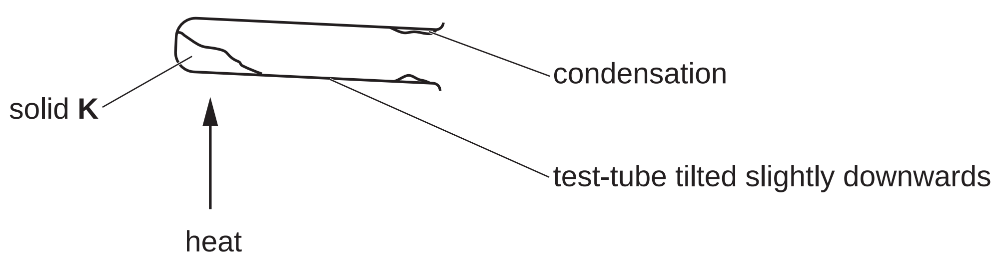


Fig. 4.1

If the test-tube is tilted upwards the condensation will run back into the hot test-tube.

Explain why having the test-tube tilted upwards is a safety hazard.

....

.... [1]

(c) The student:

- lets the hard-glass test-tube cool down
- finds that the mass of the hard-glass test-tube and its contents is 22.67 g
- heats the hard-glass test-tube and its contents for another five minutes
- lets the hard-glass test-tube cool down
- finds that the mass of the hard-glass test-tube and its contents after the second heating is 22.56 g.

(i) Record these results in Table 4.2.

Table 4.2

	mass / g
mass of hard-glass test-tube and its contents after first heating	
mass of hard-glass test-tube and its contents after second heating	
mass of solid remaining in hard-glass test-tube after second heating	

[1]

(ii) State if solid **K** finishes decomposing during the first heating.

Explain your answer using Table 4.2.

....

.... [1]

(iii) Calculate the mass of the solid remaining in the hard-glass test-tube after the second heating.

The mass of the empty hard-glass test-tube is 22.18 g.

Record your answer in Table 4.2. [1]

(iv) Use the data in Table 4.1 and your answer to **(c)(iii)** to calculate the total mass of carbon dioxide and steam given off in this reaction.

total mass of carbon dioxide and water given off = ... g [1]

(d) Suggest why it is better to heat the hard-glass test-tube with a blue Bunsen burner flame than a yellow Bunsen burner flame.

....

.... [1]

[Total: 8]

5 A student investigates the electrolysis of dilute sulfuric acid.

The electrolysis of dilute sulfuric acid forms oxygen at the anode (positive electrode) and hydrogen at the cathode (negative electrode).

The student wants to find out how changing the concentration of sulfuric acid affects the rate of formation of oxygen gas.

Plan an investigation to find out how changing the concentration of dilute sulfuric acid affects the rate of formation of oxygen gas.

You are given a constant current power supply, leads and dilute sulfuric acid. You may also use any other common laboratory apparatus.

In your answer, include:

- the apparatus needed, including a labelled diagram
- a brief description of the method and the measurements you will make
- how you will control the variables
- how you will process your results and draw a conclusion.

....

....

....

....

....

....

....

....

.... [6]

6 A student investigates the resistance of different lamp combinations.

The student:

- sets up the circuit shown in Fig. 6.1 (this is circuit **1**)

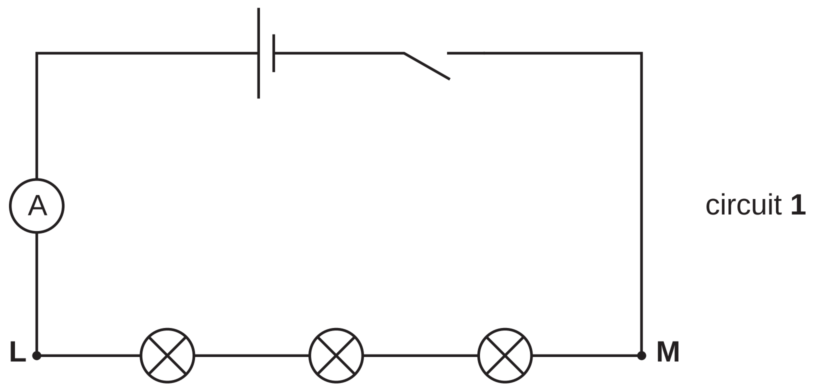


Fig. 6.1

- connects a voltmeter into circuit **1** to measure the potential difference (p.d.) between **L** and **M**.

(a) On Fig. 6.1, draw the symbol for a voltmeter connected to measure the potential difference between point **L** and point **M**. [2]

(b) The student:
- closes the switch.

Fig. 6.2 shows the readings on the voltmeter and the ammeter.

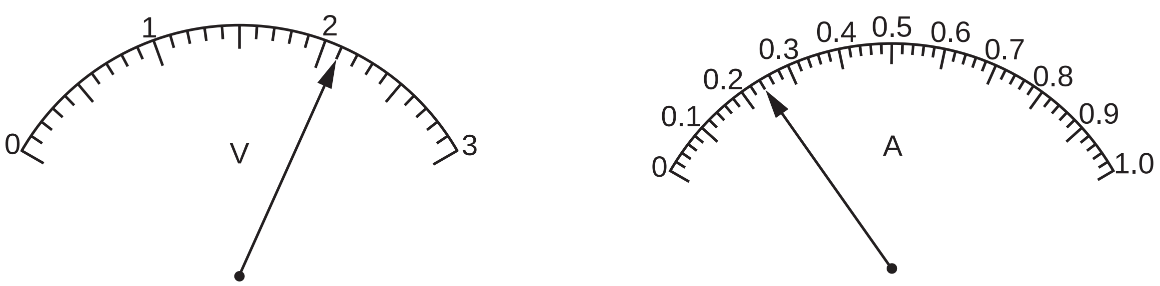


Fig. 6.2

Record in Table 6.1 the potential difference *V* and the current *I*.

The student:

- also records the brightness of the lamps
- opens the switch.

Table 6.1

circuit	*V* / V	*I* / A	*R* /	brightness of lamps
1				dim
2	1.9	0.89		bright

[2]

(c) The student:

- reconnects the lamps between **L** and **M** as shown in Fig. 6.3 (this is circuit **2**)

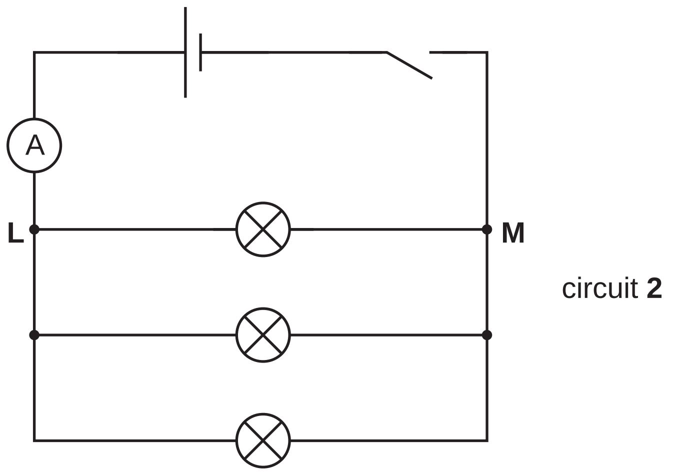


Fig. 6.3

- connects the voltmeter into circuit **2** to measure the potential difference between **L** and **M**
- closes the switch
- records in Table 6.1 the potential difference *V* and the current *I*
- records the brightness of the lamps
- opens the switch.

Her results are shown in Table 6.1.

(i) State why the student opens the switch after taking each reading from the ammeter and voltmeter.

....

.... [1]

(ii) Calculate and record in Table 6.1 the total resistance *R* measured between points **L** and **M** for circuit **1** and circuit **2**. Use the equation shown.

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

Give your answers to two significant figures. [2]

(iii) Complete the headings in Table 6.1 by adding the unit of resistance. [1]

(d) The teacher makes the following statement.

'If each lamp has the same resistance, the total resistance between points **L** and **M** in circuit **1** should be nine times the total resistance between **L** and **M** in circuit **2**.'

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

Justify your statement by using the values of *R* you have calculated in Table 6.1.

....

....

....

.... [1]

(e) Use Table 6.1 to state in which circuit the power of the lamps is greater. Explain how you arrived at your answer.

circuit ....

explanation ....
[1]

[Total: 10]

7 A student investigates the rate of decrease in temperature of two beakers **P** and **Q** that contain hot water.

Beaker **P** has no lid.

Beaker **Q** is identical to beaker **P**, but has a lid.

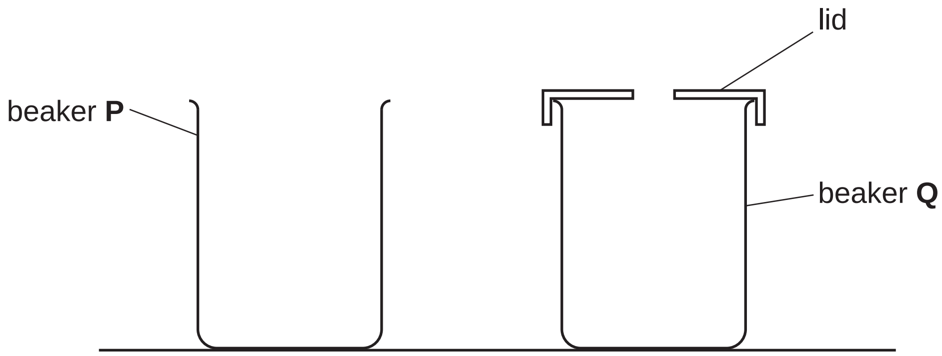


Fig. 7.1

(a) Procedure

The student:

- pours 200 cm^3 of hot water into beaker **P**
- places a thermometer into the water
- measures the temperature θ_0 of the hot water when the reading stops rising and starts the stop-watch.

Fig. 7.2 shows the reading on the thermometer.

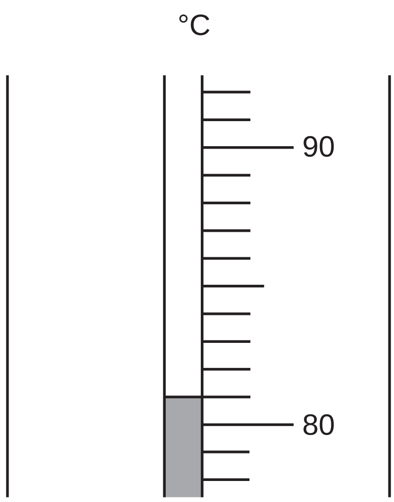


Fig. 7.2

(i) Record in Table 7.1 this temperature at time t = 0. [1]

(ii) Explain why the student waits until the reading stops rising before taking the temperature of the hot water at time $t = 0$.

....

.... [1]

Table 7.1

time t /	beaker **P** temperature θ /	beaker **Q** temperature θ / ....
0		79.5
30	78.5	79.0
60	76.0	78.0
90	74.0	77.0
120	72.5	75.5
150	71.0	75.0
180	70.0	74.5

(iii) The student:

- measures the temperature of the hot water every 30 s for 180 s
- records her results in Table 7.1.

Complete the column headings by adding the units. [1]

(iv) The student stirs the water before taking each reading. State why this is good experimental practice.

....

.... [1]

(b) Calculate the decrease in temperature θ_P of the hot water in beaker **P** over the 180 s.

θ_P = ... [1]

(c) The student:

- repeats the procedure in **(a)** using beaker **Q** instead of beaker **P**
- replaces the lid as soon as the water has been added to beaker **Q**.

Calculate the decrease in temperature θ_Q of the hot water in beaker **Q** over the 180 s.

θ_Q = ... [1]

(d) Write a conclusion based on the student's results in **(b)** and **(c)**.

....

.... [1]

(e) State **one** safety precaution that the student should take when carrying out this investigation.

Explain your answer.

precaution ....

explanation ....
[1]

(f) State **one** way of reducing thermal energy loss (other than by adding a lid) from beaker **Q**.

.... [1]

(g) State **one** variable that should be controlled to ensure that the comparison between beaker **P** and beaker **Q** is fair.

.... [1]

[Total: 10]