Cambridge Assessment International Education

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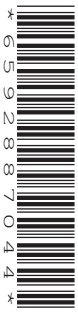
CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			



COMBINED SCIENCE **0653/62**

Paper 6 Alternative to Practical **February/March 2022**

1 hour

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 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages.

[Turn over

1 **(a)** A student investigates the rate of an enzyme-catalysed reaction.

Potato cells contain an enzyme that breaks down hydrogen peroxide to make oxygen gas.

The student has three samples of potato, as shown in Fig. 1.1.

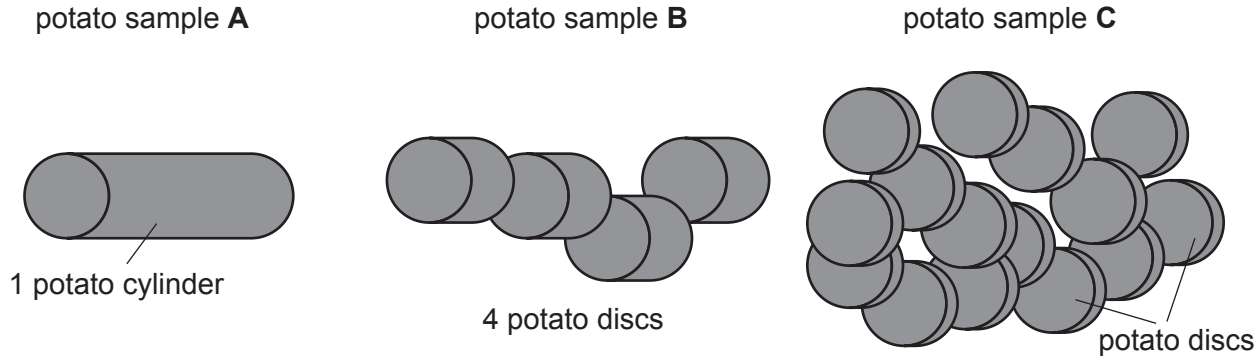


Fig. 1.1

Procedure

The student:

Step 1 Puts potato sample **A** into test-tube **A**.

Step 2 Puts potato sample **B** into test-tube **B**.

Step 3 Puts potato sample **C** into test-tube **C**.

(i) Use Fig. 1.1 to count the number of discs of potato that are added to test-tube **C**.

Record your result in Table 1.1. [1]

The student:

Step 4 Sets up the apparatus shown in Fig. 1.2 using test-tube **A**, and starts a stop-clock.

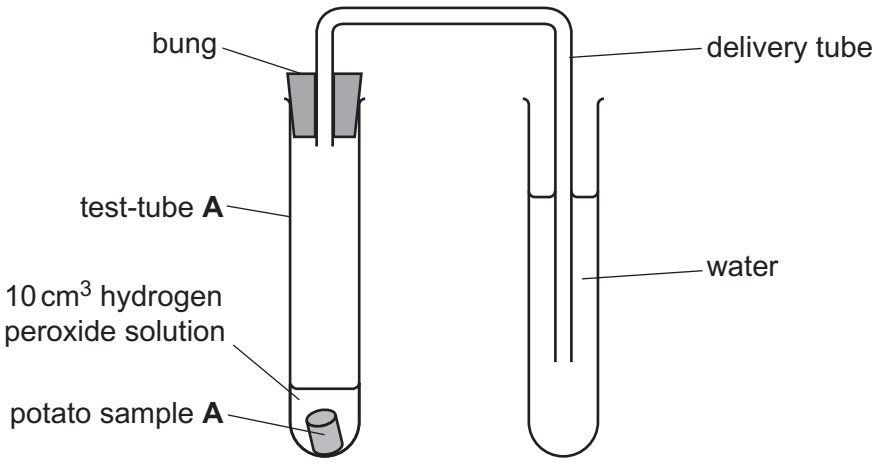


Fig. 1.2

Step 5 Records in a tally chart the number of bubbles produced at the end of the delivery tube in 3 minutes.

Step 6 Repeats **Step 4** and **Step 5** using test-tube **B**.

Step 7 Repeats **Step 4** and **Step 5** using test-tube **C**.

Fig. 1.3 shows the tally chart.

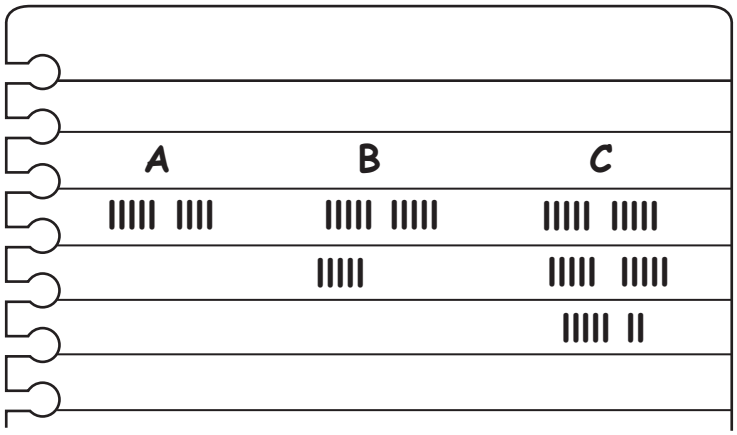


Fig. 1.3

(ii) Record in Table 1.1 the number of bubbles produced in 3 minutes for test-tubes **A**, **B** and **C**.

Use the information in Fig. 1.3.

Table 1.1

test-tube	number of potato discs in test-tube	number of bubbles produced in 3 minutes	rate of reaction / number of bubbles per minute
A	1		
B	4		
C			

[2]

(iii) Calculate the rate of the reaction in each test-tube.

Use the equation shown.

$$\text{rate of reaction} = \frac{\text{number of bubbles produced in 3 minutes}}{3}$$

Record in Table 1.1 the rate of reaction in each test-tube. [1]

[Turn over

(b) Another student does a similar experiment using different sized potato discs and timing for five minutes.

The student calculates the total surface area of the potato discs in each test-tube.

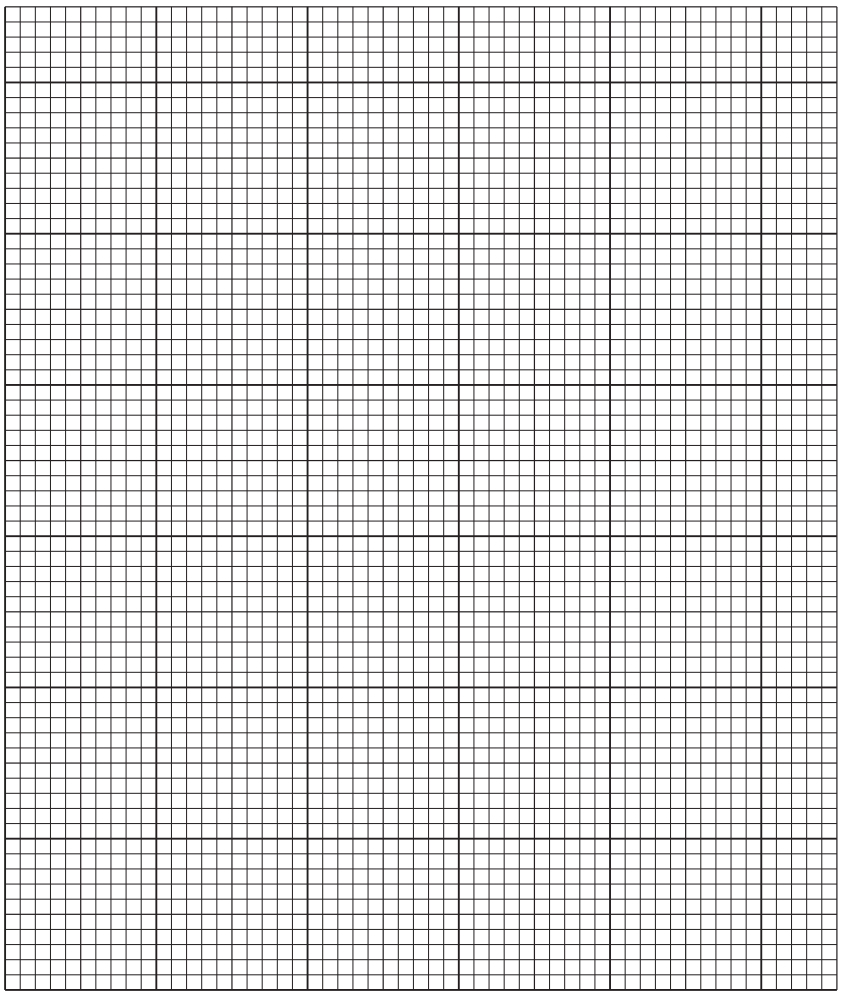
All of the potato discs are cut from the same potato.

The student's results are shown in Table 1.2.

Table 1.2

total surface area of the potato discs / cm^2	number of bubbles produced in 5 minutes	rate of reaction / number of bubbles per minute
14	5	1
23	85	17
32	165	33
41	225	45
50	295	59

(i) On the grid, plot the rate of reaction (vertical axis) against the total surface area of the potato discs.



[3]

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

(iii) State the relationship between the total surface area of the potato discs and the rate of reaction.

.....

..... [1]

(iv) Use your graph to estimate the surface area of the potato discs when the rate of reaction is 24 bubbles per minute.

surface area of potato discs = ... cm^2 [1]

(v) Identify **one** way the procedure in **(b)** is an improvement on the procedure in **(a)**.

.....

..... [1]

(vi) Describe how the volume of oxygen gas made can be collected and measured.

.....

..... [1]

(vii) Describe a test to confirm that the gas made is oxygen. Include the observation for a positive result.

test .....

.....

observation .....

.....
[1]

[Total: 13]

[Turn over

2 A student investigates some properties of solid **H**.

(a) The student investigates the pH of an aqueous solution of **H**.

Procedure

The student:

- dissolves solid **H** in some distilled water
- adds three drops of universal indicator to the aqueous solution of **H**.

The student observes a green-blue colour.

Fig. 2.1 shows a pH colour chart.

	red	orange	yellow	green	dark green	blue	purple
pH	1	4	6	7	8	10	14

Fig. 2.1

(i) Estimate the pH of the aqueous solution of **H**. Use the colour chart in Fig. 2.1.

..... [1]

(ii) Explain why it is difficult to determine an accurate pH value for the solution of **H** using universal indicator and the colour chart.

.....

..... [1]

(b) The student investigates the reaction of solid **H** with aqueous sodium hydroxide.

Procedure

The student:

- puts some solid **H** into a test-tube
- adds some aqueous sodium hydroxide to the test-tube
- heats the test-tube gently
- tests the gas made with damp red litmus paper.

The student observes damp red litmus paper turning blue.

(i) Tick (✓) the box that shows the name of the gas made.

ammonia	☐
carbon dioxide	☐
hydrogen	☐
oxygen	☐

[1]

(ii) Name the positive ion (cation) present in solid **H**.

..... [1]

(iii) Describe **one** safety precaution the student takes when heating the test-tube.

Explain your answer.

safety precaution .....

.....

explanation .....

.....

[1]

(c) The student investigates the reaction of solid **H** with dilute hydrochloric acid.

Procedure

The student:

- puts some solid **H** into a test-tube
- adds dilute hydrochloric acid to solid **H**.

Carbon dioxide gas is made.

(i) Predict **one** observation the student makes about this reaction.

.....

..... [1]

(ii) Tick (✓) the box that names the negative ion (anion) present in solid **H**.

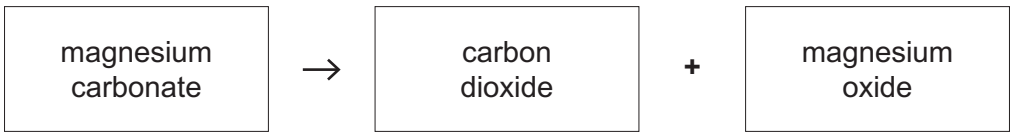
carbonate	☐
chloride	☐
nitrate	☐
sulfate	☐

[1]

[Total: 7]

[Turn over

3 Magnesium carbonate is a white solid that decomposes when heated.



Plan an investigation to find the relationship between the mass of magnesium carbonate heated and the volume of carbon dioxide made.

You are provided with magnesium carbonate powder.

You may use any common laboratory apparatus.

In your plan, include:

- the apparatus needed
- a brief description of the method and an explanation of any safety precautions you will take
- what you will measure
- a results table to record the measurements
- how you will process your results to draw a conclusion.

You are not required to include any results in your results table.

You may include a labelled diagram if you wish.

.....

.....

.....

.....

.....

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..... [7]

4 A student calculates the work done when a metal block slides down a ramp.

(a) Fig. 4.1 shows the apparatus used by the student.

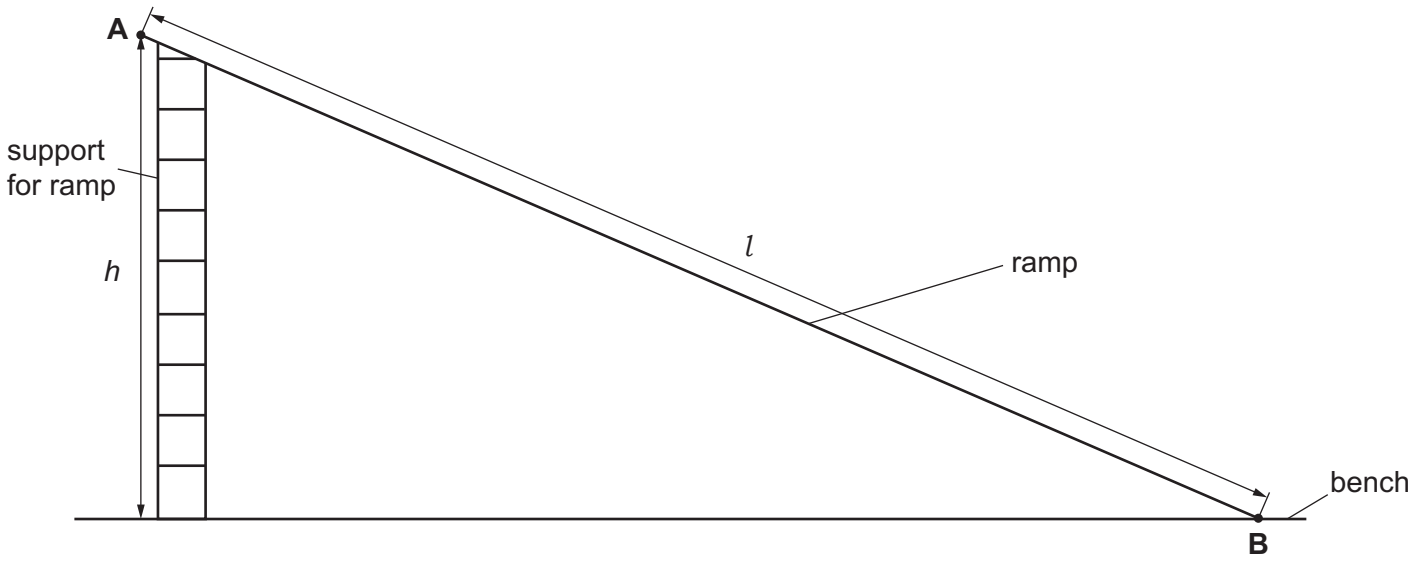

Fig. 4.1

(i) On Fig. 4.1, measure the **vertical** height *h* from **A**, the top of the ramp, to the bench.

Record your answer in centimetres to the nearest 0.1 cm.

h = ... cm [1]

(ii) On Fig. 4.1, measure the length *l* of the ramp from **A** to **B**.

Record your answer in centimetres to the nearest 0.1 cm.

l = ... cm [1]

(iii) The actual size of the apparatus is 10 times larger than Fig. 4.1.
Use your answers in **(a)(i)** and **(a)(ii)** to calculate:

- the actual vertical height *H* of the top of the ramp above the bench
- the actual length *L* of the ramp.

H = ... cm

L = ... cm
[1]

(b) The student places a metal block at the top of the ramp **A**.
The metal block has a mass *m* = 99.8 g.

Calculate the gravitational force *F* on the metal block acting down the ramp.

Use your answers in **(a)(iii)** and the equation shown.

Give your answer to **two** significant figures.

$$F = \frac{9.8 \times m \times H}{1000 \times L}$$

F = ... N [2]

(c) Calculate the work done W by the gravitational force on the metal block as it moves from **A** to **B**.

Use your results from **(a)(iii)**, **(b)** and the equation shown.

$$W = 0.01 \times F \times L$$

W = ... J [1]

(d) The student measures the time taken for the metal block to slide from **A** to **B**.
The experiment is repeated several times and the results are shown in Table 4.1.

Table 4.1

time taken for metal block to travel length of ramp l from **A** to **B** / s					
trial 1	trial 2	trial 3	trial 4	trial 5	average
2.68	2.73	5.40	2.86	2.54	

(i) Suggest a suitable piece of apparatus to measure the time taken for the metal block to move from **A** to **B**.

..... [1]

(ii) Identify the anomalous result in Table 4.1.

Explain why you have chosen this result.

anomalous result .....

explanation .....

.....
[1]

(iii) Suggest an error that causes this anomalous result.

.....

..... [1]

(iv) Calculate the average time taken for the metal block to move from **A** to **B**.

Record your answer in Table 4.1.

[2]

[Turn over

(e) A student says that measuring the time taken is inaccurate.

Suggest **one** practical improvement to increase the accuracy of the measurement of the time taken. You can assume that all readings are taken avoiding line of sight (parallax) errors.

Explain your answer.

suggestion .....

explanation .....

.....

.....

[2]

[Total: 13]