Cambridge Assessment
International Education

Cambridge IGCSE™

CANDIDATE NAME											
CENTRE NUMBER							CANDIDATE NUMBER				

COMBINED SCIENCE **0653/61**

Paper 6 Alternative to Practical **May/June 2021**

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 **16** pages. Any blank pages are indicated.

DC (CJ/CB) 208217/4

1 A student investigates an enzyme-catalysed reaction.

Hydrogen peroxide is broken down by catalase, an enzyme found in living cells such as the cells of potato tissue. Oxygen gas is released during the reaction.

(a) Procedure

The student:
Step 1 labels three test-tubes, **A**, **B** and **C**

Step 2 makes up three different concentrations of hydrogen peroxide solution by adding the volumes of 6% hydrogen peroxide solution and water as shown in Table 1.1.

Table 1.1

test-tube	volume of 6% hydrogen peroxide solution / cm^3	volume of water / cm^3	percentage concentration of hydrogen peroxide solution
A	2	4	2
B	4	2	
C	6	0	6

(i) Calculate the percentage concentration of hydrogen peroxide solution for test-tube **B**.

Record your answer in Table 1.1 **and** Table 1.2. [1]

(ii) The student:
Step 3 cuts three 1 mm slices of potato from a potato cylinder as shown in Fig. 1.1.

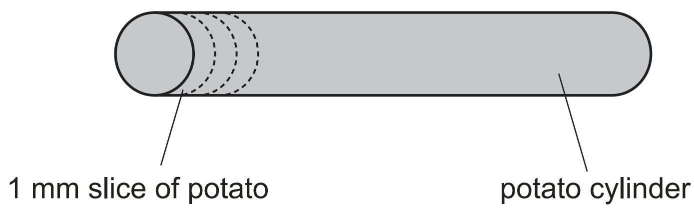

Fig. 1.1

Step 4 drops one potato slice into each labelled test-tube and starts the stop-watches

Step 5 records, in Table 1.2, the time taken for each potato slice to rise to the surface of the liquid.

The times for each potato slice are shown in Fig. 1.2.

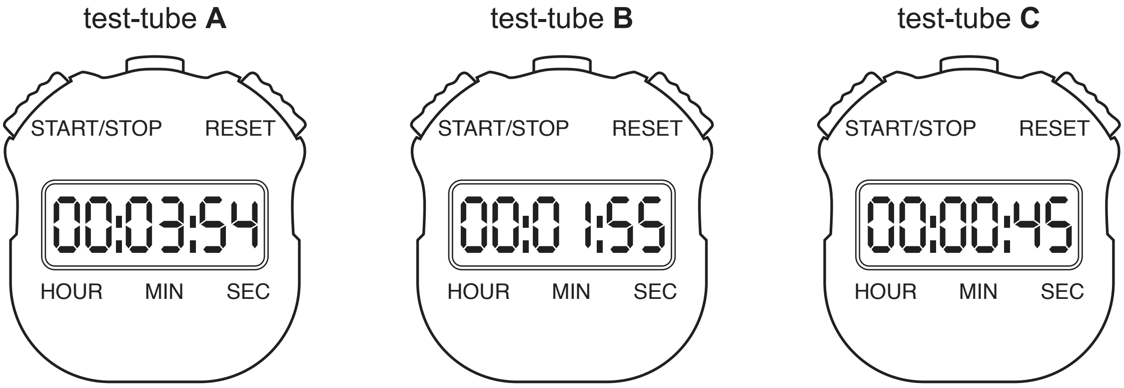

Fig. 1.2

Record in Table 1.2 the results shown in Fig. 1.2. Test-tube **B** has been completed for you.

Table 1.2

test-tube	percentage concentration of hydrogen peroxide solution	time taken for potato slice to rise to the surface / seconds
A	2	
B		115
C	6	

[2]

(iii) State a conclusion for these results.

....

.... [1]

(iv) State and explain **one** safety precaution taken when cutting the potato slices.

....

.... [1]

(v) Identify **two** variables that are controlled in this investigation.

1 ....

2 ....

[2]

(vi) Suggest why the experiment is **not** done using 20% concentration of hydrogen peroxide solution.

....

.... [1]

(vii) Predict how the results will change if the potato slices are cut to a thickness of 2 mm instead of 1 mm. Explain your answer.

....

.... [1]

(b) The student then adds the remaining potato cylinder to some iodine solution.
State the nutrient tested for with iodine solution and state the observation for a positive result.

nutrient ....

observation ....

....
[2]

(c) A student tests some potato with Benedict's solution by following the procedure shown in Fig. 1.3.

Step 1	put a piece of potato in a test-tube
Step 2	add 2 cm^3 Benedict's solution
Step 3	shake the test-tube to mix
Step 4	....
Step 5	observe the colour after 3 minutes

Fig. 1.3

(i) State the instruction for Step 4.

....

.... [1]

(ii) State an observation for a positive result.

.... [1]

[Total: 13]

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2 A student is provided with five aqueous solutions, **F**, **G**, **H**, **J** and **K**.

(a) The student puts three drops of Universal Indicator into test-tubes, each containing one of the solutions.

The results are shown in Table 2.1.

Table 2.1

solution	colour with Universal Indicator	pH of solution
F	red	
G	green	
H	blue-green	
J	purple	
K	red	

Use the pH colour chart to determine the pH of each solution.

colour with Universal Indicator	red	orange	yellow	green	blue-green	blue	purple
pH	0 – 3	4 – 5	6	7	8 – 9	10 – 11	12 – 14

Write your answers in Table 2.1. [2]

(b) **(i)** Put the solutions in order of decreasing acidity and increasing alkalinity.

most acidic ....

....

....

....

most alkaline ....

[1]

(ii) Explain why it is difficult to decide where to put **F** and **K** in the list in **(b)(i)**.

....

.... [1]

(c) The student adds a small piece of magnesium to solution **F**.

The reaction mixture fizzes and produces hydrogen gas.

Describe a test for hydrogen gas and give the observation for a positive test.

test ....

observation ....
[2]

(d) The student bubbles some carbon dioxide through solution **H**.

Solution **H** goes milky because it forms an insoluble white precipitate.

Name solution **H**.

.... [1]

[Total: 7]

3 Sodium carbonate is a white solid that reacts with dilute hydrochloric acid as shown in the word equation.

sodium carbonate	+	hydrochloric acid	→	sodium chloride	+	carbon dioxide	+	water

When sodium carbonate is added to dilute hydrochloric acid the reaction fizzes (bubbles). When the fizzing stops the reaction is complete.

The time it takes for the reaction to be completed is called the reaction time.

Plan an investigation to find out how the reaction time depends on the temperature of the hydrochloric acid.

You are provided with:
- sodium carbonate powder
- dilute hydrochloric acid

You may use any common laboratory apparatus in your plan.

In your plan, include:

- the apparatus needed
- a brief description of the method and explain any safety precautions you would take
- what you would measure
- which variables you would keep constant
- how you would process your results to draw a conclusion.

You may include a labelled diagram if you wish.

You may include a table that can be used to record the results if you wish.

....

....

....

....

....

....

....

....

....

....

....

....

....

.... [7]

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4 A student investigates how forces affect an elastic band.

Fig. 4.1 shows the elastic band before it is used by the student. It is drawn full-size. The elastic band has not yet been stretched with any forces.

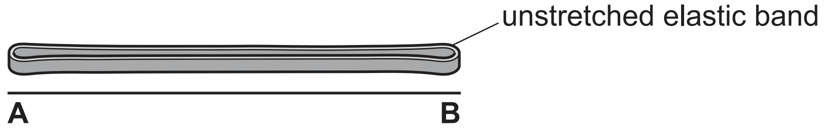


Fig. 4.1

Procedure
The student:

- suspends the elastic band from a nail and carefully places a 100 g mass hanger onto the elastic band as shown in Fig. 4.2

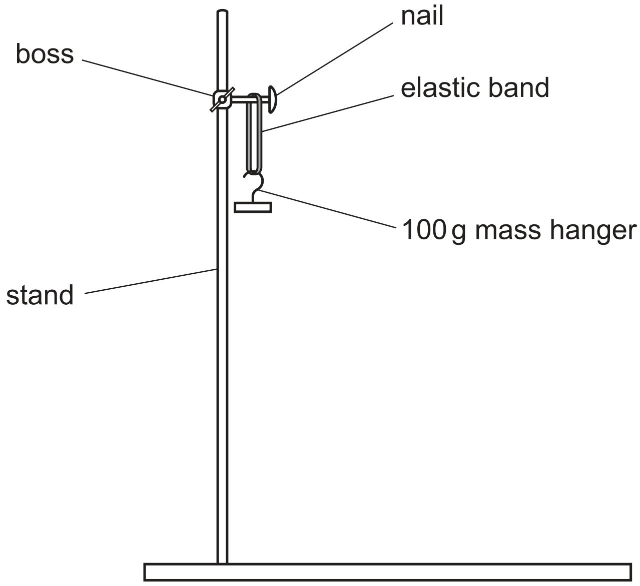


Fig. 4.2

- measures and records in Table 4.1 the stretched length of the elastic band
- without removing the mass hanger, carefully adds a 100 g mass to the hanger
- measures and records in Table 4.1 the stretched length of the elastic band
- continues adding 100 g masses one at a time until a total of 500 g is suspended from the elastic band, recording the length each time
- carefully removes the 100 g masses, one at a time
- after removing each 100 g mass, measures and records in Table 4.2 the stretched length of the elastic band
- measures the final length of the elastic band after the mass hanger has been removed.

(a) Measure the unstretched length of the elastic band in Fig. 4.1 from point **A** to **B** to the nearest millimetre and record your result in Table 4.1.

Table 4.1

mass / g	force / N	length of elastic band / mm
0	0	
100	1.0	65
200	2.0	73
300	3.0	90
400	4.0	125
500	5.0	166

Table 4.2

mass / g	force / N	length of elastic band / mm
500	5.0	166
400	4.0	152
300	3.0	136
200	2.0	107
100	1.0	78
0	0	64

[1]

(b) Explain why the student wears safety goggles during this experiment.

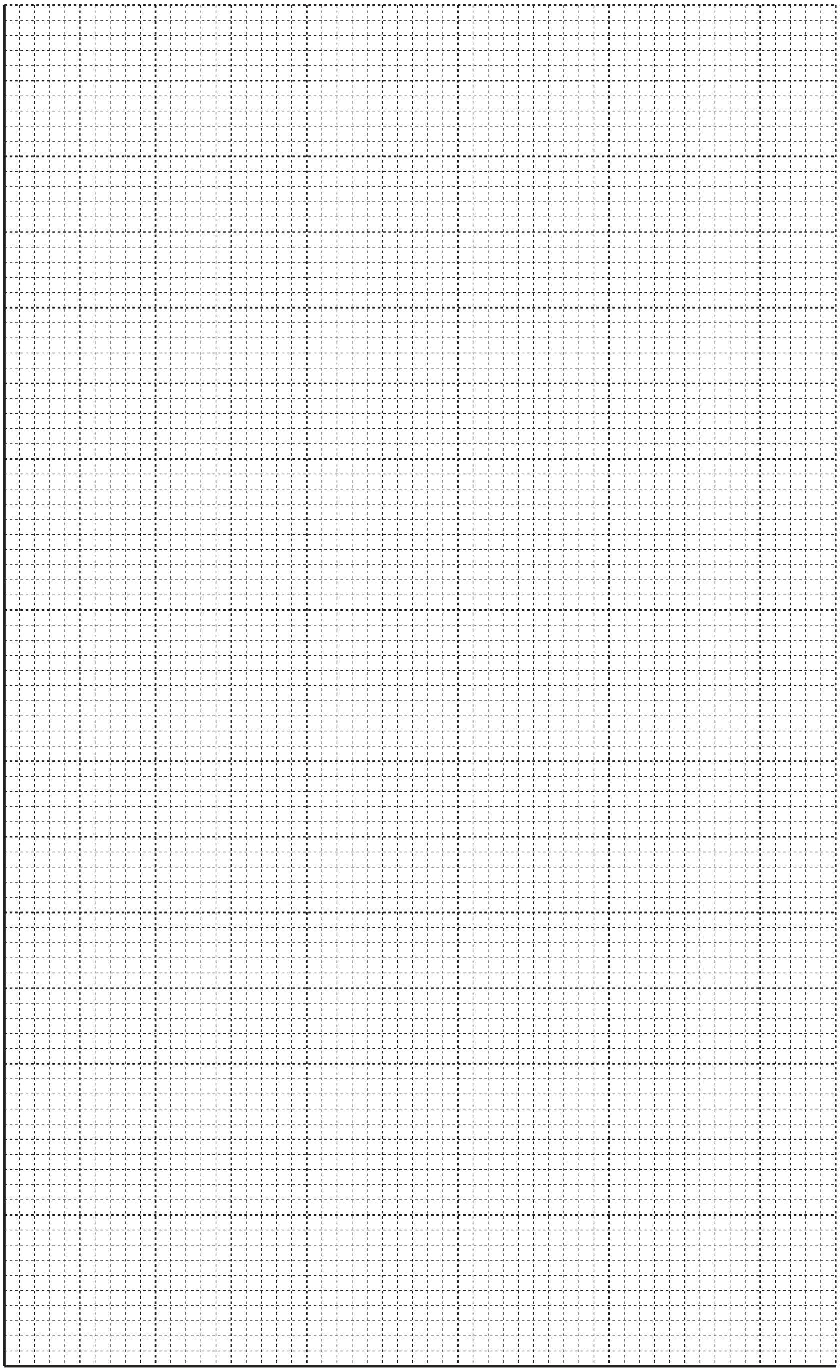
....

.... [1]

(c) Use the information in Table 4.1 to deduce the force exerted by a 650 g mass.

force = ... N [1]

(d) **(i)** Use the results in Table 4.1 to plot a graph of the length of the elastic band (vertical axis) against force. Start your graph at (0,0).



[2]

(ii) Draw the best-fit curve. Label this curve "increasing force". [1]

(iii) Use your graph to estimate the length of the elastic band when a force of 2.5 N is applied to stretch it.

length of elastic band when force is 2.5 N = ... mm [1]

(iv) On the same axes, plot the results in Table 4.2. [1]

(v) Draw the best-fit curve for the points plotted in **(d)(iv)**. Label this curve "decreasing force". [1]

(e) Work is done as the elastic band is stretched. Elastic potential energy is stored in the stretched band.

When the stretching force is removed, some of the stored elastic potential energy is converted into thermal energy. This thermal energy is represented by the area between the two best-fit curves on the graph.

(i) Estimate the area on the graph by counting the number of 1 cm^2 squares between your two best-fit curves from 0–5 N.
Show how you arrived at your answer.

area between the two best-fit curves = ... [2]

(ii) Suggest how the student can improve the **experimental procedure** to get a more accurate estimate of the energy lost in the elastic band.

....

.... [1]

(f) The area between the two best-fit curves can be used to calculate the energy lost.

A student does this experiment with a **different** elastic band.
The student calculates the area between their two best-fit curves as 150 N mm.

Calculate the energy lost when the student's elastic band is stretched.

Use the equation shown.

energy lost = area between the two best-fit lines × 0.001

energy lost = ... J [1]

[Total: 13]

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