Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

COMBINED SCIENCE **0653/51**

Paper 5 Practical Test **May/June 2021**

1 hour 15 minutes

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 40.
- 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	
Total	

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[Turn over

1 You are going to investigate 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) You are provided with a supply of hydrogen peroxide solution of concentration 6% and a cylinder of potato tissue.

Procedure

Step 1 Label three test-tubes **A**, **B** and **C**.

Step 2 Use a syringe to add the volumes of 6% hydrogen peroxide solution and water to the test-tubes as shown in Table 1.1.

Step 3 Shake the test-tubes gently to mix.

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) **Step 4** Cut three 1 mm slices of potato from the potato cylinder as shown in Fig. 1.1.

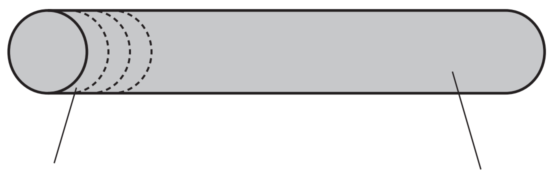

Fig. 1.1

Step 5 Drop one potato slice into each labelled test-tube and start the stop-clock.

Step 6 Record in Table 1.2 the time taken to the nearest second, for each potato slice to rise to the surface of the liquid.

If the time taken is greater than 5 minutes then record this time as **>300**.

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		
C	6	

[3]

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(iii) State a conclusion for your results.

....

.... [1]

(iv) State and explain **one** safety precaution taken when doing **Step 4**.

....

.... [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]

(b) Add a few drops of biuret solution to the remaining potato cylinder.

Record your observations and state a conclusion.

observation with biuret solution ....

conclusion ....

[2]

(c) A student tests some potato with Benedict's solution by following the procedure shown in Fig. 1.2.
Do **not** do this procedure.

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. 1.2

(i) State the instruction for Step 4.

....

.... [1]

(ii) State an observation for a positive result.

.... [1]

[Total: 13]

2 You are provided with five aqueous solutions, **F**, **G**, **H**, **J** and **K**.

(a) Put approximately 1 cm depth of each solution into separate test-tubes.

Add three drops of Universal Indicator solution to each test-tube.

Record the colour for each solution in Table 2.1. [1]

Table 2.1

solution	colour with Universal Indicator	pH of solution
F		
G		
H		
J		
K		

(b) Use the Universal Indicator colour chart to determine the pH of each solution.

Record your answers in Table 2.1. [2]

(c) **(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 **(c)(i)**.

....

.... [1]

(d) Add approximately 2 cm depth of solution **F** into a test-tube.

Add a small piece of magnesium to the test-tube.

Describe **two** observations of the reaction.

1 ....

2 ....

[2]

[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.

You are not required to do this investigation.

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 You are going to investigate how forces affect an elastic band. You are provided with an unstretched elastic band.

(a) (i) Measure the length l of your elastic band to the nearest millimetre, by pushing your band together and measuring against a ruler as shown in Fig. 4.1.

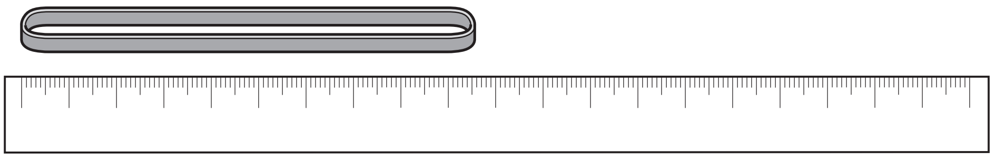


Fig. 4.1

Record your value in Table 4.1. [1]

(ii) Suggest one practical difficulty in obtaining an accurate value for length l.

....

.... [1]

(b) Procedure

- Suspend the elastic band from the nail.
- Attach the mass hanger to the elastic band as shown in Fig. 4.2.

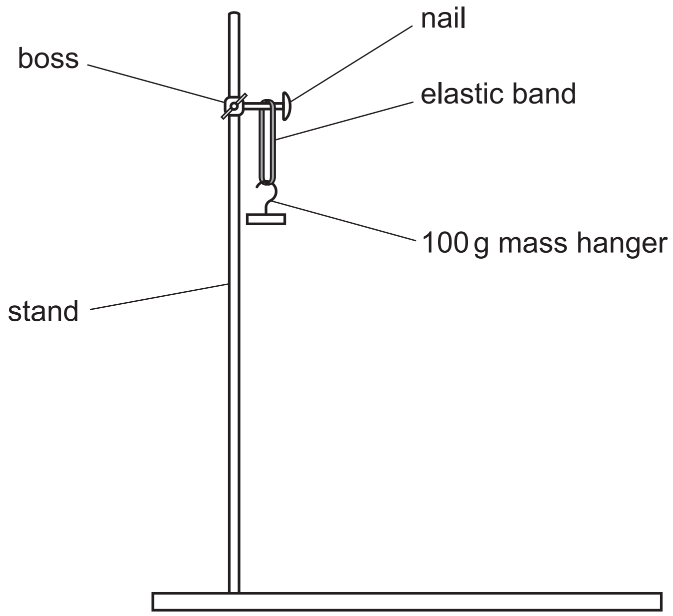


Fig. 4.2

- Measure and record in Table 4.1 the stretched length l of the elastic band.
- Carefully add a 100 g mass to the mass hanger.
- Measure and record in Table 4.1 the stretched length l of the elastic band.
- Continue adding masses 100 g at a time, recording length l after each addition, until 500 g is suspended from the elastic band.
- Record the length l at 500 g in Table 4.1 **and** Table 4.2.
- Now carefully remove **one** 100 g mass from the hanger.
- Measure length l and record it in Table 4.2.
- Continue removing 100 g masses from the mass hanger, recording length l each time.
- Remove the mass hanger and record in Table 4.2 the final length l of the elastic band.

Table 4.1

mass / g	force / N	length l / mm
0	0.0	
100 (mass hanger)	1.0	
200	2.0	
300	3.0	
400	4.0	
500	5.0	

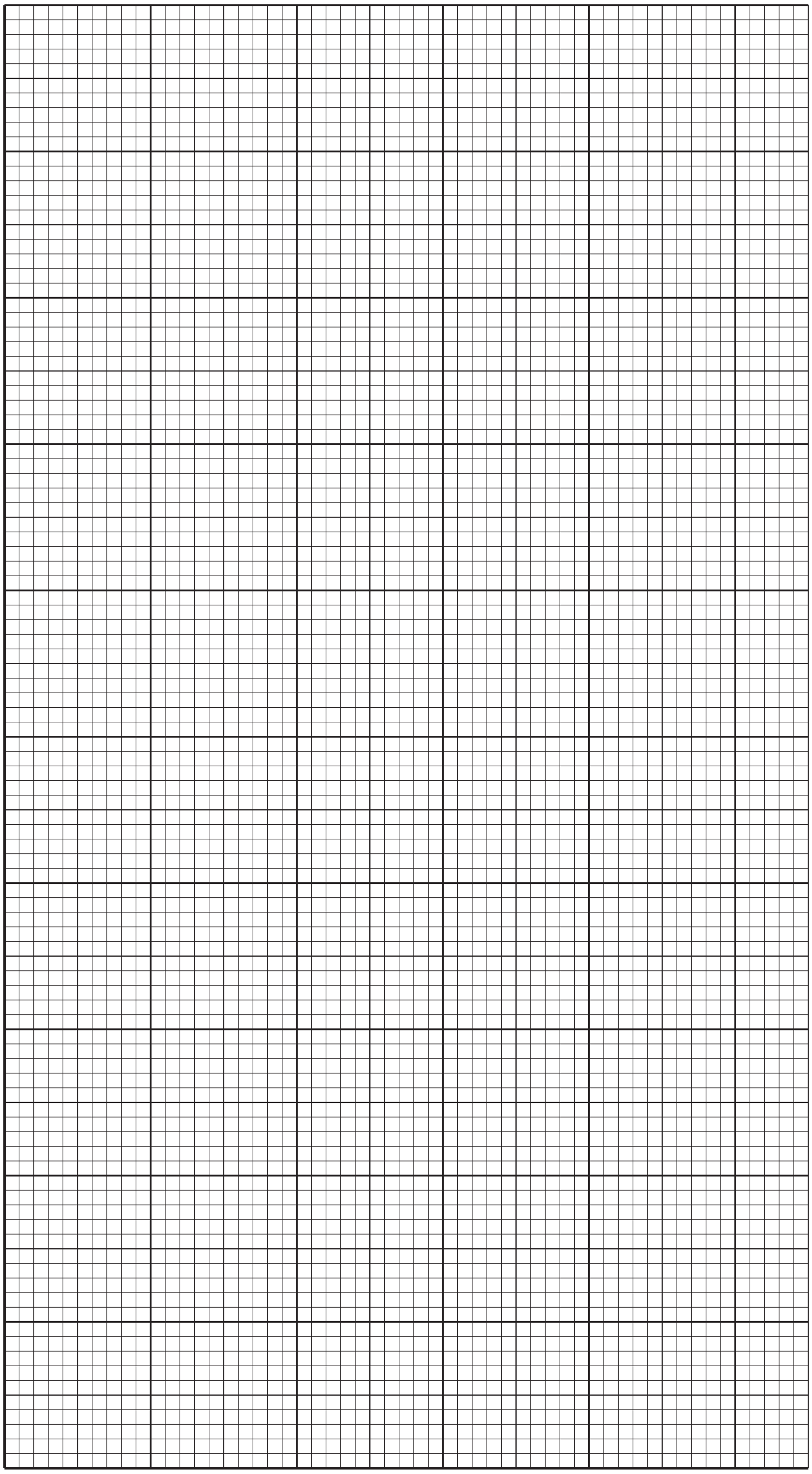
Table 4.2

mass / g	force / N	length l / mm
500	5.0	
400	4.0	
300	3.0	
200	2.0	
100 (mass hanger)	1.0	
0	0.0	

[3]

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

length / mm



force / N

[2]

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

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

(iv) Draw the best-fit curve for the points plotted in **(c)(iii)**. Label this curve “decreasing force”. [1]

(d) 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.

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]

(e) 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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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.
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 (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 results
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

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