Cambridge
IGCSE

				CANDIDATE NAME									

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CENTRE NUMBER

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CO-ORDINATED SCIENCES **0654/51**

Paper 5 Practical Test **October/November 2019**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
Notes for Use in Qualitative Analysis for this paper are printed on page 16.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
Total	

This document consists of **15** printed pages and **1** blank page.

Cambridge Assessment
International Education

[Turn over

1 You are going to investigate an enzyme controlled reaction.

Catalase is an enzyme that is found inside living cells, such as those found in beans. It catalyses the breakdown of hydrogen peroxide, releasing oxygen gas.

You are provided with a sample of beans that has been liquidised.

(a) Suggest why the beans have been liquidised.

.... [1]

(b) Procedure

- Place about 1 cm depth of the liquidised beans into a test-tube.
- Add 1 cm^3 hydrogen peroxide solution to the test-tube.
- Immediately start the stopclock.
- Measure the time it takes for the height of the foam produced to reach the top of the test-tube.
- If the foam has not reached the top of the test-tube after 2 minutes, record the time as 120.

(i) Record, in Table 1.1, this time for trial 1 to the nearest second.

Table 1.1

time taken for foam to reach the top of the test-tube / s			
trial 1	trial 2	trial 3	average

[1]

(ii) Empty the test-tube into the beaker labelled waste, and rinse the test-tube with distilled water.

Repeat the procedure in **(b)** two more times.

Record, in Table 1.1, the results for trial 2 and trial 3. [1]

(iii) Calculate the average time taken. Record, to the nearest second, this value in Table 1.1.

[1]

(c) Fig. 1.1 shows a test-tube containing liquidised beans and hydrogen peroxide solution.

Draw on Fig. 1.1 suitable apparatus to collect the oxygen gas produced.

foam

liquidised beans
and hydrogen
peroxide solution
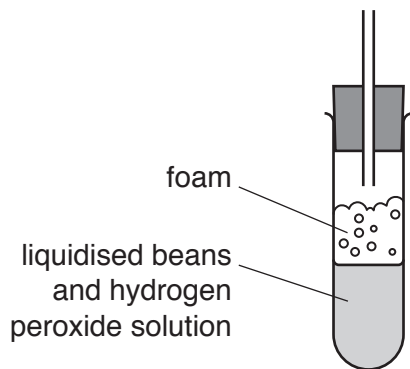
Fig. 1.1

[1]

(d) Describe the test to identify oxygen gas. Include the observation for a positive result.

test ....

observation for a positive result ....
[2]

(e) You are going to test the liquidised beans for their nutrient content.

Procedure

- Pour approximately 1 cm depth of liquidised beans into a clean test-tube.

- Add an equal depth of Benedict's solution to the test-tube.

- Place the test-tube in a hot water bath for a few minutes.
  Continue with the rest of the procedure while you are waiting.

- Pour approximately 1 cm depth of liquidised beans into a clean test-tube.

- Add an equal depth of biuret solution to the test-tube.

Complete Table 1.2.

Table 1.2

test solution	colour observed after adding test solution	nutrient content of beans
Benedict's solution		
biuret solution		

[4]

(f) Describe how to test a liquid for the presence of fat.

Do **not** perform this test.

....

....

.... [2]

[Total: 13]

2 Photosynthesis takes place in aquatic plants (plants that live in water). Photosynthesis produces bubbles of oxygen gas. The greater the rate of photosynthesis, the faster the oxygen is produced.

A student suggests that the rate of photosynthesis in aquatic plants is affected by the colour of light that the plant receives.

Plan an investigation to see which colour of light produces the greatest rate of photosynthesis in an aquatic plant.

You are given several samples of the same aquatic plant and sources of red light, blue light and green light. You may also use any other common laboratory apparatus.

Do **not** carry out this investigation.

Include in your answer:

- what you would do, including the apparatus you would use
- what you would measure
- what you would control
- how you would use your results to draw a conclusion
- a labelled diagram, if you wish.

....

....

....

....

....

....

....

....

.... [7]

[Total: 7]

3 You are going to investigate the effect of the surface area of a solid on the rate of a reaction.

The equation for the reaction between marble chips (calcium carbonate) and hydrochloric acid is shown.

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

The rate of this reaction is found by timing how long it takes the carbon dioxide gas released to turn limewater milky.

(a) Procedure

- Select the test-tube marked with a line.

- Add limewater up to the line on this test-tube.

- Set up the apparatus as shown in Fig. 3.1.
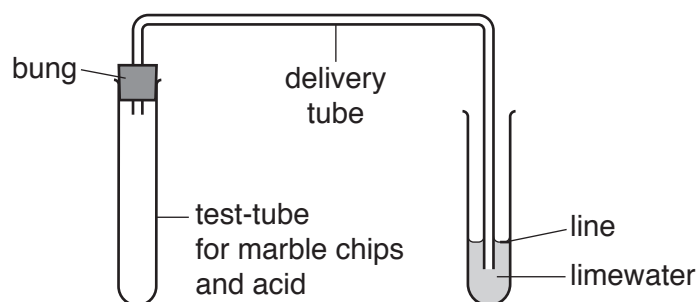
Fig. 3.1

- Remove the bung from the empty test-tube.

- Place 10 marble chips in the empty test-tube.

- Add 5 cm³ hydrochloric acid to the marble chips and replace the bung.

- Immediately start the stopclock.

- Stop the stopclock when the limewater turns milky.

(i) Record in Table 3.1 the time t, to the nearest second, for the limewater to turn milky.

Table 3.1

number of marble chips	time t /s	rate $\frac{1}{t}$ /$\frac{1}{s}$
10		
20		
30		
40		

[1]

(ii) Procedure

- Pour the used acid and marble chips into the beaker labelled **waste**.

- Discard the limewater and wash out both test-tubes with water.

- Rinse the end of the delivery tube which was in the limewater.

Repeat the procedures in **(a)** and **(a)(ii)** using 20, 30 and 40 marble chips instead of 10.

Record in Table 3.1 the times t to the nearest second. [3]

(b) (i) Calculate the rate $\dfrac{1}{t}$ for each value of t.

Record in Table 3.1 these values to **two** significant figures. [2]

(ii) The surface area of the marble chips increases as the number of chips increases.

Use the information in Table 3.1 to state the relationship between the rate of the reaction and the total surface area of the marble chips.

....

.... [1]

(c) (i) State **one** variable which is kept constant in this experiment.

.... [1]

(ii) Suggest **one** reason why varying the number of marble chips is **not** a fair way of changing the total surface area.

....

.... [1]

(iii) Suggest **one** other major source of inaccuracy in the procedure for this experiment.

....

.... [1]

[Total: 10]

4   You are going to investigate the properties of compound **H** and identify the anion in **H**.

   (a) (i) Place about $25\,cm^3$ of distilled water in the large test-tube. Measure and record the temperature T_1 of this water to the nearest $0.5\,°C$.

   Keep the water for use in **(a)(ii)**.

   $T_1 =$ .... °C [1]

   (ii) Add **all** of compound **H** to the water in the large test-tube.

   Stir well and record, to the nearest $0.5\,°C$, the highest or lowest temperature T_2 of the mixture.

   Describe the appearance of the resulting mixture.

   Keep this mixture for use in **(b)**.

   $T_2 =$ .... °C

   appearance of mixture ....

   .... [2]

   (iii) Calculate the temperature change ΔT when **H** is added to the water in **(a)(ii)**. Include a plus (+) or minus sign (−) as appropriate.

   $\Delta T =$ .... °C [1]

   (iv) Use your observation in **(a)(ii)** and your answer in **(a)(iii)** to state two conclusions about what happens when **H** is mixed with water.

   conclusion 1 ....

   conclusion 2 ....
   [2]

(b) (i) Procedure

- Place about 1 cm depth of the mixture from **(a)(ii)** in a test-tube.
- Add an equal volume of dilute nitric acid and record your observations.

observations with nitric acid ....

- Add a few drops of barium nitrate solution and record your observations.

observations with barium nitrate ....

- Record your conclusions about the anions present or not present.

conclusions about anions present or not present in **H** ....

....
[2]

(ii) Procedure

- Place about 1 cm depth of the mixture from **(a)(ii)** in a clean test-tube.
- Add an equal volume of dilute nitric acid and record your observations.

observations with nitric acid ....

- Add a few drops of silver nitrate solution and record your observations.

observations with silver nitrate ....

- Record your conclusions about the anions present or not present.

conclusions about anions present or not present in **H** ....

....
[2]

[Total: 10]

5 You are going to calculate an approximate value for the density of modelling clay.

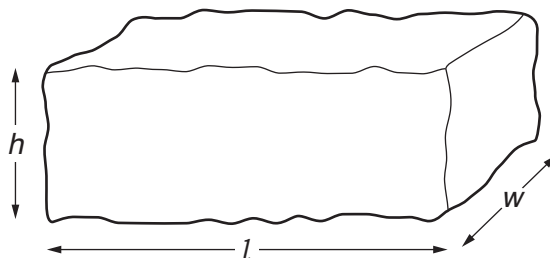**(a)** Mould the piece of modelling clay into a block, similar to the one shown in Fig. 5.1.

Fig. 5.1

(i) Measure and record the length l, width w and height h of the block to the nearest 0.1 cm.

$l =$ .... cm

$w =$ .... cm

$h =$ .... cm
[2]

(ii) Calculate the volume V of the block. Use the equation shown.

$$V = l \times w \times h$$

$V =$ .... cm^3 [1]

(b) (i) State **one** reason why the value for the volume you have obtained is not accurate.

....

.... [1]

(ii) Suggest an alternative method of measuring the volume of the block that would give a more accurate value.

....

.... [1]

(c) (i) Procedure

- Place the pivot under the 50.0 cm mark on the metre rule, as shown in Fig. 5.2.

mass secured to rule

block of modelling clay

x

0   100

15.0 cm mark
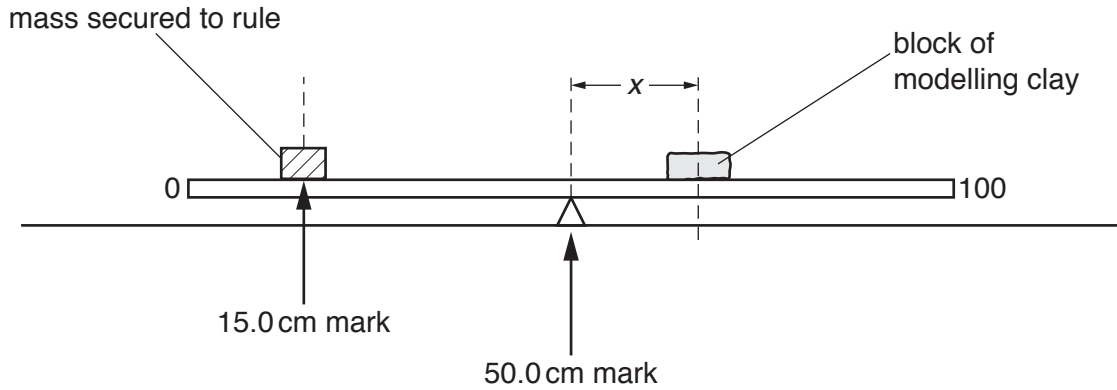
50.0 cm mark

Fig. 5.2

- A mass has been attached securely to the metre rule. Its position is fixed with its centre over the 15.0 cm mark. Do **not** move this mass.

- Place the block of modelling clay on the metre rule.

- Adjust the position of the block of modelling clay until the rule is just balanced.

- Measure and record the distance *x* from the **centre** of the block to the 50.0 cm mark.

x = ... cm [2]

(ii) Calculate the mass *m* of the block of modelling clay. Use the equation shown.

$$m = \frac{1750}{x}$$

m = ... g [1]

(d) (i) State **one** reason why the value for the mass you have calculated in **(c)(ii)** may not be accurate.

....

.... [1]

(ii) Use your answers to **(a)(ii)** and **(c)(ii)** to calculate the density *d* of the modelling clay. Use the equation shown.

$$d = \frac{m}{V}$$

d = ... g / cm^3 [1]

[Total: 10]

6 You are going to investigate how the resistance of a wire depends upon its length.

The circuit shown in Fig. 6.1 has been set up for you.
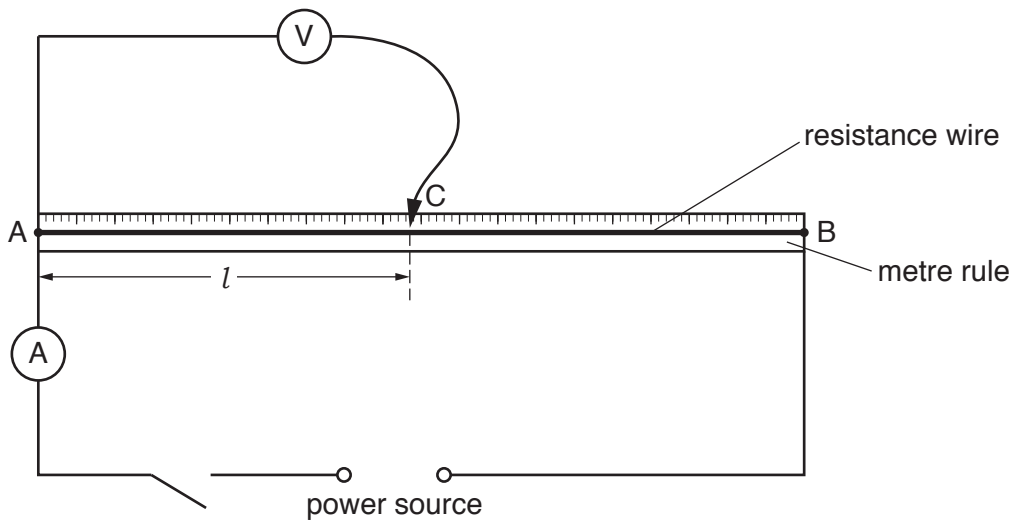
Fig. 6.1

(a) Procedure

- Close the switch.
- Place the sliding contact C on the wire so that the length of wire l = 10.0 cm.
- Measure, and record in Table 6.1, the current I in the wire.
- Measure, and record in Table 6.1, the potential difference V across the wire.
- Open the switch.

Table 6.1

length l /cm	current I /A	potential difference V /V	resistance R /Ω
10.0			
20.0			
30.0			
40.0			
50.0			

[2]

(b) Calculate the resistance of the 10.0 cm length of the wire. Use the equation shown.

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

Record your answer in Table 6.1. [1]

(c) Repeat the procedure in **(a)** and the calculation in **(b)** for values of length l = 20.0 cm, 30.0 cm, 40.0 cm and 50.0 cm. [2]

(d) (i) Plot a graph of R against l. Start your axes from the origin (0, 0).

R/Ω

l/cm
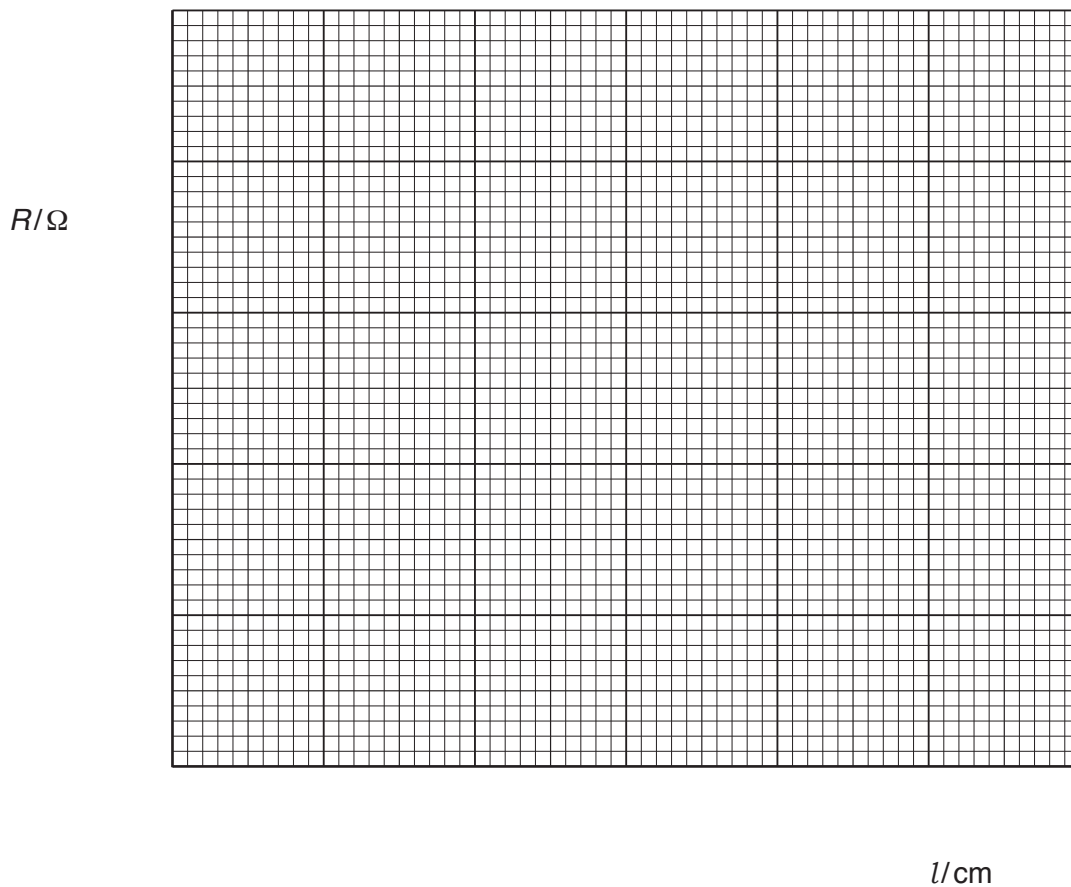
[2]

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

(e) (i) A student states that the resistance R of the wire is directly proportional to its length l.

State whether your graph agrees with this statement.

Justify your answer by referring to the graph you have drawn.

....

.... [1]

(ii) Suggest how you could improve the investigation so that you are more confident about the conclusion in **(e)(i)**.

Do **not** carry out the improvements you suggest.

....

.... [1]

[Total: 10]

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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 (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