Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
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T0278600509

COMBINED SCIENCE **0653/51**

Paper 5 Practical Test **May/June 2022**

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	

This document has **16** pages. Any blank pages are indicated.

DC (LK/JG) 303321/2

[Turn over

1 You are going to investigate the effect of ethanol on cell membranes.

Beetroot cells contain a red colour that comes out of the cells when the cell membranes break. Ethanol can break down the cell membranes.

You are provided with some **ethanol**, **distilled water** and five pieces of **beetroot** of equal size.

Procedure

Step 1 Label five boiling tubes (large test-tubes) **A**, **B**, **C**, **D** and **E**.

Step 2 Use syringes to add 8 cm^3 of ethanol and 2 cm^3 of distilled water to boiling tube **A**.

Step 3 Repeat **Step 2** by adding ethanol and distilled water to boiling tubes **B**, **C**, **D** and **E** using the volumes shown in Table 1.1.

Table 1.1

boiling tube	volume of ethanol / cm^3	volume of distilled water / cm^3
A	8	2
B	6	4
C	4	6
D	2	8
E	0	10

Step 4 On a white tile, cut one piece of beetroot into 10 thin discs as shown in Fig. 1.1.

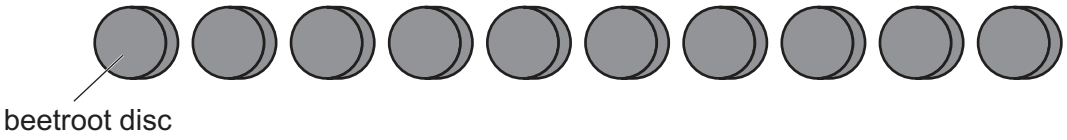

Fig. 1.1

Step 5 Put the 10 discs of cut beetroot into boiling tube **A**.

Step 6 Repeat **Step 4** and **Step 5** for boiling tubes **B**, **C**, **D** and **E**.

Step 7 Start the stop-watch and leave for 10 minutes.

While waiting you can start question 2.

Step 8 After 10 minutes, gently swirl each boiling tube to mix the contents.

(a) Place your five boiling tubes in colour order, from darkest red to lightest red.

Record in Table 1.2 the order of your boiling tubes.

Table 1.2

colour	boiling tube
darkest red ↓	.....
	.....
	.....
	.....
lightest red	.....

[3]

(b) State the relationship between concentration of ethanol and darkness of colour in this experiment.

.....

..... [1]

(c) State why different volumes of water are used in this experiment.

.....

..... [1]

(d) Describe **one** source of error in the procedure.

.....

..... [1]

(e) Identify **one** safety hazard in the procedure and suggest a way to reduce the risk.

safety hazard .....

.....

way to reduce risk .....

.....

[1]

[Total: 7]

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.

Figure 2.1 shows apparatus used to investigate the effect of light intensity (amount of light) on the rate of photosynthesis.

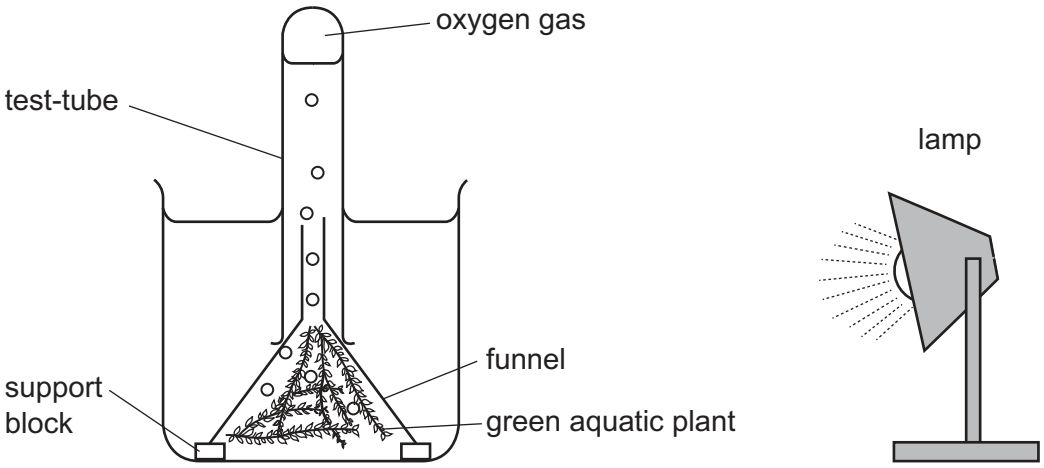

Fig. 2.1

Plan an investigation to find the relationship between light intensity and the rate of photosynthesis.

You are provided with the apparatus in Fig. 2.1.

You may also use any other common laboratory apparatus.

You are not required to do this investigation.

In your plan, include:

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

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

.....

.....

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.....

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.....

.....

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.....

.....

..... [7]

3 You are going to investigate some reactions of dilute sulfuric acid.

(a) Procedure

Step 1 Add approximately 2 cm depth of dilute sulfuric acid to a test-tube.

Step 2 Add approximately 1 cm depth of dilute nitric acid followed by approximately 1 cm depth of aqueous barium nitrate to the test-tube.

(i) Describe your observations.

.....

..... [1]

(ii) Name the negative ion (anion) present in dilute sulfuric acid.

..... [1]

(b) Procedure

Step 1 Add approximately 2 cm depth of dilute sulfuric acid to a boiling tube (large test-tube).

Step 2 Add a small spatula load of solid sodium hydrogencarbonate to the boiling tube.

Describe your observations.

.....

..... [2]

(c) Procedure

Step 1 Add approximately 5 cm depth of dilute sulfuric acid to a clean test-tube.

Step 2 Add one piece of magnesium to the test-tube.

The mixture fizzes.

(i) Test the gas made with a lighted splint.

Name the gas made.

observation with lighted splint .....

name of gas .....
[1]

(ii) Procedure

Step 1 Add approximately 5 cm depth of dilute sulfuric acid to a clean boiling tube.

Step 2 Add one piece of magnesium into the dilute sulfuric acid and immediately start the stop-watch.

Step 3 Stop the stop-watch when the mixture stops fizzing.

Record to the nearest second this time in seconds.

time = ... s [2]

(d) Procedure

Step 1 Add approximately 5 cm depth of dilute sulfuric acid to a clean boiling tube.

Step 2 Measure the temperature of the dilute sulfuric acid.

(i) Record this temperature in Table 3.1. [1]

Table 3.1

temperature of dilute sulfuric acid / °C	
temperature of reaction mixture / °C	
temperature increase / °C	

(ii) Step 3 Add approximately 5 cm depth of aqueous sodium hydroxide to the acid in the boiling tube.

Step 4 Stir the mixture with the thermometer for approximately 20 seconds.

Step 5 Measure the temperature of the reaction mixture.

Record this temperature in Table 3.1. [1]

(iii) Calculate the temperature increase.

Record your answer in Table 3.1. [1]

(iv) The temperature increase is not as large as expected.

This is because some thermal energy (heat) is transferred into the air.

Suggest a change in the **apparatus** or an addition to the **apparatus** that reduces this loss in thermal energy (heat).

.....

..... [1]

(v) Suggest why the reaction mixture is stirred before its temperature is recorded.

.....

..... [1]

(vi) Suggest why it is better to repeat the experiment and calculate the average temperature increase.

.....

..... [1]

[Total: 13]

4 You are going to use a spring to determine the mass of an unknown object **O**.

The apparatus shown in Fig. 4.1 has been set up for you.

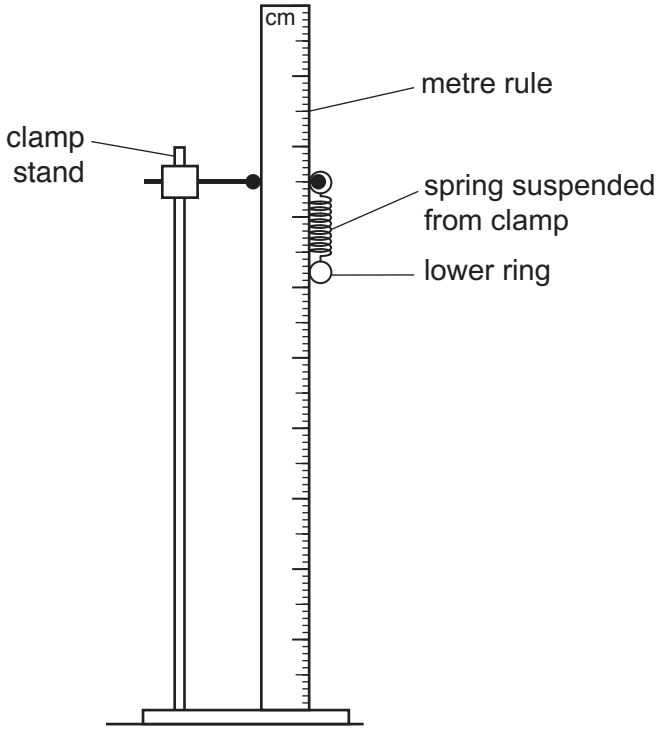


Fig. 4.1

(a) Record the reading r_0 on the metre rule at the bottom of the spring. (Do not include the lower ring.)

Give your answer in centimetres to the nearest 0.1 cm.

r_0 = ... cm [1]

(b) (i) Procedure

Step 1 Add a mass m = 100 g to the spring.

Step 2 Record in Table 4.1 the reading r_l on the metre rule at the bottom of the spring.

Step 3 Remove the mass from the spring. [1]

Table 4.1

m / g	r_l / cm	e / cm
100		
200		
300		
400		
500		

(ii) Describe how you avoid line-of-sight (parallax) errors when taking the reading at the bottom of the spring.

.....

..... [1]

(iii) Repeat the procedure in **(b)(i)** with values of mass m = 200 g, 300 g, 400 g and 500 g. [2]

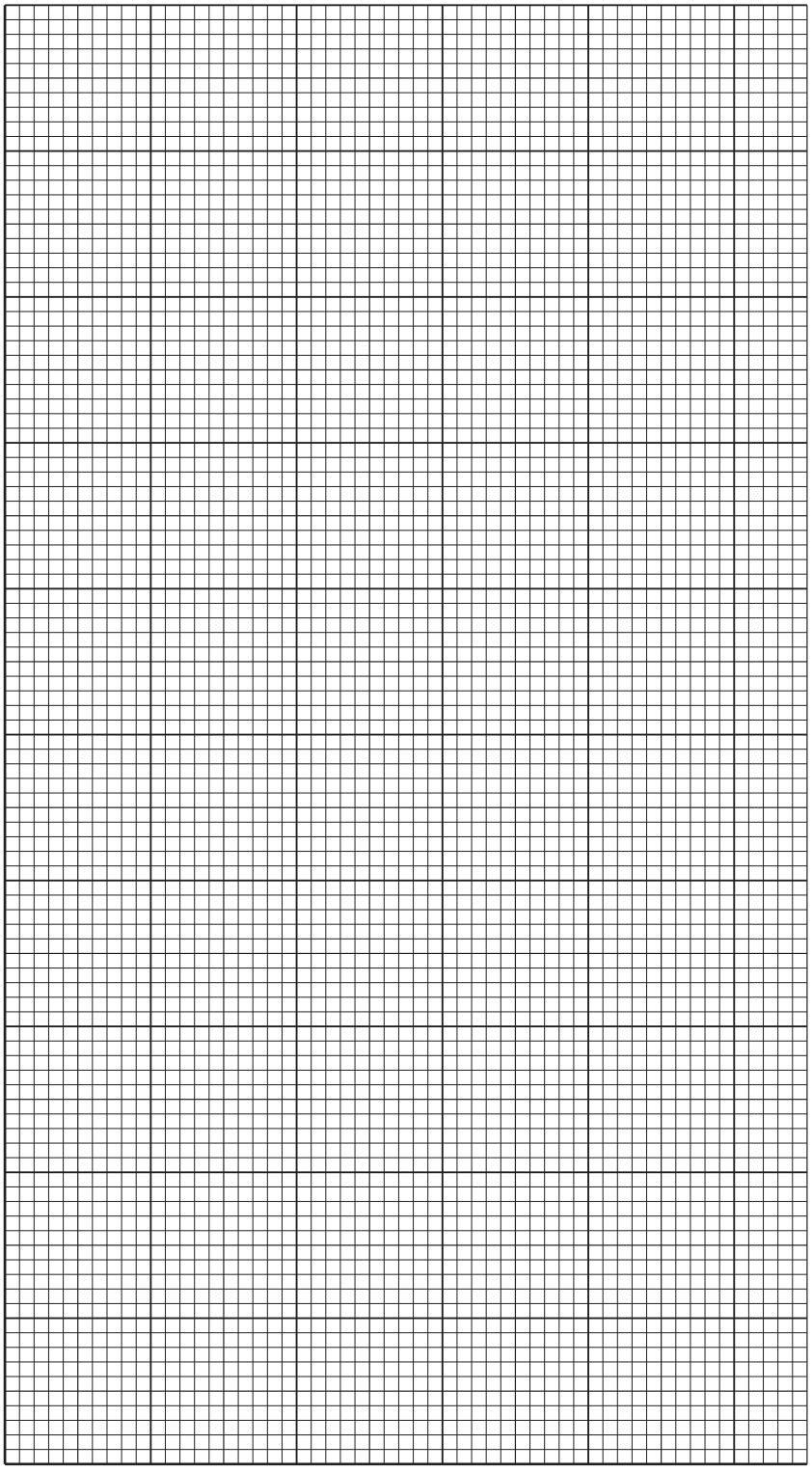
(iv) Calculate the extension e of the spring for each mass m added to the spring.

Use the equation shown.

$$e = r_l - r_0$$

Record your values in Table 4.1. [1]

(c) **(i)** Plot a graph of extension *e* (vertical axis) against mass *m*.



[3]

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

(d) (i) Suspend the object **O** from the spring and measure r_l .

r_l = ... cm

Calculate the extension e of the spring caused by **O**.

e = ... cm
[1]

(ii) Use your graph to determine the mass of **O**.

Show on your graph how you found the mass.

mass of **O** = ... g [2]

[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(II) (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