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Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

COMBINED SCIENCE **0653/61**

Paper 6 Alternative to Practical **May/June 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 **16** pages. Any blank pages are indicated.

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1 A student investigates 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.

The student is given five pieces of beetroot of equal size.

Procedure

The student:

- sets up five test-tubes containing the volumes of ethanol and distilled water shown in Table 1.1

Table 1.1

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

- uses a sharp knife to cut each piece of beetroot into 10 thin discs as shown in Fig. 1.1

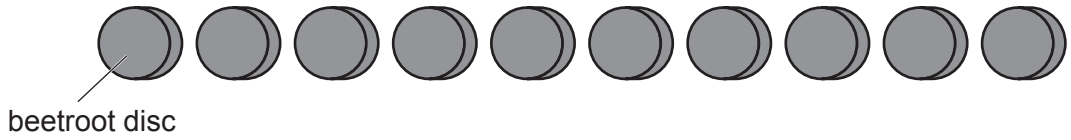

Fig. 1.1

- puts 10 discs of cut beetroot into each test-tube and starts a stop-watch
- waits 10 minutes and then gently swirls each test-tube to mix the contents.

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Fig. 1.2 shows the student's test-tubes after 10 minutes.

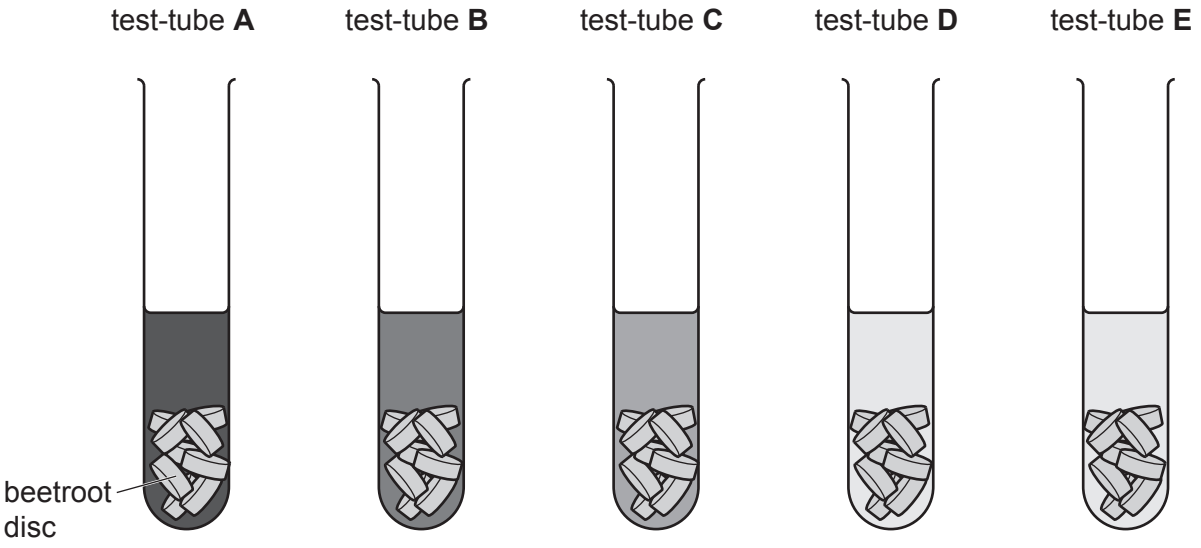

Fig. 1.2

(a) Use Fig. 1.3 to judge the darkness of the colour of the solution in each test-tube.

Fig. 1.3

Record in Table 1.1 the colour score for each test-tube. [3]

(b) State the relationship between concentration of ethanol and colour score.

Use the information in Table 1.1 to help you.

.....

..... [1]

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

.....

..... [1]

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[Turn over

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(d) In the procedure, the student uses different syringes to measure the ethanol and the water.

Explain why different syringes are used.

.....

..... [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]

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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.

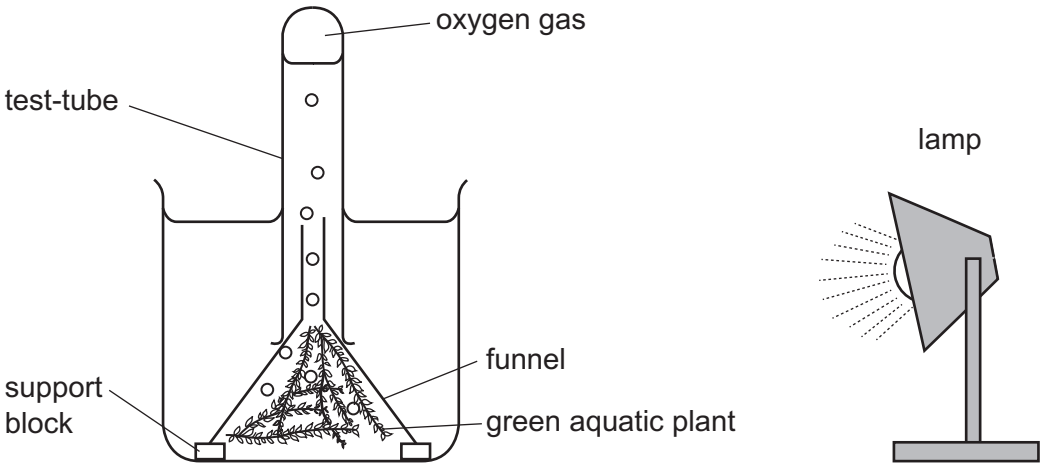

Fig. 2.1

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.

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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..... [7]

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3 A student investigates some reactions of dilute sulfuric acid.

(a) Procedure

The student:

- adds dilute sulfuric acid to a test-tube
- adds dilute nitric acid to the test-tube
- adds aqueous barium nitrate to the test-tube.

The student observes a white precipitate.

(i) Tick (✓) the box to identify the negative ion (anion) present in dilute sulfuric acid.

carbonate	
chloride	
nitrate	
sulfate	

[1]

(ii) The student separates the insoluble white precipitate from the reaction mixture.

Draw a labelled diagram to show the assembled apparatus the student uses.

Include labels for the precipitate and the filtrate.

[3]

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(b) Procedure

The student:

- adds dilute sulfuric acid to a test-tube
- adds magnesium to the test-tube and starts a stop-watch
- stops timing when the mixture stops fizzing.

The mixture makes a gas that gives a squeaky pop with a lighted splint.

(i) Name the gas made.

..... [1]

(ii) Fig. 3.1 shows the reading on the stop-watch.

Fig. 3.1

Record, to the nearest second, the reading on the stop-watch.

time = ... s [2]

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(c) Procedure

The student:

- adds dilute sulfuric acid to a test-tube
- records the temperature of the dilute sulfuric acid
- adds aqueous sodium hydroxide to the dilute sulfuric acid
- stirs the mixture
- records the temperature of the reaction mixture.

Fig. 3.2 shows the two thermometer readings.

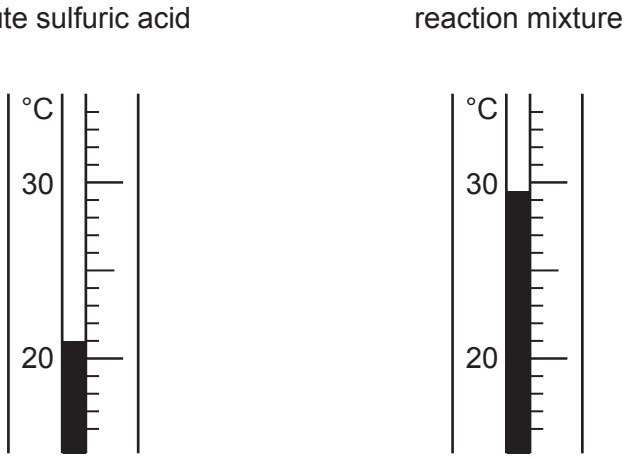

Fig. 3.2

(i) Record in Table 3.1 the thermometer reading of the dilute sulfuric acid to the nearest 0.5 °C.

Table 3.1

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

[1]

(ii) Record in Table 3.1 the thermometer reading of the reaction mixture to the nearest 0.5 °C. [1]

(iii) Calculate the temperature increase.

Record your answer in Table 3.1. [1]

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(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]

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4 A student uses a spring to determine the mass of an unknown object **U**.

The apparatus is shown in Fig. 4.1.

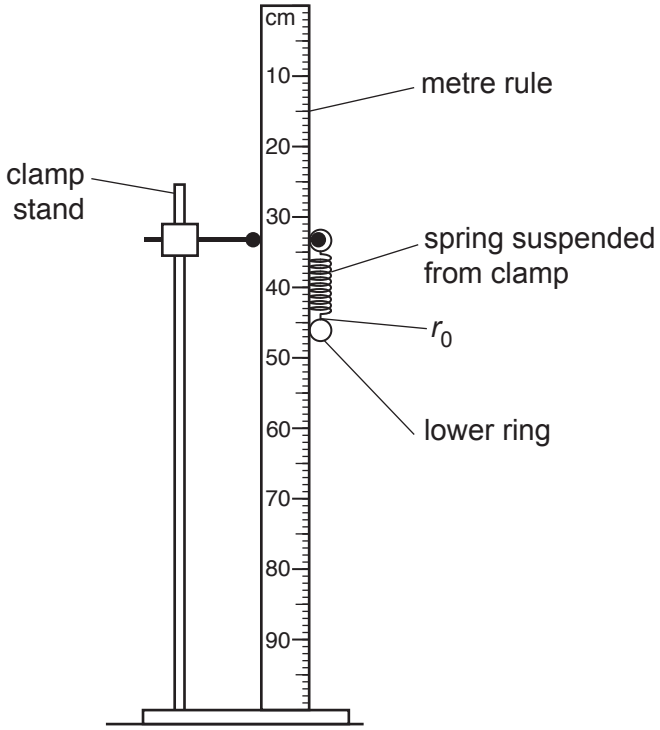

Fig. 4.1

(a) The student records the reading r_0 on the metre rule at the bottom of the spring (not including the lower ring).

The reading r_0 = 44.5 cm.

Procedure

The student:

- adds a mass m = 100 g to the spring
- records in Table 4.1 the reading r_1 on the metre rule at the bottom of the spring
- removes the mass from the spring.

The student repeats the procedure using masses m = 200 g, 300 g, 400 g and 500 g.

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(i) Fig. 4.2 shows part of the metre rule when the 100 g mass is suspended from the spring.

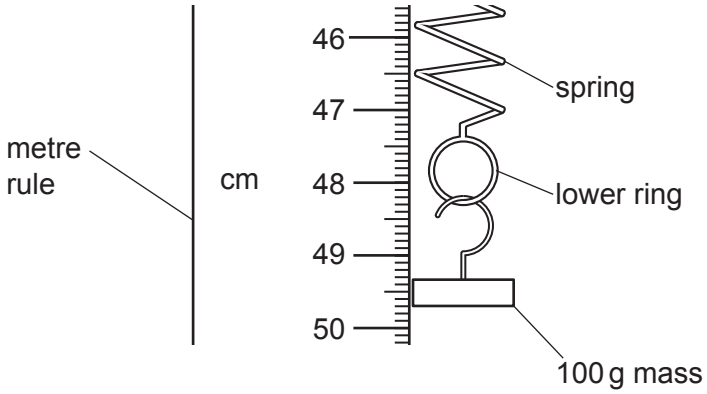

Fig. 4.2

Record in Table 4.1 the reading r_l on the metre rule at the bottom of the spring. (Do not include the lower ring.)

Table 4.1

m / g	r_l / cm	e / cm
100		
200	51.1	6.6
300	55.0	10.5
400	58.8	14.3
500	62.6	18.1

[2]

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

.....

..... [1]

(b) Calculate the extension e of the spring when the 100 g mass is suspended from the spring.

Use the equation shown.

$$e = r_l - r_0$$

Record the extension in Table 4.1. [1]

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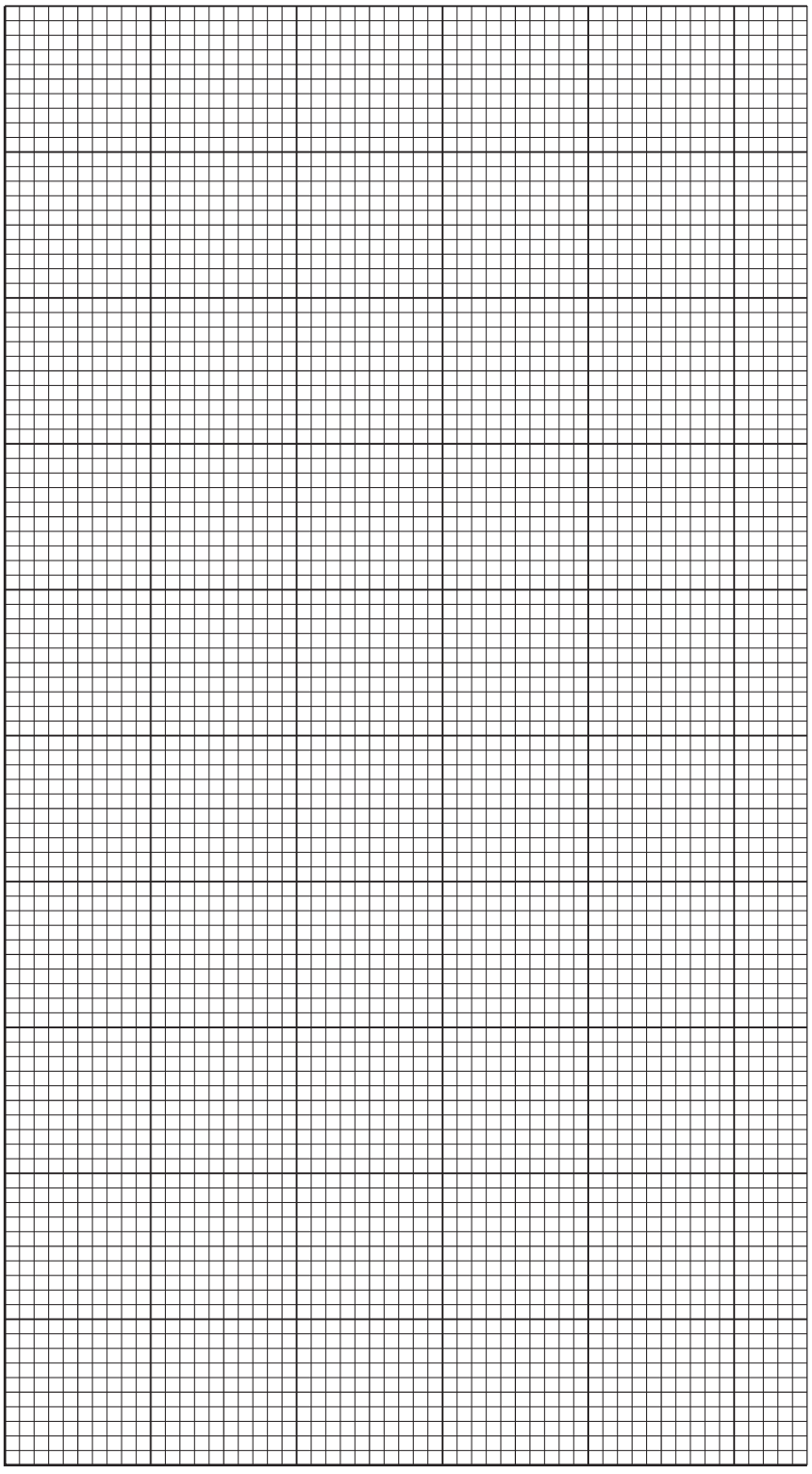
(c) (i) Plot a graph of extension *e* (vertical axis) against mass *m*.



[3]

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

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(d) Next, the student uses the spring to determine the mass of the object **U**.

The teacher states that the student should check that the reading r_0 is still 44.5 cm before suspending object **U** from the spring.

(i) Explain why the student checks this reading.

.....

..... [1]

(ii) The student suspends object **U** from the spring.

Fig. 4.3 shows the new position r_l of the bottom of the spring.

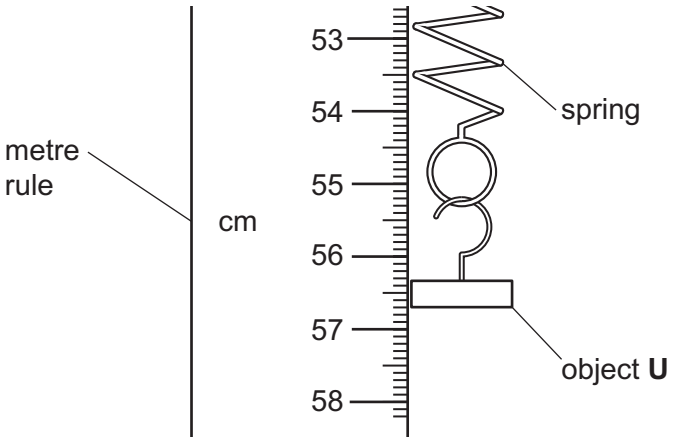

Fig. 4.3

Use Fig. 4.3 to determine the value of r_l.

r_l = ... cm [1]

(iii) Calculate the extension e with object **U** suspended from the spring.

e = ... cm [1]

(iv) Use your graph to find the mass of object **U**.

Show on your graph how you found the mass.

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

[Total: 13]

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