Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

4154711332

COMBINED SCIENCE **0653/61**

Paper 6 Alternative to Practical **May/June 2019**

1 hour

Candidates answer on the Question Paper.

No Additional Materials are required.

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.

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.

This document consists of **13** printed pages and **3** blank pages.

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Cambridge Assessment International Education

1 A student investigates the nutrient content of an apple.

(a) Fig. 1.1 shows a photograph of the cut surface of an apple.

Fig. 1.1

(i) In the box, make an enlarged detailed drawing of the cut surface of the apple.

[2]

(ii) Use a ruler to measure your drawing, in millimetres, at its widest point and record this value.

width of apple in drawing = ... mm

Measure the same distance on the photograph in Fig. 1.1 and record this value.

width of apple from photograph = ... mm
[1]

(iii) Calculate the magnification of your drawing.

Show your working.

magnification of drawing = ... [1]

(b) Describe how you would test this fruit to show the presence of reducing sugar. Include the observation that shows a positive result.

test ....

....

....

....

....

observation for a positive result ....

.... [3]

[Total: 7]

2 Fig. 2.1 shows a cut stem of the water plant *Elodea* placed in a beaker of water. When light shines on the *Elodea* it photosynthesises, and bubbles of gas are produced.

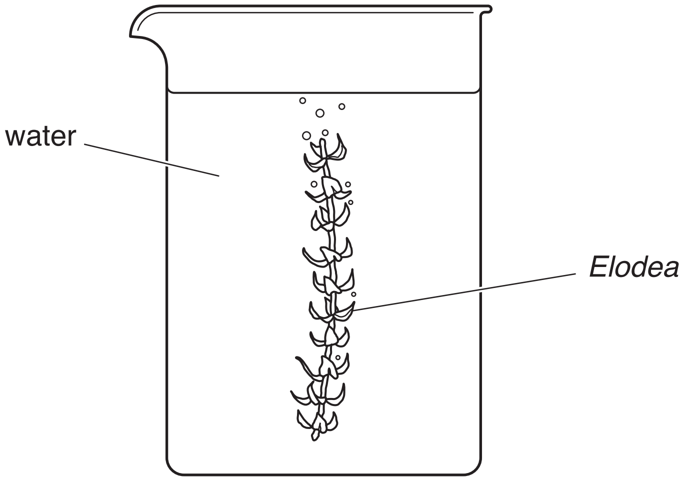

Fig. 2.1

Plan an investigation to find out how the rate of photosynthesis of *Elodea* is affected by the brightness of the light.

In your answer, include:

- the apparatus needed, including a labelled diagram if you wish
- a brief description of the method, including how you will treat variables and any safety precautions
- the measurements you will make
- how you will process your results
- how you will use your results to draw a conclusion.

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.... [7]

3 A student investigates the temperature change which occurs when aqueous copper(II) sulfate reacts separately with excess magnesium and with excess zinc.

(a) Method

1. Using a measuring cylinder the student places 25 cm^3 aqueous copper(II) sulfate into a small glass beaker.

2. She measures the temperature of the aqueous copper(II) sulfate and records it in Table 3.1 to the nearest 0.5 °C for time = 0.

3. She starts the stop-clock and immediately adds 2 g magnesium powder, an excess, to the beaker and stirs.

4. She measures the temperature every 30 seconds for 4 minutes. She records the temperatures, to the nearest 0.5 °C, in Table 3.1.

Table 3.1

reaction with magnesium	
time / min	temperature / °C
0	20.0
0.5	
1.0	47.0
1.5	60.0
2.0	60.0
2.5	58.0
3.0	56.5
3.5	
4.0	53.0

Fig. 3.1 shows the thermometer scales for the temperatures at 0.5 and 3.5 minutes.

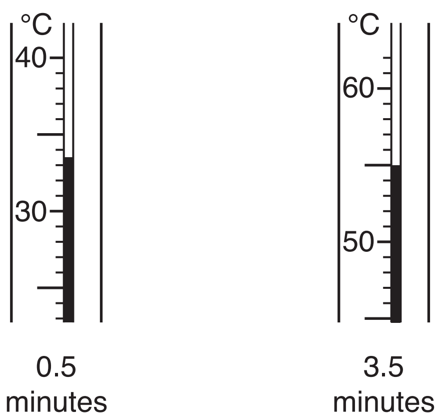
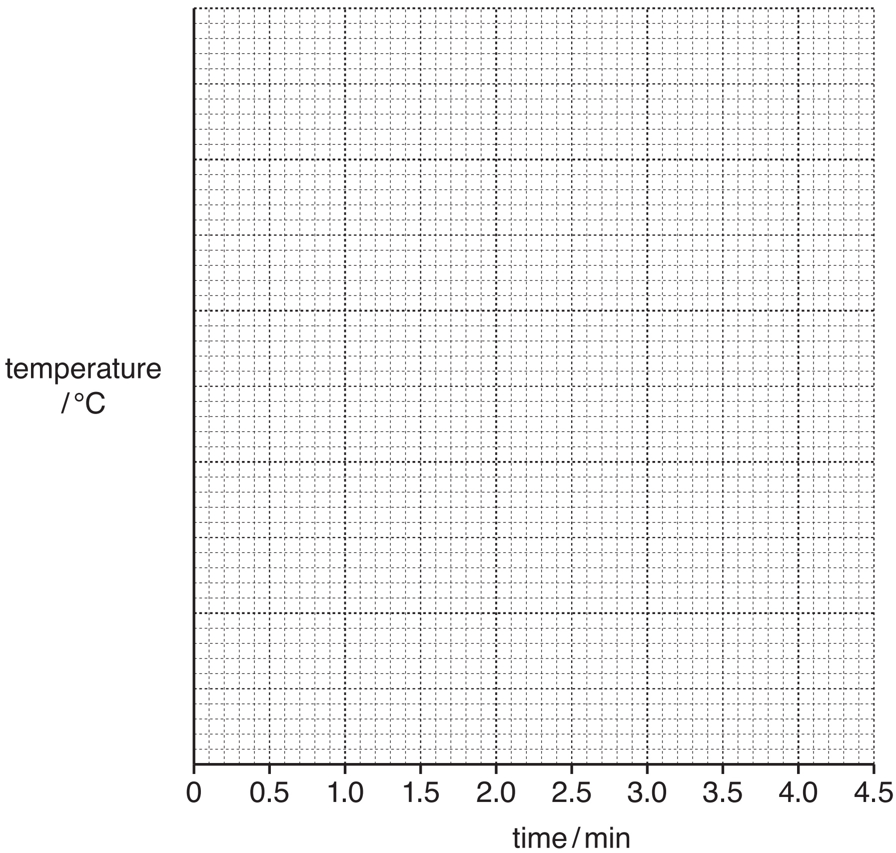


Fig. 3.1

Read the temperatures to the nearest 0.5 °C and record them in Table 3.1. [2]

(b) **(i)** On the grid provided plot a graph of temperature (vertical axis) against time.



[2]

(ii) Draw a best-fit straight line for the **increasing** temperatures. Extend the line further than the highest point. Label the line magnesium.

Draw a best-fit line through the **decreasing** temperatures. Extend the line back past the highest point. [1]

(iii) The maximum temperature reached by the reaction is where the two lines cross.

State the maximum temperature reached by the reaction.

maximum temperature = ... °C [1]

(c) Suggest a value for the maximum temperature reached if 5 g magnesium powder is reacted with 25 cm^3 of the same copper(II) sulfate solution.

maximum temperature = ... °C [1]

(d) She then repeats the experiment using 2 g zinc powder, an excess, instead of magnesium powder.

She records the temperatures in Table 3.2.

Table 3.2

reaction with zinc	
time / mins	temperature / °C
0	20.0
0.5	29.5
1.0	38.0
1.5	45.0
2.0	45.0
2.5	
3.0	41.5
3.5	40.0
4.0	38.0

(i) Fig. 3.2 shows the thermometer scale for the temperature at 2.5 minutes.

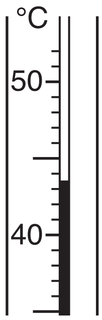


Fig. 3.2

Read the temperature to the nearest 0.5 °C and record it in Table 3.2. [1]

(ii) Repeat **(b)** for the results for zinc. Draw the graph on the same grid as that used for magnesium.
Label this graph zinc.

State the maximum temperature reached by this reaction.

maximum temperature = ... °C [2]

(e) Suggest why the maximum temperature for magnesium is different from the maximum temperature for zinc.

....

.... [1]

(f) **(i)** State the name of a piece of apparatus which could be used to measure the volume of copper(II) sulfate more accurately.

.... [1]

(ii) Suggest **and** explain **one** other improvement to the **apparatus** that would increase the accuracy of the maximum temperature for the reactions.

improvement ....

explanation ....

.... [1]

[Total: 13]

4 A student calculates the density of a liquid using two different methods.

Method 1

(a) He measures the mass m_c of an empty measuring cylinder.

$$m_c = 102.31\,g$$

He adds approximately 75 cm^3 of the liquid to the measuring cylinder.

(i) Fig. 4.1 shows part of the measuring cylinder scale.

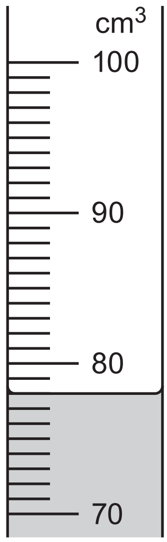


Fig. 4.1

Read and record the volume V_L of the liquid to the nearest 0.5 cm^3.

V_L = ... cm^3 [1]

(ii) State how parallax (line of sight) errors are avoided when using a measuring cylinder.

....

.... [1]

(iii) He measures and records the total mass of the measuring cylinder and liquid.

total mass = 189.00 g

Determine the mass m_L of the liquid. Use the equation shown.

$$m_L = \text{total mass} - m_c$$

m_L = ... g [1]

(iv) Calculate the density ρ_L of the liquid. Use your answers in **(a)(i)** and **(a)(iii)** and the equation shown.

Record your answer to a suitable number of significant figures.

$$\rho_L = \frac{m_L}{V_L}$$

ρ_L = ... g/cm^3 [2]

Method 2

(b) (i) The student measures the mass m_t of a test-tube. Fig. 4.2 shows the balance reading.

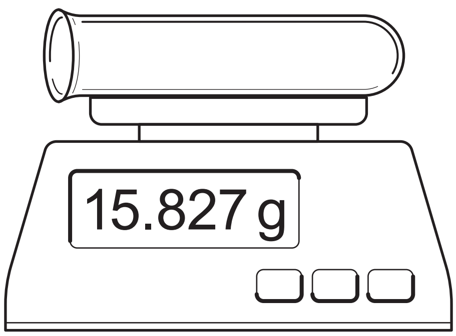


Fig. 4.2

Read and record the mass of the test-tube to the nearest 0.01 g.

m_t = ... g [1]

(ii) He also measures the length l_t and the diameter d_t of the test-tube. His results are shown in Fig. 4.3.

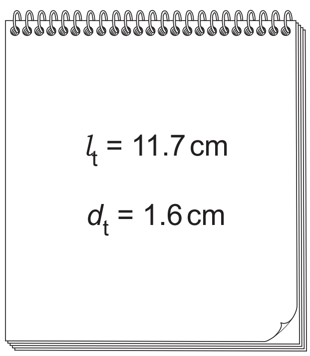


Fig. 4.3

Use the student's values of l_t and d_t to calculate the volume V_t of the test-tube. Use the equation shown:

$$V_t = 0.79 \times d_t^2 \times l_t$$

V_t = ... cm^3 [1]

(iii) Calculate the density ρ_t of the test-tube. Use your answers to **(b)(i)** and **(b)(ii)** and the equation shown:

$$\rho_t = \frac{m_t}{V_t}$$

ρ_t = ... g/cm^3 [1]

(iv) The student lowers the test-tube into a measuring cylinder containing the liquid until it floats, as shown in Fig. 4.4.

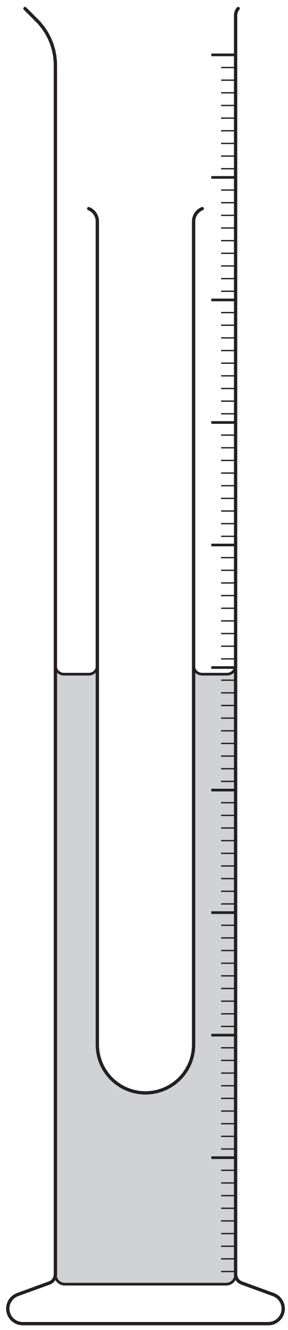


Fig. 4.4

Use a ruler to measure the length l_b of the test-tube, to the nearest 0.1 cm, that is below the surface of the liquid.

l_b = ... cm [1]

(v) Calculate the density ρ_L of the liquid. Use the data in **(b)(ii)** and your answers to **(b)(iii)** and **(b)(iv)** and the equation shown:

$$\rho_L = \frac{\rho_t \times l_t}{l_b}$$

ρ_L = ... g/cm^3 [1]

(c) Compare the values of ρ_L that you calculated in **(a)(iv)** and **(b)(v)**.

State whether your two values of ρ_L agree, within the limits of experimental error. Explain your answer with reference to the data.

....

.... [1]

(d) **Method 2** assumes that the test-tube is a perfect cylinder.

(i) Use Fig. 4.4 to explain why this assumption is incorrect.

....

.... [1]

(ii) State what effect this assumption will have on:

1. the calculated volume V_t of the test-tube

....

....

2. the calculated value of the density ρ_L of the liquid.

....

....
[1]

[Total: 13]

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