Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

8111871361

COMBINED SCIENCE **0653/53**

Paper 5 Practical Test **May/June 2019**

1 hour 15 minutes

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 12.

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	
Total	

This document consists of **12** printed pages.

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Cambridge Assessment International Education

[Turn over

1 You are going to investigate the nutrient content of an apple.

(a) You are provided with half of an apple, **A**.

(i) Remove the plastic film from the apple.

In the box, make a large 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 half apple, **A**, and record this value.

width of apple **A** = ... mm
[1]

(iii) Calculate the magnification of your drawing.

Show your working.

magnification of drawing = ... [1]

(b) • Place the half apple, **A**, on the white tile. Use the knife, with care, to cut two small cubes of apple. The cubes must be small enough to fit into the test-tubes provided.

- Place one cube into a test-tube and add two drops of iodine solution.
- Place the second cube into another test-tube and add about 1 cm^3 of Benedict's solution. Heat in a water bath for five minutes.

(i) Record your observations.

colour observed after adding iodine solution ....

colour observed after heating with Benedict's solution ....
[2]

(ii) State the conclusions about the nutrient content of an apple that can be made from your observations.

....

.... [1]

[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.

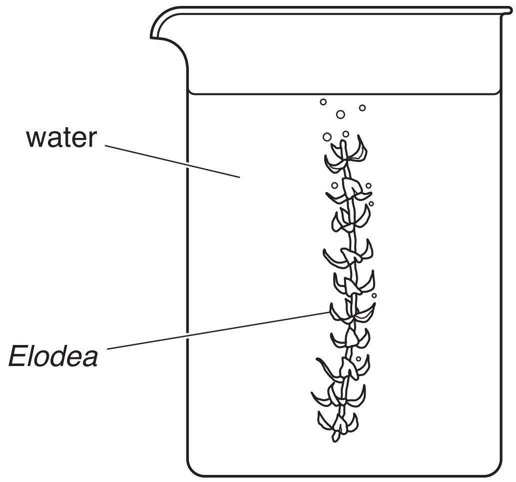

Fig. 2.1

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

You are not required to carry out this investigation.

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 You are going to investigate the temperature changes which occur when aqueous copper(II) sulfate reacts separately with excess magnesium and with excess zinc.

(a) Method

1. Use a measuring cylinder to place 25 cm^3 aqueous copper(II) sulfate into the small beaker.
2. Measure the temperature of the aqueous copper(II) sulfate. Record this temperature in Table 3.1 to the nearest 0.5 °C for time = 0.
3. Start the stop-clock and immediately add 2 g magnesium powder, an excess, to the beaker and stir.
4. Measure the temperature every 30 seconds for 5 minutes. Record these temperatures, to the nearest 0.5 °C, in Table 3.1.
5. Pour the mixture into the waste container.
6. Rinse the small beaker with distilled water.

[2]

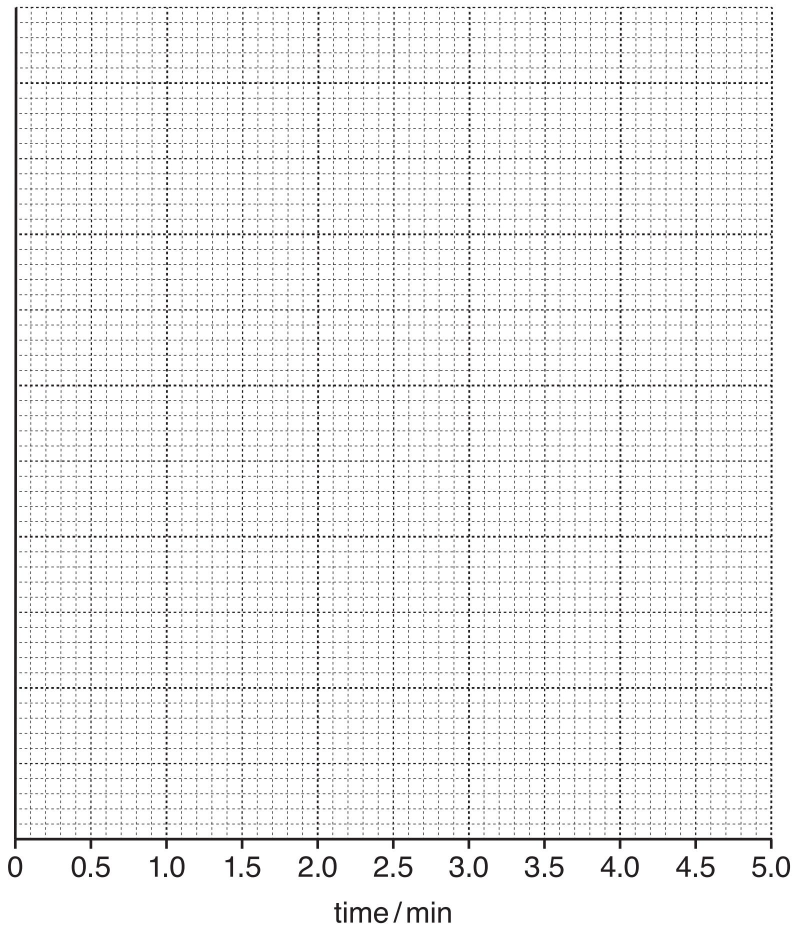
Table 3.1

reaction with magnesium	
time / min	temperature / °C
0	
0.5	
1.0	
1.5	
2.0	
2.5	
3.0	
3.5	
4.0	
4.5	
5.0	

Table 3.2

reaction with zinc	
time / min	temperature / °C
0	
0.5	
1.0	
1.5	
2.0	
2.5	
3.0	
3.5	
4.0	
4.5	
5.0	

(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 only. Extend the line further than the highest point. Label the line magnesium.

Draw a best-fit line through the **decreasing** temperatures only. 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) **(i)** Repeat steps 1 to 6 in **(a)** using 2 g zinc, an excess, instead of magnesium.

Record the temperatures in Table 3.2. [2]

(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) Suggest and explain **one** improvement to the **apparatus** which would increase the accuracy of the maximum temperature.

improvement ....

....

explanation ....

.... [1]

[Total: 13]

4 You are going to calculate the density of a liquid using two different methods.

You are provided with a balance, a measuring cylinder, a beaker containing liquid **L** and a test-tube.

Method 1

(a) **(i)** Measure and record the mass m_c of the measuring cylinder to the nearest 0.01 g.

m_c = ... g [1]

(ii) Add approximately 75 cm^3 of liquid **L** to the measuring cylinder.

Record the exact volume V_L of liquid **L** to the nearest 0.5 cm^3.
Keep the liquid in the measuring cylinder for **(b)**.

V_L = ... cm^3 [1]

(iii) Measure and record the total mass of the measuring cylinder and liquid **L**.

total mass = ... g [1]

(iv) Determine the mass m_L of liquid **L**. Use your answers to **(a)(i)** and **(a)(iii)** and the equation shown:

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

m_L = ... g [1]

(v) Calculate the density ρ_L of liquid **L**. Use your answers to **(a)(ii)** and **(a)(iv)** and the equation shown:

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

ρ_L = ... g / cm^3 [1]

Method 2

(b) **(i)** Measure and record the mass m_t of the test-tube to the nearest 0.01 g.

m_t = ... g [1]

(ii) Measure the length l_t of the test-tube and the internal diameter d_t of the test-tube each to the nearest 0.1 cm.

l_t = ... cm

d_t = ... cm [1]

(iii) Calculate the approximate volume V_t of the test-tube. Use your answers to **(b)(ii)** and the equation shown:

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

V_t = ... cm^3 [1]

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

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

ρ_t = ... g/cm^3 [1]

(v) Carefully lower the test-tube into the measuring cylinder of liquid **L** from **(a)** until the test-tube is floating as shown in Fig. 4.1.

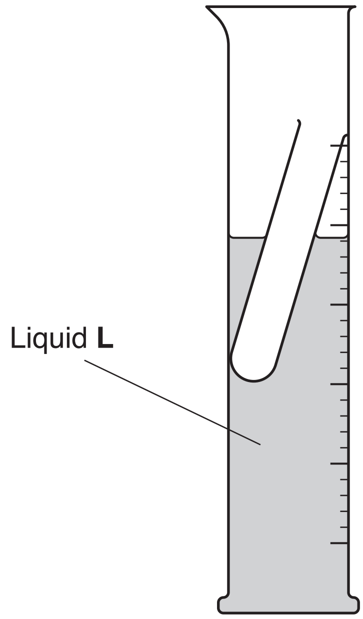


Fig. 4.1

Measure the length of the test-tube l_w that is below the surface of the liquid.
You will need to support the test-tube very gently in an upright position to take this measurement.

l_w = ... cm [1]

(vi) Calculate the density ρ_L of liquid **L**. Use your answers to **(b)(ii)**, **(b)(iv)** and **(b)(v)** and the equation shown:

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

ρ_L = ... g/cm^3 [1]

(c) Compare your values of ρ_L in **(a)(v)** and **(b)(vi)**.

Suggest whether your two values of ρ_L agree within the limits of experimental error. Explain your answer.

....

....

.... [1]

(d) Suggest **one** practical difficulty in **method 2** that makes it difficult to get an accurate answer for the density of the liquid.

....

....

.... [1]

[Total: 13]

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