Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

6913568660

COMBINED SCIENCE **5129/32**

Paper 3 Experimental Skills and Investigations **May/June 2023**

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.

DC (DE/SG) 315746/3

[Turn over

1 A student investigates leaves from a tree.

During photosynthesis, the leaf produces glucose and converts some of the glucose to starch.

(a) The student tests a sample of leaf tissue for the presence of glucose and starch.

(i) State the name of the chemical the student uses to test for starch.

..... [1]

(ii) The student uses Benedict's solution to confirm the presence of glucose.

State the colour change.

colour of solution before the test .....

colour of solution that confirms the presence of glucose .....
[2]

(b) Amylase is a protein found in leaves.

The student now tests a colourless extract of the leaf tissue for the presence of amylase.

State the name of the test that the student uses to confirm the presence of the protein amylase and describe a positive result for this test.

test .....

positive result of test .....

.....
[2]

(c) Fig. 1.1 shows a photograph of a leaf from the tree.

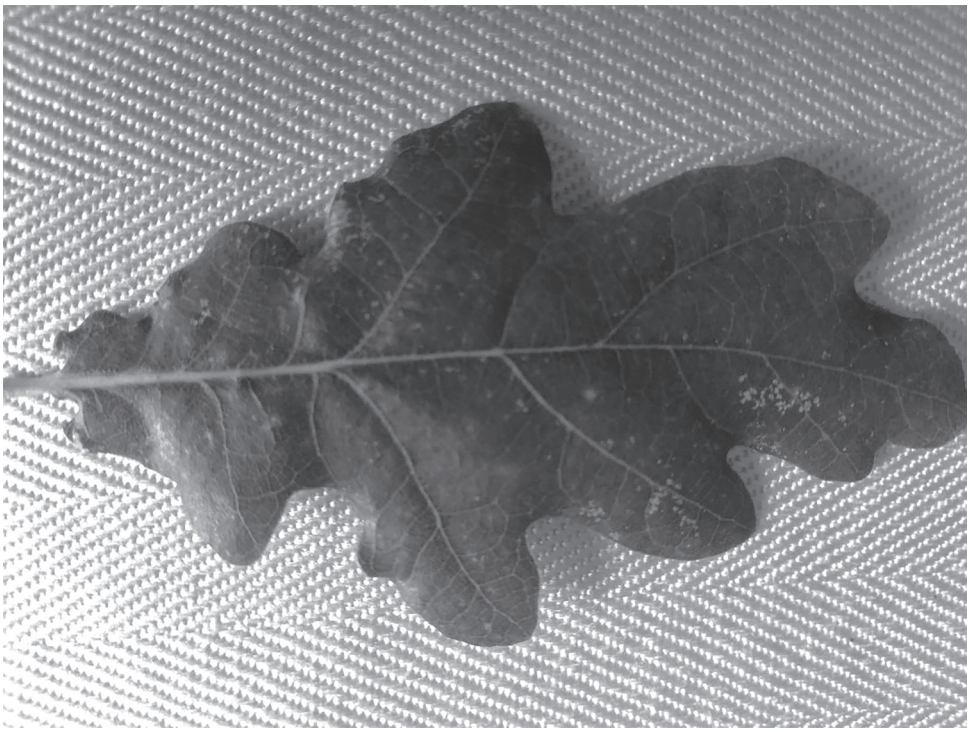


Fig. 1.1

(i) Make a **large** drawing of the leaf shown in Fig. 1.1.

[4]

(ii) The leaves are eaten by caterpillars.

Fig. 1.2 shows a student's drawing of a caterpillar.

Line AB shows the length of the drawing of the caterpillar.

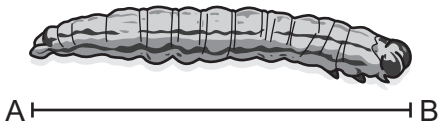


Fig. 1.2

Measure and record the length of the line AB on Fig. 1.2.

length of line AB = ... mm [1]

(iii) The actual length of the caterpillar is 75 mm.

Calculate the magnification of the student's drawing using the equation:

$$\text{magnification} = \frac{\text{length of line AB}}{\text{actual length of the caterpillar}}$$

magnification = × ..... [1]

[Total: 11]

2 A student investigates the relationship between temperature and mass of magnesium added to dilute hydrochloric acid.

The apparatus used is shown in Fig. 2.1.

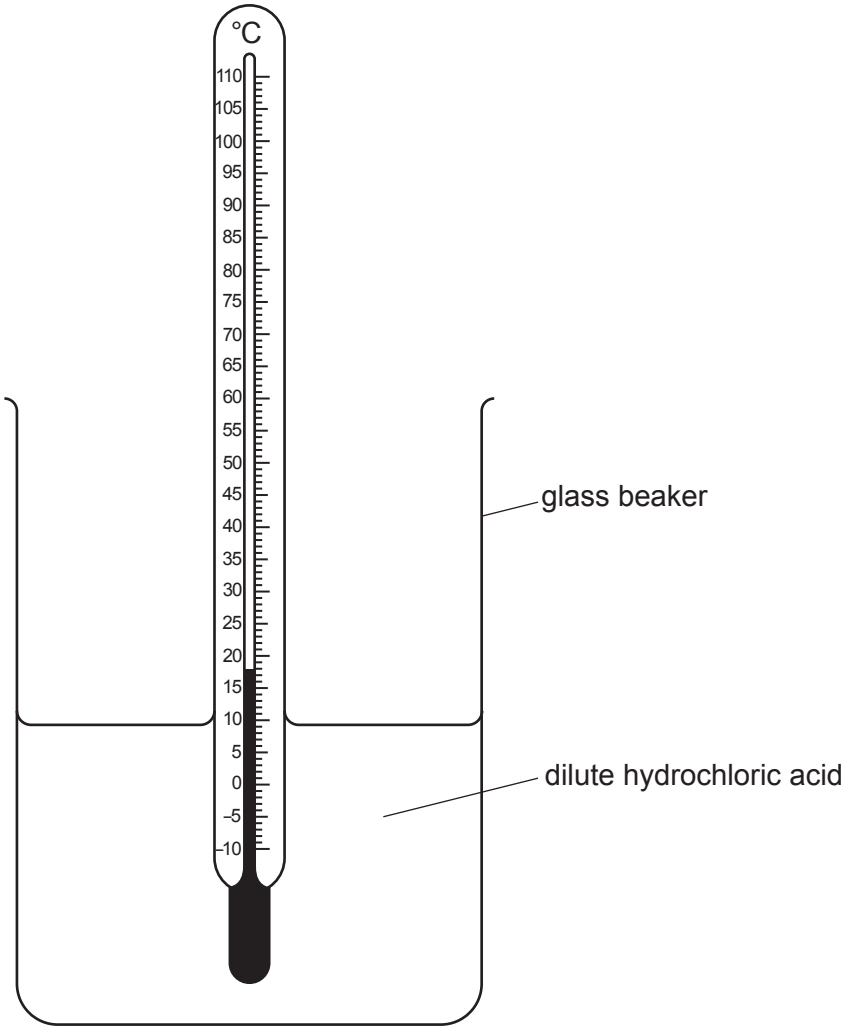


Fig. 2.1

The student:

- measures 50 cm^3 of dilute hydrochloric acid and pours it into the beaker
- measures the initial temperature of the acid
- adds 0.20 g of magnesium to the acid
- records the final temperature of the mixture after 5 minutes
- repeats the experiment using different masses of magnesium.

(a) Name the apparatus used to measure the temperature.

..... [1]

(b) Table 2.1 shows the results.

Table 2.1

mass of magnesium / g	initial temperature / °C	final temperature / °C	temperature change / °C
0.00	.....	.....	.....
0.20	19	28	9
0.40	20	23	3
0.60	17	48	.....
0.80	20	55	35
1.20	19	69	50
1.40	20	70	50
1.60	18	68	50

(i) Fig. 2.2 shows the temperature of the acid **before** any magnesium is added.

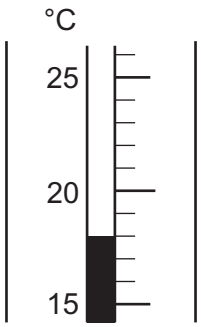


Fig. 2.2

Use the information shown in Fig. 2.2 to complete the row of results for 0.00 g magnesium in Table 2.1. [1]

(ii) Complete Table 2.1 by calculating the temperature change for 0.60 g of magnesium. [1]

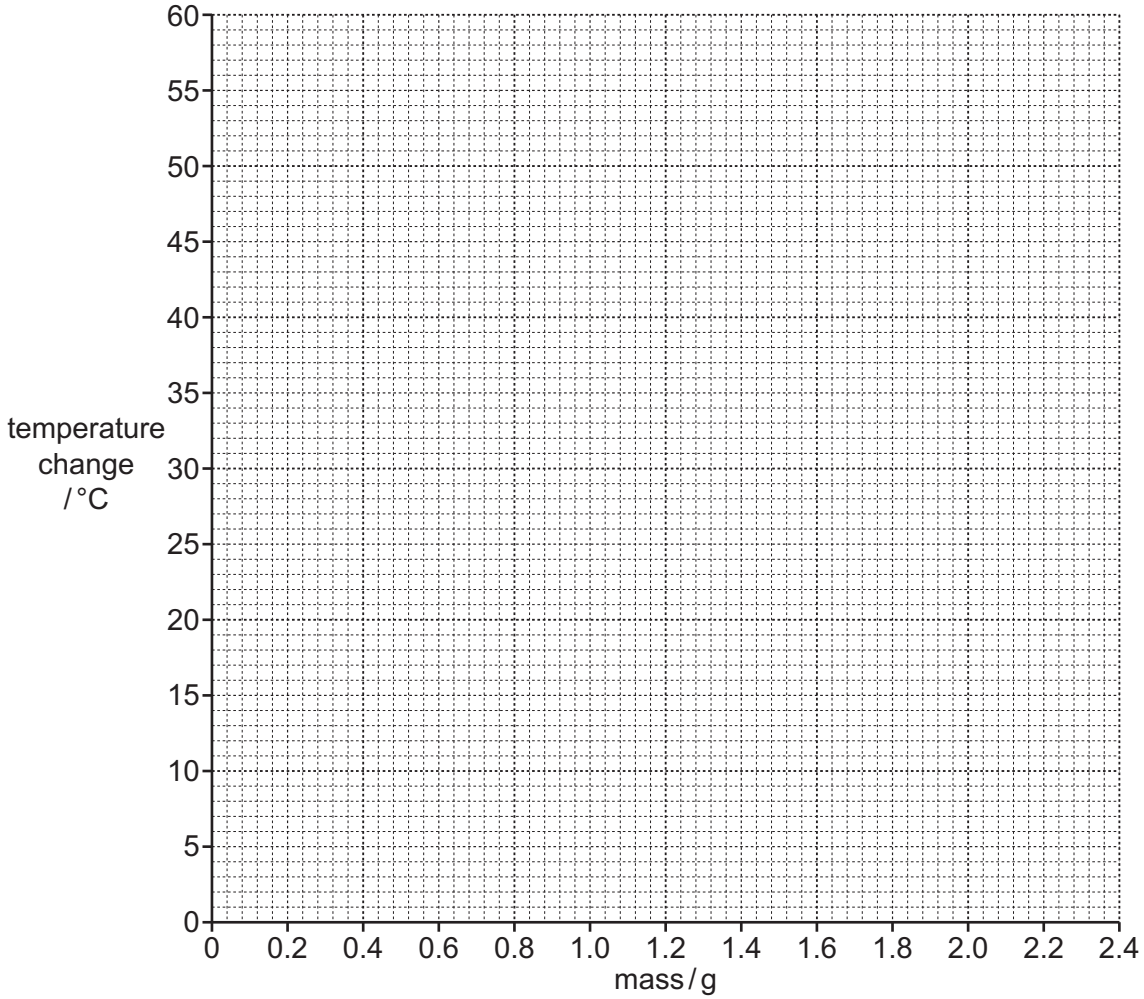
(iii) On the grid provided, plot a graph of temperature change on the *y*-axis against mass of magnesium on the *x*-axis.

Draw a first straight line of best fit on the grid using **only** the first 5 rows in the table.

Draw a second straight line of best fit on the grid using **only** the last 3 rows in the table.

Extend both lines of best fit so that they meet.

Draw a circle around the anomalous point on the graph.



[4]

(iv) Explain why the temperature change becomes constant.

.....

..... [1]

(v) Using your graph, determine the minimum mass of magnesium that reacts with **all** of the dilute hydrochloric acid.

minimum mass of magnesium = ... g [1]

(c) (i) Explain why the temperature changes calculated in this experiment are less than the true values.

.....

..... [1]

(ii) Suggest an improvement to the experiment that would make the calculated temperature changes more accurate.

.....

..... [1]

[Total: 11]

Question 3 begins over the page.

3 A student investigates the density of an object.

The student places a spanner in apparatus A and then adds some water as shown in Fig. 3.1.

Air bubbles form on the surface of the spanner.

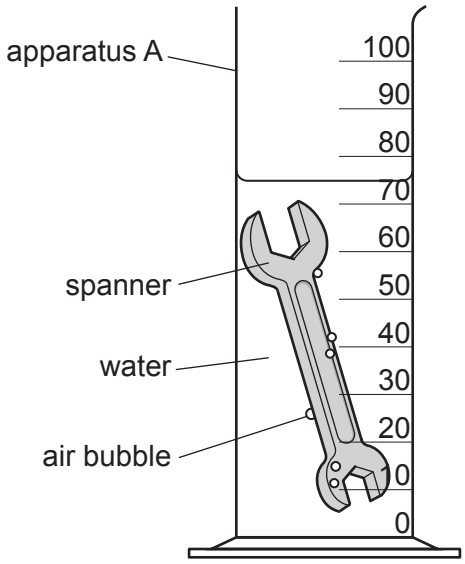


Fig. 3.1

(a) (i) State the name of apparatus A shown in Fig. 3.1.

..... [1]

(ii) On Fig. 3.1 draw an arrow (◄——) to show the point on the scale where the volume reading should be taken. [1]

(iii) Describe how the student determines the volume of the spanner.

.....

.....

..... [2]

(iv) Explain why the air bubbles are a source of error when determining the volume of the spanner.

Suggest what the student does to minimize this error.

explanation .....

.....

suggestion .....

.....

[2]

(b) The student:

- measures the mass of the spanner
- determines the volume of the spanner
- records the measurements in Table 3.1.

Table 3.1

mass	volume .....
78	10

(i) Complete the headings in Table 3.1 by writing appropriate units. [2]

(ii) Calculate the density of the spanner. Use the equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

density = ... [1]

(c) (i) The student calculates a value for the density of the spanner.

A teacher tells the student that the value calculated is 8% more than the true value but the calculated value can be considered accurate.

Explain why.

.....

.....

..... [1]

(ii) Suggest one change to the procedure to improve the accuracy of the density calculated in **(b)(ii)**.

.....

..... [1]

[Total: 11]

4 A student investigates the relationship between light intensity and the rate of photosynthesis.

Fig. 4.1 shows some of the apparatus used in the investigation.

The pondweed produces bubbles of oxygen gas during photosynthesis.

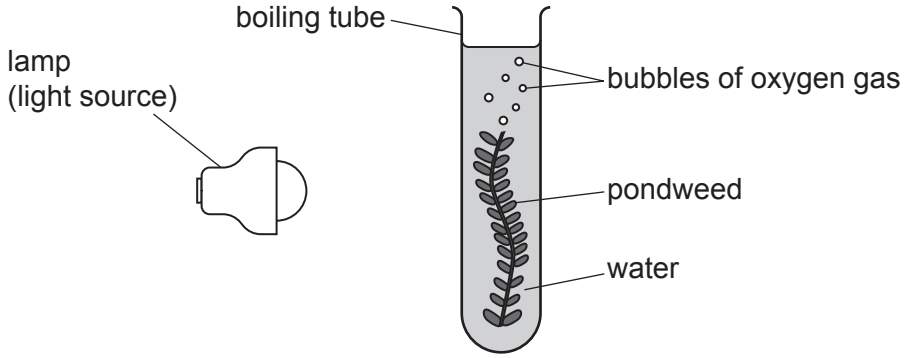


Fig. 4.1

A student states:

“As the light intensity increases, the rate of photosynthesis also increases.”

Plan an investigation to test whether this statement is correct.

You are provided with pondweed in a boiling tube, a lamp, a ruler and may use any other common laboratory apparatus.

Include in your answer:

- a brief description of the method
- the measurements you will make
- what you will keep constant and what you will change
- how you will use your results to draw a conclusion.

A diagram of apparatus and a results table are not required but you may include them if it helps to explain your plan.

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..... [7]

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Notes for use in qualitative analysis

Tests for anions

anion	test	test result
carbonate, CO_3^{2-}	add dilute acid, then test for carbon dioxide gas	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.
iodide, I^- [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	yellow ppt.
sulfate, SO_4^{2-} [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.

Tests for aqueous cations

cation	effect of aqueous sodium hydroxide	effect of aqueous ammonia
aluminium, Al^{3+}	white ppt., soluble in excess, giving a colourless solution	white ppt., insoluble in excess
ammonium, NH_4^+	ammonia produced on warming	–
calcium, Ca^{2+}	white ppt., insoluble in excess	no ppt. or very slight white ppt.
chromium(III), Cr^{3+}	green ppt., soluble in excess	green ppt., insoluble in excess
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, ppt. turns brown near surface on standing	green ppt., insoluble in excess, ppt. turns brown near surface on standing
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