Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4497554609

COMBINED SCIENCE **0653/61**

Paper 6 Alternative to Practical **October/November 2020**

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. Blank pages are indicated.

DC (LK/CB) 194070/3

1 (a) A student investigates the amount of vitamin C in orange juice.

She is given half an orange, as shown in Fig. 1.1.

Fig. 1.1

In the box, make a large drawing of the orange shown in Fig. 1.1.

[3]

BLANK PAGE

(b) The student tests the juice from the orange with DCPIP.

DCPIP is a dark blue solution that turns colourless when vitamin C is added.

If the orange juice contains a lot of vitamin C, less orange juice is needed to turn the DCPIP colourless.

Procedure

The student:

- puts 2.0 cm^3 DCPIP into a test-tube
- fills a syringe with 10.0 cm^3 orange juice
- adds orange juice to the DCPIP until the DCPIP turns colourless
- records the volume of orange juice **remaining** in the syringe in Table 1.1.

The student repeats the procedure two more times (experiment **2** and experiment **3**).

(i) Fig. 1.2 shows the volume of orange juice **remaining** in the syringe in experiment **3**.

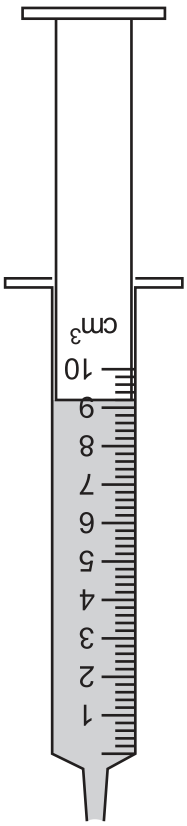


Fig. 1.2

Record in Table 1.1 the volume of orange juice **remaining** in the syringe in experiment **3**.

Table 1.1

experiment	volume of orange juice **remaining** in syringe / cm^3	volume of orange juice **added** to the DCPIP / cm^3
1	9.4	0.6
2	9.3	0.7
3		

[1]

(ii) The student calculates the volume of orange juice **added** to the DCPIP in experiment **1** and experiment **2** using the equation shown.

volume of orange juice **added** = 10.0 – volume of orange juice **remaining** in the syringe

Calculate the volume of orange juice **added** to the DCPIP in experiment **3** and record your answer in Table 1.1.

[1]

(iii) Calculate the average volume of orange juice **added** to the DCPIP.

Show your working.

average volume of orange juice **added** = ... cm^3 [1]

(iv) Explain why the student repeats the experiment.

....

.... [1]

[Total: 7]

2 A manufacturer makes two drinks, **A** and **B**, as shown in Fig. 2.1.

- Drink **A** contains sugar and fat.
- Drink **B** is low in sugar and contains no fat.

Fig. 2.1

Plan an investigation to compare the sugar and fat content of the two drinks.

In your answer, include:

- your predictions for results for drink **A** and drink **B**
- the apparatus and chemicals you will need
- a brief description of the method, including how you will treat variables and any safety precautions you will take
- the observations you will make and how they will help you compare drink **A** and drink **B**.

....

....

....

....

....

....

....

....

....

....

....

....

....

....

.... [7]

3 **(a)** When magnesium ribbon is added to hydrochloric acid, bubbles of hydrogen gas are produced.

State the test which shows that the gas is hydrogen. Give the observation for a positive result.

test ....

observation ....
[1]

(b) A student investigates the effect of concentration of hydrochloric acid on the rate of a reaction.

M is a unit of acid concentration. The higher the number, the more concentrated the acid.

A sample of 2.0 M hydrochloric acid is two times more concentrated than 1.0 M hydrochloric acid.

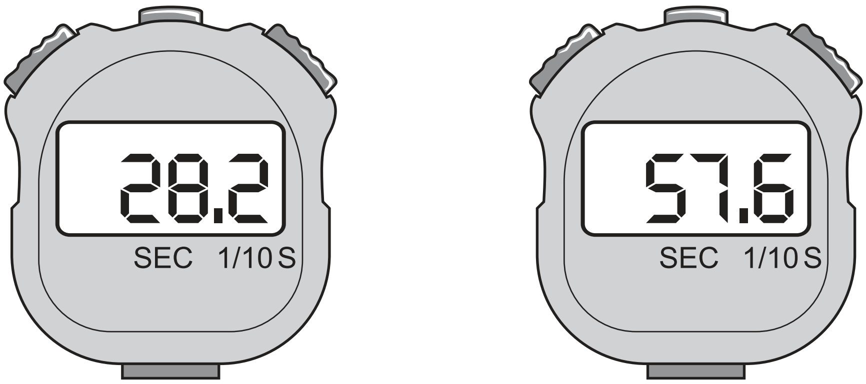
Procedure

The student:

- measures 25 cm^3 of 2.5 M hydrochloric acid with a measuring cylinder and pours it into a conical flask
- adds a 1 cm piece of magnesium ribbon to the 2.5 M hydrochloric acid and starts a stop-watch
- stops the stop-watch as soon as all of the magnesium has fully reacted
- records this time in Table 3.1.

The student repeats the procedure using 2.0 M, 1.5 M and 1.0 M hydrochloric acid instead of 2.5 M hydrochloric acid.

(i) Fig. 3.1 shows the stop-watches for the 2.0 M and 1.5 M hydrochloric acid tests.



2.0 M hydrochloric acid

1.5 M hydrochloric acid

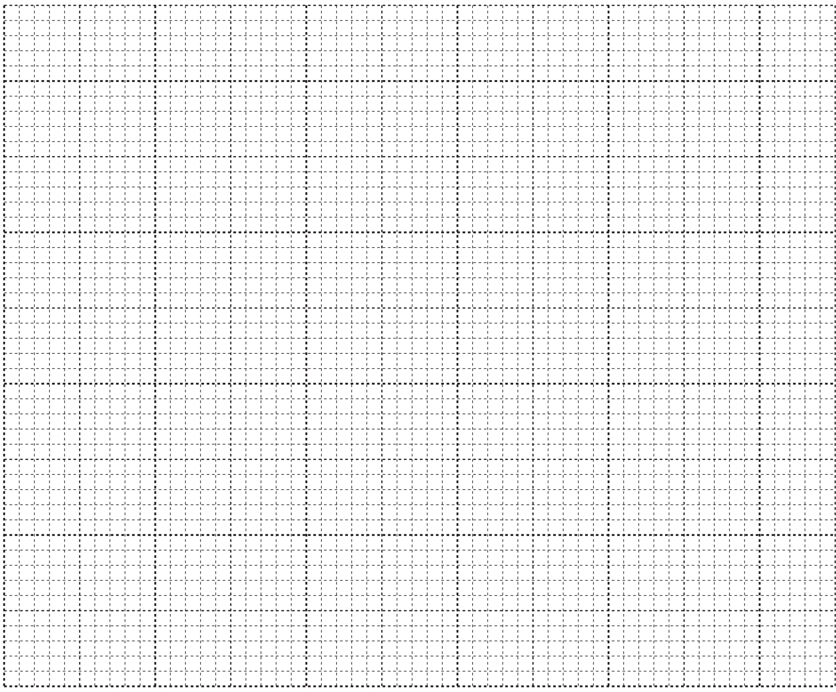
Fig. 3.1

In Table 3.1, record these times to the nearest second. [2]

Table 3.1

acid concentration / M	time for magnesium to fully react / s
2.5	12
2.0	
1.5	
1.0	78

(ii) Plot a graph of time for magnesium to fully react (vertical axis) against acid concentration.



[3]

(iii) Draw the straight best-fit line. Label the line **B**. [1]

(iv) Describe the relationship between acid concentration and time for magnesium to fully react.

....

.... [1]

(v) Use your graph to determine the time it takes for a 1 cm piece of magnesium ribbon to fully react with 1.8 M hydrochloric acid.

time = ... s [1]

(vi) Suggest **one** improvement to this experiment to make the results more accurate.

....

.... [1]

(vii) The student repeats the experiment in **(b)**.

The student uses the same concentrations of hydrochloric acid at a temperature of 50 °C instead of room temperature.

Everything else is kept the same.

The student finds the reactions happen more quickly.

On the grid in **(b)(ii)**, draw the best-fit line you would expect to get at 50 °C. Label the line **C**. [1]

(c) The rate of the reaction of magnesium and hydrochloric acid can be determined by collecting the hydrogen gas given off. The volume of gas collected is measured at regular time intervals.

Draw a labelled diagram of the assembled apparatus used to react magnesium with hydrochloric acid **and** collect **and** measure the volume of gas given off.

[2]

[Total: 13]

4 **(a)** A student determines the density of a glass block.

Fig. 4.1 shows the glass block with dimensions:

length = 11.0 cm
width = 6.0 cm
height = 2.0 cm.

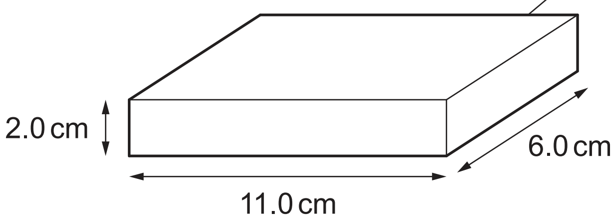


Fig. 4.1

(i) Calculate the volume of the glass block. Use the equation shown.

volume = length × width × height

volume = ... cm^3 [1]

(ii) The student measures the mass of the glass block using a balance.
Fig. 4.2 shows the reading on the balance.

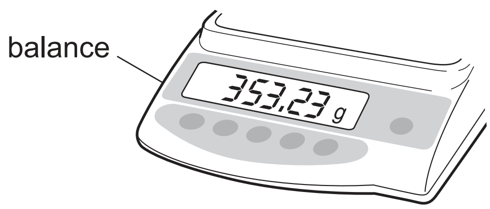


Fig. 4.2

Record the mass of the glass block to the nearest 0.1 g.

mass = ... g [1]

(iii) Calculate the density of the glass block. Use the equation shown.

Give your answer to 2 significant figures.

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

density = ... g/cm^3 [2]

(b) The student investigates the refraction of light through the glass block.

Procedure

The student:

- draws around the glass block on a sheet of paper and labels the corners **ABCD** as shown in Fig. 4.3
- draws a line **EF** as shown in Fig. 4.3
- places two optics pins P_1 and P_2 on **EF**
- views the images of P_1 and P_2 **through** the glass block
- places two more optics pins P_3 and P_4 on the sheet of paper lined up with the images of P_1 and P_2
- labels the positions of P_3 and P_4 on the paper
- removes the glass block and the pins.

(i) On Fig. 4.3, draw an **X** to show the approximate position from which the student views the images of P_1 and P_2 **through** the glass block. [1]

(ii) On Fig. 4.3, draw the normal to **AB** (a line at 90° to **AB**) at point **E**. Label the upper end of the normal **N**. [1]

(iii) Measure and record the angle θ between lines **EF** and **EN**.

θ = ... ° [1]

(c) On Fig. 4.3:

- draw a line through P_3 and P_4 and extend it to meet **CD**
- label the point at which this line meets **CD** with the letter **G**
- draw a line through **G** at 90° to **CD** and extend this line until it crosses **AB**
- label the point at which this line meets **AB** with the letter **H**
- extend the line **FE** until it meets the line **GH**
- label the point at which this line meets **GH** with the letter **J**
- draw a straight line joining points **E** and **G**.

[2]

(d) **(i)** Measure and record to the nearest 0.1 cm the length of the line **EG**.

EG = ... cm [1]

(ii) Measure and record to the nearest 0.1 cm the length of the line **EJ**.

EJ = ... cm [1]

(iii) Calculate the refractive index n of the glass block. Use the equation shown.

(If you do not have values for **EG** and **EJ**, use **EG** = 6.5 cm and **EJ** = 4.1 cm. These are **not** the correct values.)

$$n = \frac{\mathbf{EG}}{\mathbf{EJ}}$$

n = ... [1]

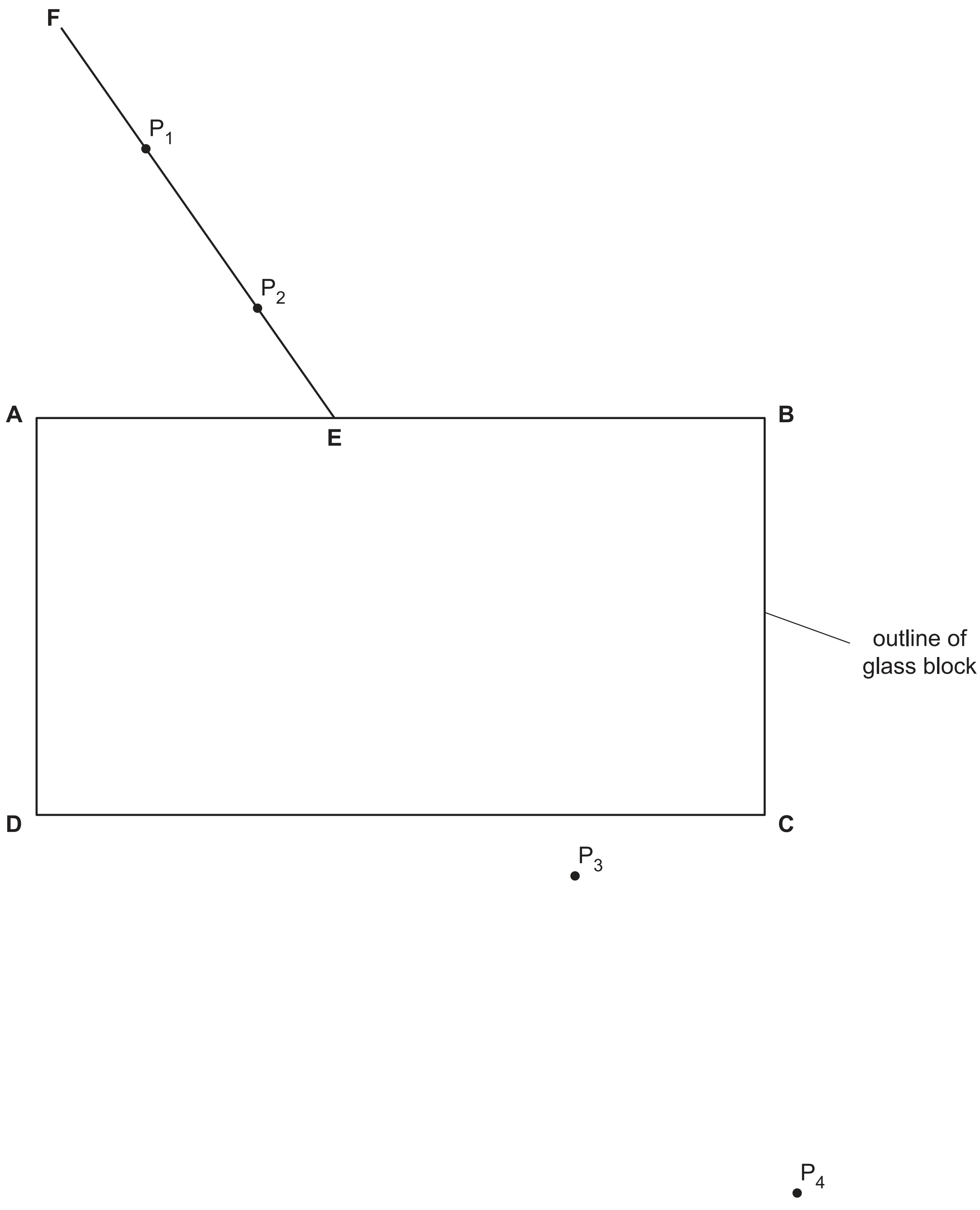


Fig. 4.3

(e) The refractive index of the glass block the student used in this experiment is 1.5.

Compare this value of the refractive index *n* with the value of *n* you calculated in **(d)(iii)**.
State whether the two values agree within the limits of experimental accuracy. Justify your answer with reference to the values.

....

.... [1]

[Total: 13]

BLANK PAGE

BLANK PAGE