Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2873664375

COMBINED SCIENCE **0653/52**

Paper 5 Practical Test **October/November 2020**

1 hour 15 minutes

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

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 [ ].
- Notes for use in qualitative analysis are provided in the question paper.

For Examiner's Use	
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3	
4	
Total	

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DC (SLM) 207485

1 **(a)** You are going to investigate the amount of vitamin C in orange juice.

You are provided with half an orange.

Make a large drawing of the cut surface of the orange.

[3]

(b) You will test 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.

(i) **Procedure**

- Squeeze the orange and collect the juice in a large beaker.
- Use a pipette to put 2 drops of DCPIP into each of three test-tubes.
- Use a clean pipette to add drops of the squeezed orange juice to one of the test-tubes containing DCPIP until the solution is orange. You may need to swirl the test-tube. Count the number of drops of orange juice as you add them.
- Record in Table 1.1 the number of drops of orange juice added. This is experiment **1**.
- Repeat for the other two test-tubes containing DCPIP (experiment **2** and experiment **3**) and record your results in Table 1.1.

Table 1.1

experiment	number of drops of orange juice added
1	
2	
3	
average	

[2]

(ii) Calculate the average number of drops of orange juice added for the three experiments.

Record your answer in Table 1.1.

[1]

(iii) Suggest why using this method to find the amount of vitamin C in orange juice may **not** be accurate.

....

.... [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.

You are **not** required to carry out this investigation.

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**.

....

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.... [7]

3 You are going to investigate the effect of concentration of hydrochloric acid on the rate of a reaction.

M is a unit of 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.

(a) Procedure

- Put 3 cm depth of 1.5 M hydrochloric acid into a test-tube.
- Add a 3 cm piece of magnesium ribbon.
- Test the gas given off in order to identify it.

State the test which identifies the gas.

Give the result of the test and identify the gas.

test ....

result ....

identity of gas ....
[1]

(b) (i) Procedure

- Measure 25 cm^3 of 2.5 M hydrochloric acid with a measuring cylinder and pour it into a conical flask.
- Add a 1 cm piece of magnesium ribbon to the hydrochloric acid and start the stop-clock.
- Stop the stop-clock as soon as all of the magnesium has fully reacted.
- Record this time in Table 3.1 to the nearest second.
- Empty and rinse the flask with water.

Repeat the procedure using 2.0 M, 1.5 M and 1.0 M hydrochloric acid instead of 2.5 M hydrochloric acid.

Table 3.1

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

[2]

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

[3]

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

(iv) Describe the relationship between the concentration of acid and the 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) A student repeats the experiment in **(b)(i)**.
She 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 same grid used in **(b)(ii)**, draw the line you would expect to get at 50 °C. Label the line **C**. [1]

(c) The rate of the reaction of magnesium and dilute hydrochloric acid can be determined by collecting the gas given off. The volume of gas collected in a given time is measured.

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

You are **not** required to carry out this experiment.

[2]

[Total: 13]

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4 You are going to investigate the refraction of light in a rectangular block.

(a) Fig. 4.1 is provided for reference. Use a sharpened pencil to draw thin neat lines.

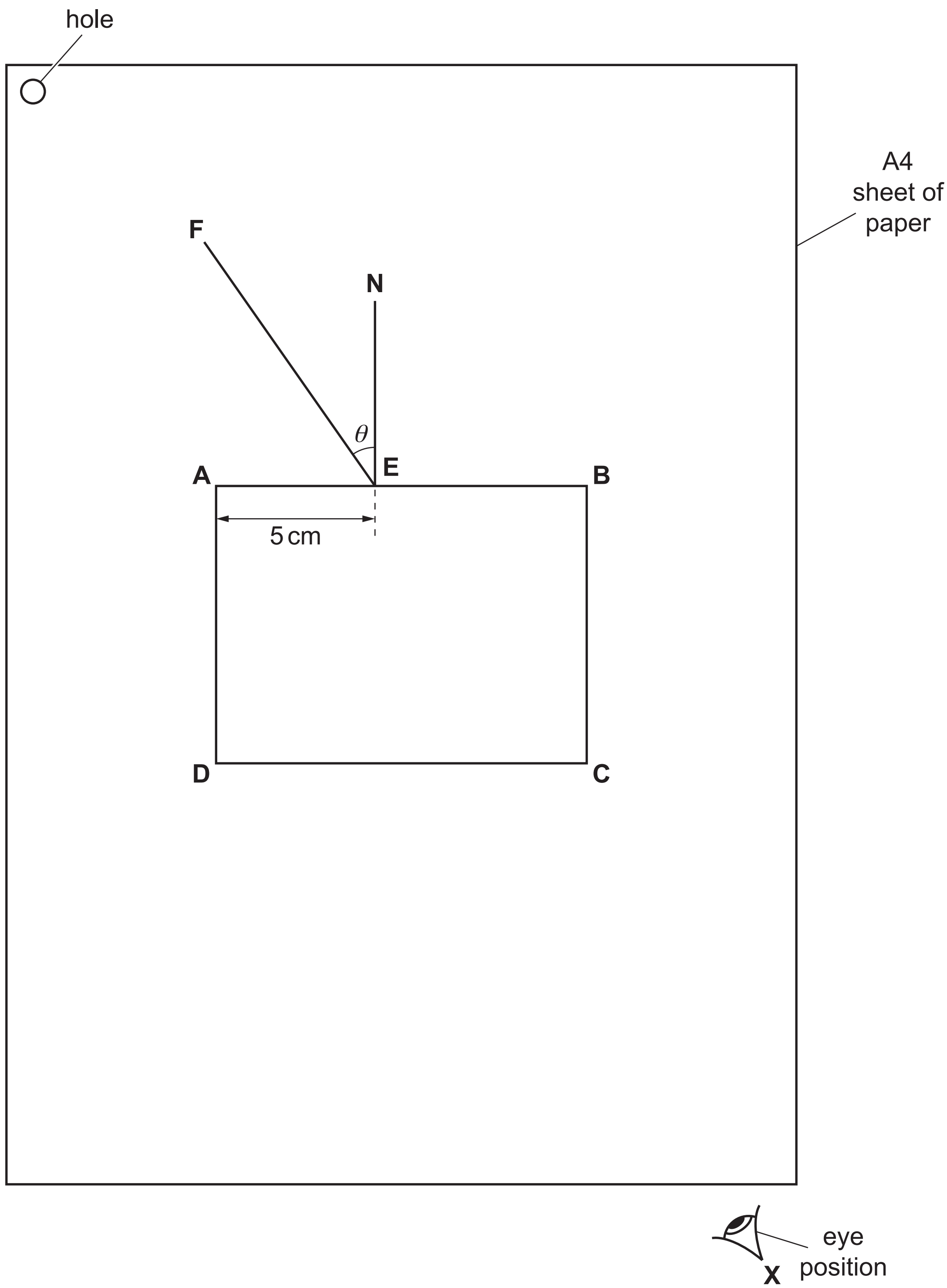

Fig. 4.1 (plan view)

Procedure

- Place the block approximately in the centre of the blank sheet of paper provided.
- Draw around the block and label the corners **ABCD** as shown in Fig. 4.1.
- Remove the block from the paper.
- Mark and label the point **E** on the line **AB** a distance of 5.0 cm from **A**.
- Draw a normal to **AB** (a line at 90° to **AB**) at point **E** and label the end of the line **N**.
- Draw an 8.0 cm line from **E** at an angle θ = 35° to the normal as shown in Fig. 4.1.
- Label the other end of this line **F**.

[3]

(b)
- Place the sheet of paper from **(a)** on the cork mat.
- Put the block back on the paper in exactly the same position as in **(a)**.
- Push two pins, P_1 and P_2, into the paper approximately 5 cm apart on the line **FE**.
- Label the positions of P_1 and P_2 on the paper.
- View the images of P_1 and P_2 through the glass block. Look from the eye position **X** shown in Fig. 4.1.
- Move your eye position until the images of P_1 and P_2 are in line with each other.
- Line up a third pin, P_3, with the images of P_1 and P_2 and push the pin into the paper close to side **CD** of the block.
- Line up a fourth pin, P_4, with P_3 and the images of P_1 and P_2 and push the pin into the paper approximately 5 cm from P_3.
- Label the positions of P_3 and P_4 on the paper.
- Remove the block and the pins from the paper.

[2]

(c)
- 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**. 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 the length of line **EG** and record to the nearest 0.1 cm.

EG = ... cm [1]

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

EJ = ... cm [1]

(iii) Calculate the refractive index n of the glass block. Use the equation shown.
Give your answer to 2 significant figures.
(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.)

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

n = ... [2]

(e) Suggest **one** precaution that you should take to ensure that your results are as accurate as possible.

....

.... [1]

(f) A teacher says that the refractive index of the block is 1.5.

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

....

.... [1]

[Total: 13]

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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 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
copper(II) (Cu^{2+})	blue-green