



Cambridge IGCSE™

CANDIDATE
NAME

--

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--

PHYSICAL SCIENCE

0652/52

Paper 5 Practical Test

October/November 2023

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

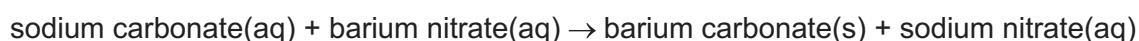
- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [].
- Notes for use in qualitative analysis are provided in the question paper.

For Examiner's Use	
1	
2	
3	
4	
Total	

This document has **16** pages. Any blank pages are indicated.

- 1 You are going to investigate the amount of precipitate formed when aqueous sodium carbonate reacts with aqueous barium nitrate.

The word equation for the reaction is shown.



(a) Procedure

- Label 6 test-tubes **1, 2, 3, 5, 6** and **7** (there is no test-tube **4**).
- Using a measuring cylinder, add 5 cm³ of aqueous barium nitrate into each test-tube.
- Using a **clean** measuring cylinder, add 1 cm³ of aqueous sodium carbonate to test-tube **1** and stir with a glass rod.
- Using the measuring cylinder used for adding aqueous sodium carbonate to test-tube **1**, add the volumes of aqueous sodium carbonate shown in Table 1.1 to the other test-tubes, stirring each with a glass rod.
- Leave the test-tubes to stand for at least 10 minutes to allow the precipitate to settle.

Complete Question 2 while you wait.

- After at least 10 minutes measure the height of precipitate in each test-tube.

Record, in Table 1.1, these heights in millimetres to the nearest millimetre.

Table 1.1

test-tube number	volume of aqueous sodium carbonate added / cm ³	height of precipitate / mm
1	1	
2	2	
3	3	
5	5	
6	6	
7	7	

[3]

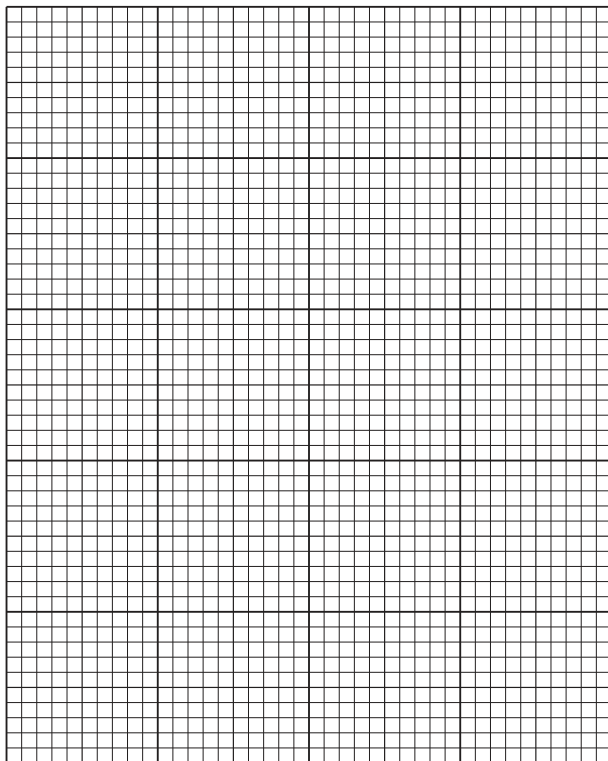
- (b) (i)** Suggest a piece of apparatus suitable for measuring the 5 cm³ of aqueous barium nitrate more accurately than the measuring cylinder.

..... [1]

- (ii) Explain why it is difficult to get an accurate value for the height of the precipitate.

.....
 [1]

- (c) (i) On the grid, plot a graph of the height of precipitate (vertical axis) against volume of aqueous sodium carbonate added.



[3]

- (ii) Draw the best-fit line.

[1]

- (iii) Describe the relationship between the height of precipitate and the volume of aqueous sodium carbonate added.

.....
 [1]

- (iv) Use your graph to estimate the height of the precipitate formed when 4.0 cm^3 of aqueous sodium carbonate is added to 5 cm^3 of aqueous barium nitrate.

Show clearly on your graph how you arrived at your answer.

..... mm [2]

- (d) Suggest how the procedure can be adapted to increase confidence in the results.

.....
 [1]

[Total: 13]

[Turn over]

2 You are going to investigate further the reaction in Question 1.

- (a) (i) In the experiment in Question 1, when aqueous sodium carbonate reacts with aqueous barium nitrate, a white precipitate forms.

The precipitate is separated from the mixture by filtration.

Draw a labelled diagram of the assembled filtration apparatus.

[1]

- (ii) Label the residue and the filtrate on your drawing in (a)(i).

[1]

(b) Procedure

Read the whole of **(b) before** doing the experiment.

- Put approximately 1 cm depth of aqueous sodium carbonate into a test-tube.
- Add approximately 1 cm depth of aqueous barium nitrate to the test-tube.
- Add approximately 3 cm³ of dilute nitric acid to the test-tube.
- Identify the gas given off.

Keep the test-tube and contents for **(b)(iii)**.

- (i) Describe what you see in the test-tube when the dilute nitric acid is added.

.....

 [2]

- (ii) Describe the test which identifies the gas given off. Give the observation for the positive result.

test

observation [1]

(iii) Use the test-tube from the end of the procedure in **2(b)** for this test.

- add a few drops of aqueous barium nitrate to the test-tube.

Record your observations.

.....
..... [1]

(c) Barium nitrate is used to identify sulfate ions.

When aqueous barium nitrate is added to a solution of sulfate ions, a white precipitate is formed.

Explain why nitric acid is also added in the test for sulfate ions.

.....
..... [1]

Remember to go back and complete Question 1.

[Total: 7]

- 3 You are going to investigate the refraction of light by a transparent block.

You will use the diagram shown in Fig. 3.1.

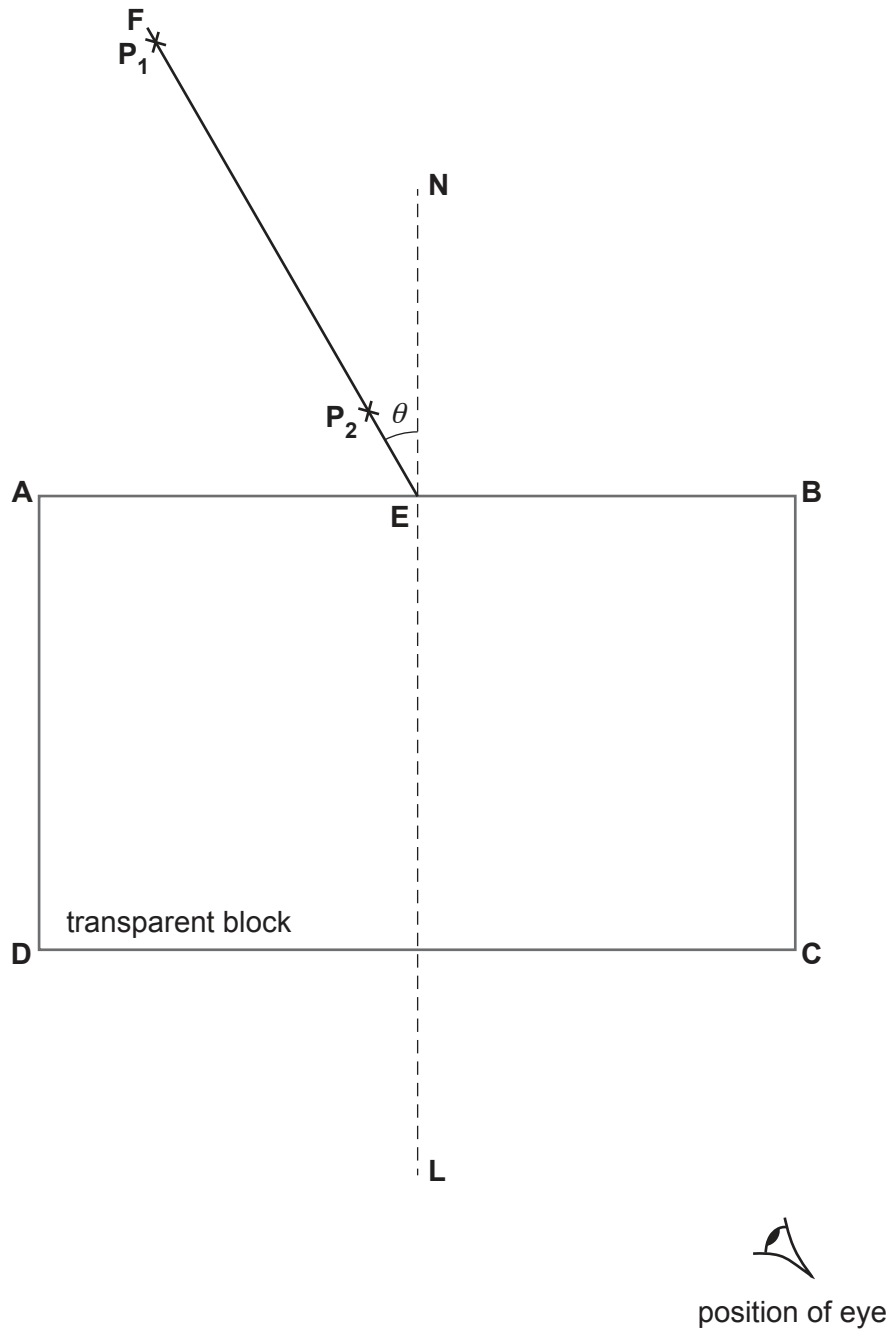


Fig. 3.1

- (a) (i) Measure and record the angle θ that line **FE** makes with the normal **NL**.

$\theta = \dots\dots\dots^\circ$ [1]

(ii) Procedure

- Arrange this paper so that page 6 lies over the pinboard provided.
- Place the block inside the labelled rectangle shown in Fig. 3.1.
- The longer side of the block must lie along **AB** with the normal **NL** crossing the longer side approximately in the centre.

The side of the block closest to the line **CD** is now referred to as side **CD**.

- Insert one pin at position **P₁** and another pin at position **P₂** on line **FE**.
- View the images of **P₁** and **P₂** through the side **CD** of the block from the position indicated by the eye. Move your head slightly so that the images of **P₁** and **P₂** appear one behind the other.
- Place a third pin between side **CD** and your eye, in line with the images of **P₁** and **P₂**. This is pin **P₃**.
- Place a fourth pin a suitable distance from pin **P₃**, in line with pin **P₃** and the images of **P₁** and **P₂**. This is pin **P₄**.
- Label the positions of the pins **P₃** and **P₄**.
- Remove the block and pins from the paper.
- Draw a line joining the positions of **P₃** and **P₄**.
- Continue the line until it meets the normal **NL** and label this point **H**.
- Also label the point at which the line crosses **CD** with the letter **G**.
- Join points **G** and **E** with a straight line. [2]

(iii) Measure the length *a* of line **GE.**

a = cm

Measure the length *b* of line **GH**.

b = cm

Calculate a value n_1 for the refractive index.

Use the equation:

$$n_1 = \frac{a}{b}$$

Record your value of n_1 to a suitable number of significant figures.

n_1 = [3]

(b) You are now going to repeat the process using a different angle of incidence.

You will use the diagram shown in Fig. 3.2.

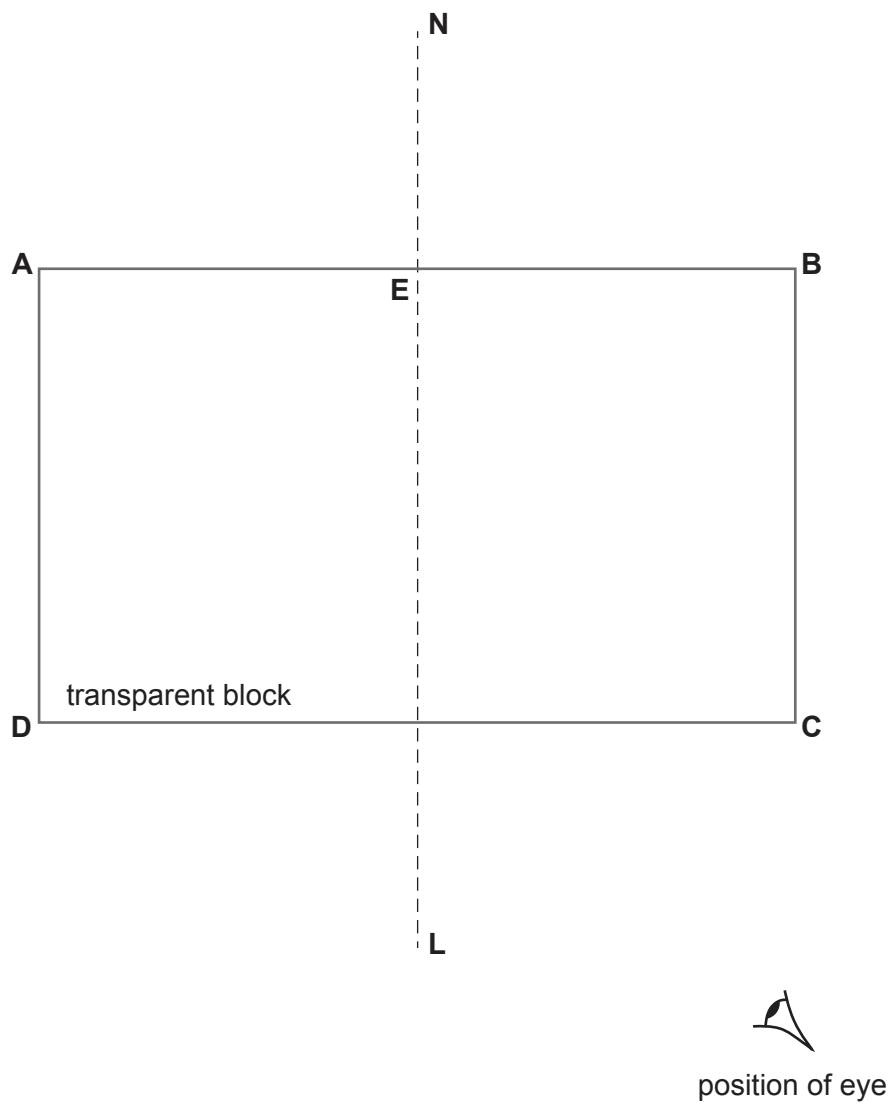


Fig. 3.2

(i) Procedure

- On Fig. 3.2, draw a line to the left of the normal **NL** at an angle of incidence $i = 50^\circ$. Label the line **FE**.
- Arrange this paper so that page 8 lies over the pinboard provided.
- Place the block inside the labelled rectangle shown in Fig. 3.2 as in part (a)(ii).
- Insert two pins a suitable distance apart on line **FE**. Label the positions of the pins **P₅** and **P₆**.
- View the images of **P₅** and **P₆** through the side **CD** of the block from the position indicated by the eye. Move your head slightly so that the images of **P₅** and **P₆** appear one behind the other.
- Place a third pin between side **CD** and your eye, in line with the images of **P₅** and **P₆**. This is pin **P₇**.
- Place a fourth pin a suitable distance from pin **P₇**, in line with pin **P₇** and the images of **P₅** and **P₆**. This is pin **P₈**.
- Label the positions of the pins **P₇** and **P₈**.
- Remove the block and pins from the paper.
- Draw a line joining the positions of **P₇** and **P₈**.
- Continue the line until it meets the normal **NL** and label this point **H**.
- Also label the point at which the line crosses **CD** with the letter **G**.
- Join points **G** and **E** with a straight line.

[1]

(ii) Measure the length c of line **GE**. $c = \dots\dots\dots$ cmMeasure the length d of line **GH**. $d = \dots\dots\dots$ cmCalculate a value n_2 for the refractive index.

Use the equation:

$$n_2 = \frac{c}{d}$$

Record your value of n_2 to a suitable number of significant figures.
 $n_2 = \dots\dots\dots$

[2]

- (c) (i) Two quantities are considered equal within the limits of experimental error if their values are within 10% of each other.

A student suggests that the values n_1 and n_2 should be considered equal.

State whether your results support this suggestion. Justify your answer by reference to your results.

.....
.....
..... [2]

- (ii) Explain why the value n_2 is likely to be a more accurate value for the refractive index than n_1 .

.....
.....
..... [1]

- (d) Suggest why different students, all doing this experiment carefully, may obtain slightly different results.

.....
.....
..... [1]

[Total: 13]

BLANK PAGE

4 Conducting putty is modelling clay that conducts electrical current.

Plan an experiment to investigate the relationship between the diameter d of the conducting putty and its resistance R .

Resistance is calculated using the equation

$$R = \frac{V}{I}$$

where V is the potential difference across the conductor and I is the current through the conductor.

The student has a battery pack, connecting leads and some conducting putty which can be moulded into a cylinder shape as shown in Fig. 4.1.



Fig. 4.1

Other apparatus normally available in a school laboratory may also be used.

You will **not** be doing this experiment.

Your plan should include:

- any additional apparatus needed
- a brief description of the method, including the measurements you make, a circuit diagram and the table you use to record your results (you are not required to enter any readings into the table)
- the variables to control
- the precautions you take to ensure the results are as accurate as possible
- an explanation of how you use your results to reach a conclusion.

NOTES FOR USE IN QUALITATIVE ANALYSIS

Tests for anions

<i>anion</i>	<i>test</i>	<i>test result</i>
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.
bromide (Br^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream 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

<i>cation</i>	<i>effect of aqueous sodium hydroxide</i>	<i>effect of aqueous ammonia</i>
ammonium (NH_4^+)	ammonia produced on warming	—
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt. or very slight white ppt.
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	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

<i>gas</i>	<i>test and test result</i>
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

<i>metal ion</i>	<i>flame colour</i>
lithium (Li ⁺)	red
sodium (Na ⁺)	yellow
potassium (K ⁺)	lilac
copper(II) (Cu ²⁺)	blue-green

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.