Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education (9–1)

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8970712186

CHEMISTRY **0971/51**

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 are provided on pages 11 and 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	
Total	

This document consists of **10** printed pages and **2** blank pages.

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1 You are going to investigate the reaction between aqueous sodium carbonate and aqueous barium nitrate.

Read all the instructions carefully before starting the experiment.

Instructions
You are going to do one experiment.

- Fill the burette up to the 0.0 cm^3 mark with the aqueous sodium carbonate.
- Label the test-tubes 1, 2, 3, 4, 5 and 6 and place them in order in the test-tube rack.
- Use the measuring cylinder to pour 6 cm^3 of the aqueous barium nitrate into each of the six test-tubes.
- Add 1.0 cm^3 of aqueous sodium carbonate from the burette to test-tube 1.
- Add 2.0 cm^3 of aqueous sodium carbonate from the burette to test-tube 2.
- Add 4.0 cm^3 of aqueous sodium carbonate from the burette to test-tube 3.
- Add 5.0 cm^3 of aqueous sodium carbonate from the burette to test-tube 4.
- Add 6.0 cm^3 of aqueous sodium carbonate from the burette to test-tube 5.
- Add 7.0 cm^3 of aqueous sodium carbonate from the burette to test-tube 6.

Using the glass rod, carefully stir the contents of each of the test-tubes. Leave the contents of the test-tubes to stand for at least 10 minutes.

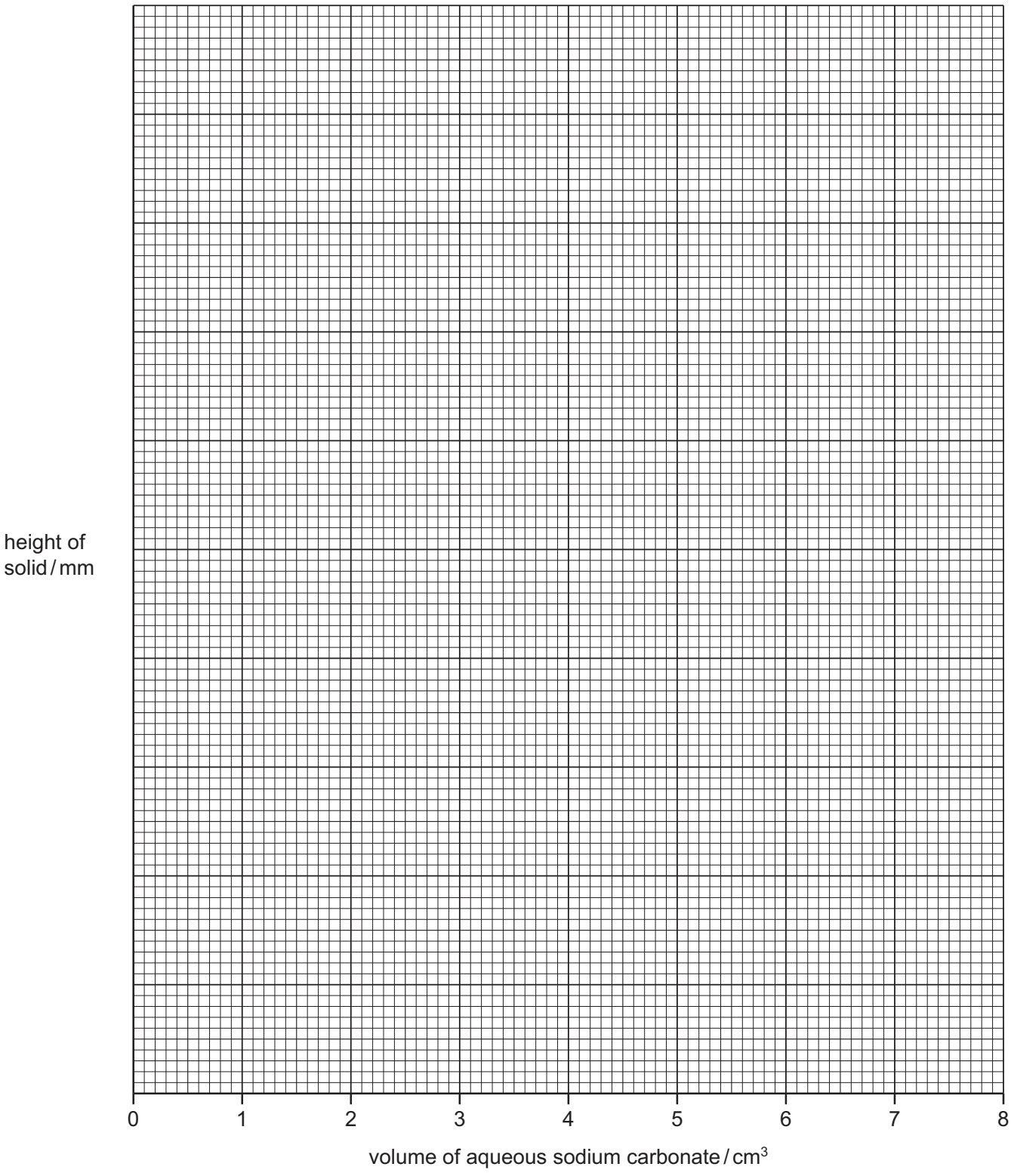
You should start Question 2 while you are waiting for the solid formed in the test-tubes to settle.

(a) After 10 minutes, use a ruler to measure the height of the solid formed in each test-tube. Record your results in the table.

test-tube number	volume of aqueous sodium carbonate / cm^3	height of solid / mm
1		
2		
3		
4		
5		
6		

[4]

(b) Plot your results on the grid. Draw a line of best fit.



[3]

(c) **From your graph**, deduce the height of the solid formed when 3.0 cm^3 of aqueous sodium carbonate is added to 6 cm^3 of aqueous barium nitrate.

Show clearly **on the grid** how you worked out your answer.

..... [3]

(d) Describe the trend in the heights of the solids formed in test-tubes 1–6.

.....

..... [1]

(e) Explain **one** improvement you could make to the experiment to obtain more accurate results for the heights of the solid formed.

improvement .....

explanation .....

.....

[2]

(f) Suggest a **different** method to measure the amount of solid formed during the experiment.

.....

.....

.....

..... [3]

(g) Suggest how the reliability of the results could be checked.

.....

..... [1]

(h) What type of chemical reaction occurs when aqueous sodium carbonate reacts with aqueous barium nitrate?

..... [1]

[Total: 18]

Question 2 starts on the next page.

2 You are provided with two substances, solution **F** and solid **G**.
Do the following tests on the substances, recording all of your observations at each stage.

tests on solution F

Divide solution **F** into five approximately equal portions in five test-tubes.

(a) Test the pH of the first portion of solution **F**.

pH = ... [1]

(b) Add a strip of magnesium ribbon to the second portion of solution **F**. Shake the mixture. Test the gas produced.
Record your observations.

.....

..... [2]

(c) Add a few drops of dilute nitric acid and about 1 cm^3 of aqueous silver nitrate to the third portion of solution **F**.
Record your observations.

..... [1]

(d) Add a few drops of dilute nitric acid and about 1 cm^3 of aqueous barium nitrate to the fourth portion of solution **F**.
Record your observations.

..... [1]

Keep the fifth portion of the solution F for the test in (f).

tests on solid G

(e) Describe the appearance of solid **G**.

..... [1]

(f) Add the fifth portion of solution **F** to solid **G**. Test the gas produced.
Record your observations.

.....

.....

..... [3]

Add about 2 cm^3 of distilled water to the solution formed in the test in **(f)** and shake the mixture. Divide the solution formed into two approximately equal portions in two test-tubes for the tests in **(g)** and **(h)**.

(g) Add aqueous sodium hydroxide to the first portion of the solution until no further change occurs.
Record your observations.

..... [2]

(h) Add an excess of aqueous ammonia to the second portion of the solution.
Record your observations.

..... [1]

(i) Identify solution **F**.

..... [2]

(j) Identify solid **G**.

..... [2]

[Total: 16]

[Turn over

3 Steel nails rust in the presence of air and water. Plan an investigation to:

- show that coating steel nails with paint helps to protect the nails from rusting
- show that coating steel nails with zinc helps to protect the nails from rusting
- determine which coating is more effective at protecting steel nails from rusting.

You are provided with:

- uncoated steel nails
- steel nails coated with paint
- steel nails coated with zinc
- common laboratory apparatus.

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..... [6]

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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.
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.
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.
sulfite (SO_3^{2-})	add dilute hydrochloric acid, warm gently and test for the presence of sulfur dioxide	sulfur dioxide produced will turn acidified aqueous potassium manganate(VII) from purple to colourless

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	grey-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	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
sulfur dioxide (SO_2)	turns acidified aqueous potassium manganate(VII) from purple to colourless

Flame tests for metal ions

metal ion	flame colour
lithium (Li^+)	red
sodium (Na^+)	yellow
potassium (K^+)	lilac
copper(II) (Cu^{2+})	blue-green