



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

CANDIDATE  
NAME

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CENTRE  
NUMBER

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**CHEMISTRY**

**0620/51**

Paper 5 Practical Test

**May/June 2016**

**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.

Practical notes are provided on pages 7 and 8.

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**

**Total**

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **8** printed pages.



- 1 You are going to investigate the reaction between aqueous sodium carbonate and two different solutions of dilute hydrochloric acid labelled **A** and **B**.

**Read all the instructions carefully before starting the experiments.**

### Instructions

You are going to carry out three experiments.

#### (a) Experiment 1

Use a measuring cylinder to pour  $25\text{ cm}^3$  of aqueous sodium carbonate into a conical flask.  
Add ten drops of thymolphthalein indicator to the conical flask.  
Fill the burette provided up to the  $0.0\text{ cm}^3$  mark with solution **A** of dilute hydrochloric acid.  
Add solution **A** from the burette while swirling the flask, until the solution just changes colour.  
Record the burette readings in the table below.

#### Experiment 2

Empty the conical flask and rinse it with distilled water.  
Repeat Experiment 1 using methyl orange indicator instead of thymolphthalein.  
Record the burette readings in the table below and complete the table.

|                                         | Experiment 1 | Experiment 2 |
|-----------------------------------------|--------------|--------------|
| final burette reading / $\text{cm}^3$   |              |              |
| initial burette reading / $\text{cm}^3$ |              |              |
| difference / $\text{cm}^3$              |              |              |

[4]

#### (b) Experiment 3

Empty the conical flask and rinse it with distilled water.  
Pour away the contents of the burette and rinse the burette with solution **B** of dilute hydrochloric acid.  
Repeat Experiment 1 using solution **B** instead of solution **A**.  
Record the burette readings in the table below and complete the table.

|                                         | Experiment 3 |
|-----------------------------------------|--------------|
| final burette reading / $\text{cm}^3$   |              |
| initial burette reading / $\text{cm}^3$ |              |
| difference / $\text{cm}^3$              |              |

[2]

- (c) What colour change was observed in the flask in Experiment 1?

from ..... to ..... [1]

- (d) State **one** observation, other than colour change, when hydrochloric acid was added to sodium carbonate.

..... [1]

- (e) Complete the sentence below.

Experiment ..... needed the largest volume of hydrochloric acid to change the colour of the indicator. [1]

- (f) What would be a more accurate method of measuring the volume of the aqueous sodium carbonate?

..... [1]

- (g) What would be the effect on the results, if any, if the solutions of sodium carbonate were warmed before adding the hydrochloric acid? Give a reason for your answer.

effect on results .....

reason .....

[2]

- (h) (i) Determine the ratio of volumes of dilute hydrochloric acid used in Experiments 1 and 3.

..... [1]

- (ii) Use your answer to (h)(i) to deduce how the concentration of solution **A** differs from that of solution **B**.

..... [1]

- (i) Suggest a **different** method, using standard laboratory chemicals, to determine which of the solutions of dilute hydrochloric acid, **A** or **B**, is more concentrated.

.....

.....

.....

.....

..... [3]

- (j) Hydrochloric acid is hazardous.

Suggest **one** safety precaution to follow when using hydrochloric acid.

..... [1]

[Total: 18]

- 2** You are provided with two substances. Solid **C** is a salt and solution **D** is an aqueous solution of a different salt.  
Carry out the following tests on each substance, recording all of your observations at each stage.

**tests on solid C**

Add about half of solid **C** to about 10 cm<sup>3</sup> of distilled water in a test-tube and shake to dissolve.

Divide the solution into two equal portions in two test-tubes, and carry out the following tests.

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

pH ..... [1]

- (ii)** To the second portion of the solution, add about 1 cm<sup>3</sup> of dilute nitric acid followed by aqueous silver nitrate.  
Record your observations.

..... [2]

- (b)** Carry out a flame test on the rest of solid **C**.  
Record your observations.

..... [1]

- (c)** Identify solid **C**.

..... [2]

**tests on solution D**

Divide the solution **D** into three equal portions in three test-tubes and carry out the following tests.

- (d) (i)** Describe the appearance of the solution.

..... [1]

- (ii)** To the first portion of the solution, add drops of aqueous sodium hydroxide until a change is seen.  
Now add an excess of aqueous sodium hydroxide to the mixture.  
Record your observations.

.....

..... [3]

- (iii) To the second portion of the solution, add drops of aqueous ammonia until a change is seen.  
Now add an excess of aqueous ammonia to the mixture.  
Record your observations.

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

- (iv) To the third portion of the solution, add about 1 cm<sup>3</sup> of dilute nitric acid followed by aqueous silver nitrate.  
Record your observations.

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

- (e) What conclusions can you draw about solution D?

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

[Total: 16]

- 3 Calcium burns in air to form calcium oxide. The reaction is vigorous and some of the calcium oxide can be lost as smoke.

Plan an investigation to determine the maximum mass of oxygen that combines to form calcium oxide when 2 g of calcium granules are burnt in air.

You are provided with common laboratory apparatus and calcium granules.

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

[Total: 6]

**NOTES FOR USE IN QUALITATIVE ANALYSIS****Test for anions**

| anion                                           | test                                                                                  | test result                                                                                            |
|-------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| carbonate ( $\text{CO}_3^{2-}$ )                | add dilute acid                                                                       | effervescence, carbon dioxide produced                                                                 |
| chloride ( $\text{Cl}^-$ )<br>[in solution]     | acidify with dilute nitric acid, then add aqueous silver nitrate                      | white ppt.                                                                                             |
| bromide ( $\text{Br}^-$ )<br>[in solution]      | acidify with dilute nitric acid, then add aqueous silver nitrate                      | cream ppt.                                                                                             |
| iodide ( $\text{I}^-$ )<br>[in solution]        | acidify with dilute nitric acid, then add aqueous silver nitrate                      | yellow ppt.                                                                                            |
| nitrate ( $\text{NO}_3^-$ )<br>[in solution]    | add aqueous sodium hydroxide, then aluminium foil; warm carefully                     | ammonia produced                                                                                       |
| sulfate ( $\text{SO}_4^{2-}$ )<br>[in solution] | acidify, then add aqueous barium nitrate                                              | white ppt.                                                                                             |
| sulfite ( $\text{SO}_3^{2-}$ )                  | 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 |

**Test for aqueous cations**

| cation                             | effect of aqueous sodium hydroxide                          | effect of aqueous ammonia                                       |
|------------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------|
| aluminium ( $\text{Al}^{3+}$ )     | white ppt., soluble in excess giving a colourless solution  | white ppt., insoluble in excess                                 |
| ammonium ( $\text{NH}_4^+$ )       | ammonia produced on warming                                 | —                                                               |
| calcium ( $\text{Ca}^{2+}$ )       | white ppt., insoluble in excess                             | no ppt. or very slight white ppt.                               |
| chromium(III) ( $\text{Cr}^{3+}$ ) | green ppt., soluble in excess                               | grey-green ppt., insoluble in excess                            |
| copper ( $\text{Cu}^{2+}$ )        | light blue ppt., insoluble in excess                        | light blue ppt., soluble in excess, giving a dark blue solution |
| iron(II) ( $\text{Fe}^{2+}$ )      | green ppt., insoluble in excess                             | green ppt., insoluble in excess                                 |
| iron(III) ( $\text{Fe}^{3+}$ )     | red-brown ppt., insoluble in excess                         | red-brown ppt., insoluble in excess                             |
| zinc ( $\text{Zn}^{2+}$ )          | white ppt., soluble in excess, giving a colourless solution | white ppt., soluble in excess, giving a colourless solution     |

**Test for gases**

| gas                               | test and test results                                                      |
|-----------------------------------|----------------------------------------------------------------------------|
| ammonia (NH <sub>3</sub> )        | turns damp, red litmus paper blue                                          |
| carbon dioxide (CO <sub>2</sub> ) | turns limewater milky                                                      |
| chlorine (Cl <sub>2</sub> )       | bleaches damp litmus paper                                                 |
| hydrogen (H <sub>2</sub> )        | 'pops' with a lighted splint                                               |
| oxygen (O <sub>2</sub> )          | relights a glowing splint                                                  |
| sulfur dioxide (SO <sub>2</sub> ) | turns acidified aqueous potassium manganate(VII) from purple to colourless |

**Flame tests for metal ions**

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

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