



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

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CHEMISTRY

0620/53

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 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

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 **9** printed pages and **3** blank pages.

- 1 You are going to investigate what happens when dilute hydrochloric acid and copper(II) sulfate solution react with different metals.

Read all the instructions carefully before starting the experiments.

Instructions

You are going to carry out five experiments.

(a) Experiment 1

Use a measuring cylinder to pour 10 cm³ of dilute hydrochloric acid into a boiling tube. Put the boiling tube into a rack for support.

Measure the temperature of the hydrochloric acid and record it in the table below.

Add 1 g of zinc to the boiling tube and stir the mixture with the thermometer.

Measure and record the maximum temperature reached by the mixture. Pour the mixture away and rinse the boiling tube.

Experiment 2

Repeat Experiment 1 using 1 g of iron instead of zinc.

Record your results in the table.

Experiment 3

Repeat Experiment 1 using 1 g of magnesium instead of zinc.

Record your results in the table. Complete the final column in the table.

| experiment | initial temperature of acid / °C | maximum temperature reached / °C | temperature rise / °C |
|------------|----------------------------------|----------------------------------|-----------------------|
| 1 | | | |
| 2 | | | |
| 3 | | | |

[3]

(b) Experiment 4

Use a measuring cylinder to pour 10 cm³ of copper(II) sulfate solution into a boiling tube. Measure the temperature of the solution and record it in the table on page 3.

Add 1 g of magnesium to the boiling tube and stir the mixture with the thermometer.

Test the gas given off with a splint and record your result in the space below. Measure the maximum temperature reached by the mixture and record it in the table. Pour the mixture away and rinse the boiling tube.

test

result

[1]

(c) Experiment 5

Repeat Experiment 4 using 1 g of iron instead of magnesium. You do **not** need to test the gas. Record your observations in the space below and record your temperatures in the table.

Complete the final column in the table.

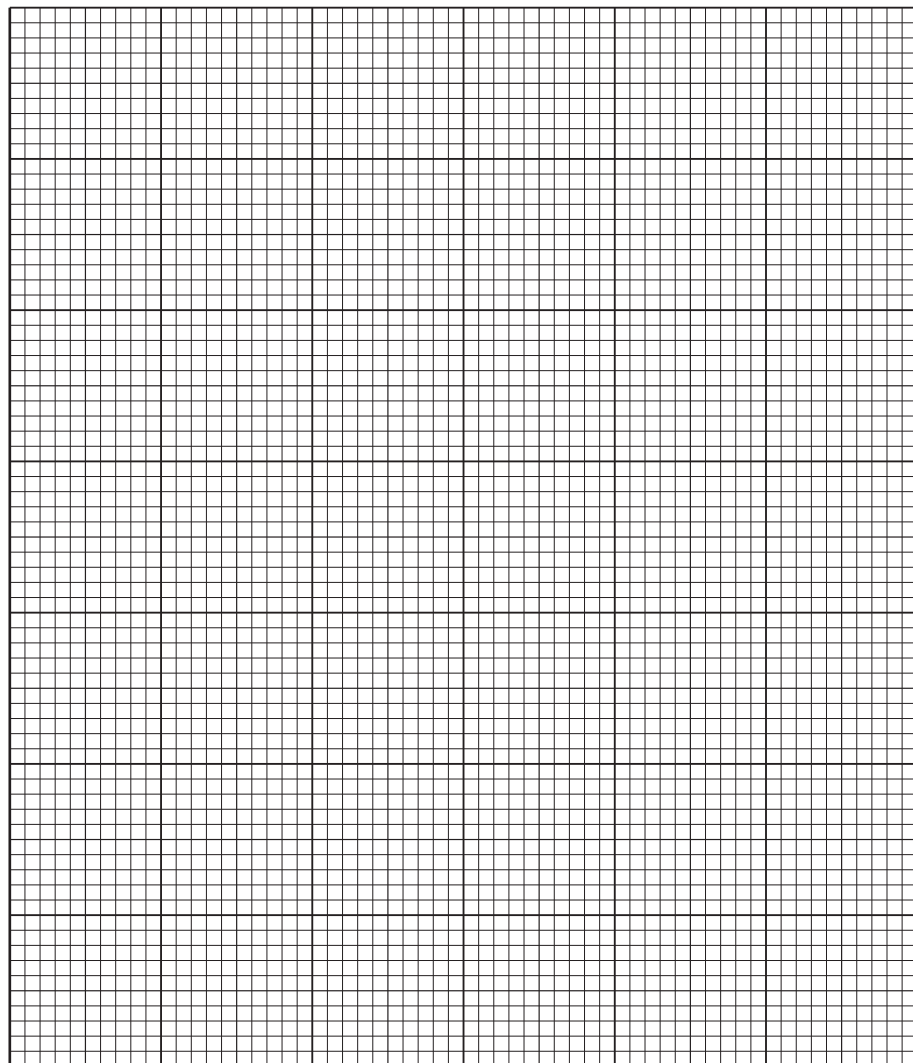
| experiment | initial temperature / °C | maximum temperature / °C | temperature rise / °C |
|------------|--------------------------|--------------------------|-----------------------|
| 4 | | | |
| 5 | | | |

observation

[3]

(d) Draw a labelled bar chart for the results of Experiments 1, 2, 3, 4 and 5 on the grid.

temperature
rise / °C



[3]

Use your results and observations for Experiments 1, 2 and 3 to answer the following questions.

(e) (i) Which experiment, 1, 2 or 3, produced the largest temperature rise?

..... [1]

(ii) Suggest why this experiment produced the largest temperature rise.

.....

..... [1]

(f) Name the gas given off in Experiment 4.

..... [1]

(g) Suggest why potassium was **not** used as one of the metals in these experiments.

..... [1]

(h) Give **one** advantage of using a measuring cylinder to add the hydrochloric acid to the boiling tube.

..... [1]

(i) Suggest and explain **one** change to improve the accuracy of these experiments.

.....

.....

..... [2]

[Total: 17]

- 2 You are provided with a mixture of two solids, **G** and **H**.
Solid **G** is water soluble and solid **H** is insoluble in water.
Carry out the following tests on the mixture, recording all of your observations at each stage.

Add about 15 cm³ of distilled water to the mixture in a boiling tube.

Shake the boiling tube for one minute. Filter the contents of the tube, keeping the filtrate and the residue. Divide the filtrate into four equal portions in four test-tubes and carry out the following tests.

tests on filtrate

- (a) (i) Add several drops of aqueous sodium hydroxide to the first portion of the solution and shake the test-tube.
Now add excess aqueous sodium hydroxide to the test-tube.
Record your observations.

.....
.....
..... [3]

- (ii) Using the second portion of the solution, repeat the test in (a)(i) using aqueous ammonia instead of aqueous sodium hydroxide.
Record your observations.

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

- (iii) Add a few drops of dilute nitric acid to the third portion of the solution followed by about 1 cm³ of aqueous silver nitrate.
Record your observations.

..... [1]

- (iv) Pour the fourth portion of the solution into a boiling tube.
Add about 1 cm³ of aqueous sodium hydroxide and a small piece of aluminium foil.
Warm the mixture carefully and test the gas given off.
Record your observations.

.....
.....
..... [3]

- (b) Identify solid **G**.

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

tests on the residue

- (c) Use a spatula to transfer some of the residue into a test-tube.
To the residue, add about 2 cm³ of dilute hydrochloric acid. Test any gases given off.
Record your observations.

.....
.....
..... [3]

- (d) Carry out a flame test on the residue.
Record your observations.

..... [1]

- (e) Identify solid H.

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

[Total: 17]

- 3 Nickel sulfate-6-water, $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$, is a blue crystalline salt. Plan an experiment to obtain a sample of pure water from this salt. Your answer should include a diagram of the apparatus, any expected observations and a test to show the presence of pure water. You are provided with common laboratory apparatus.

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.....

.....

..... [6]

[Total: 6]

NOTES FOR USE IN QUALITATIVE ANALYSIS**Test 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 |

Test 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 (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 |

Test for gases

| gas | test and test results |
|-----------------------------------|--|
| 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 |

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