



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

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CANDIDATE
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CHEMISTRY

0620/51

Paper 5 Practical Test

October/November 2011

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 a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, highlighters, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

Practical notes are provided on page 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 | |
|--------------------|--|
| 1 | |
| 2 | |
| Total | |

This document consists of **7** printed pages and **1** blank page.



- 1 You are going to investigate what happens when aqueous copper(II) sulfate reacts with two different metals, zinc and iron.

Read all the instructions below carefully before starting the experiments.

Instructions

You are going to carry out two experiments.

(a) Experiment 1

Use a measuring cylinder to pour 25 cm³ of the aqueous copper(II) sulfate provided into the polystyrene cup. Put the cup into a 250 cm³ beaker for support. Measure the temperature of the solution and record it in the table below. Start the timer and record the temperature every half a minute for one minute.

At exactly 1 minute, add the 5 g of zinc powder provided to the cup and stir the mixture with the thermometer. Measure and record the temperature of the mixture every half minute for an additional three minutes. Pour the solution away and rinse the polystyrene cup.

| | | | | | | |
|----------------|-----|-----|-----|-----|-----|-----|
| time/min | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 |
| temperature/°C | | | | | | |
| time/min | 3.0 | 3.5 | 4.0 | | | |
| temperature/°C | | | | | | |

[3]

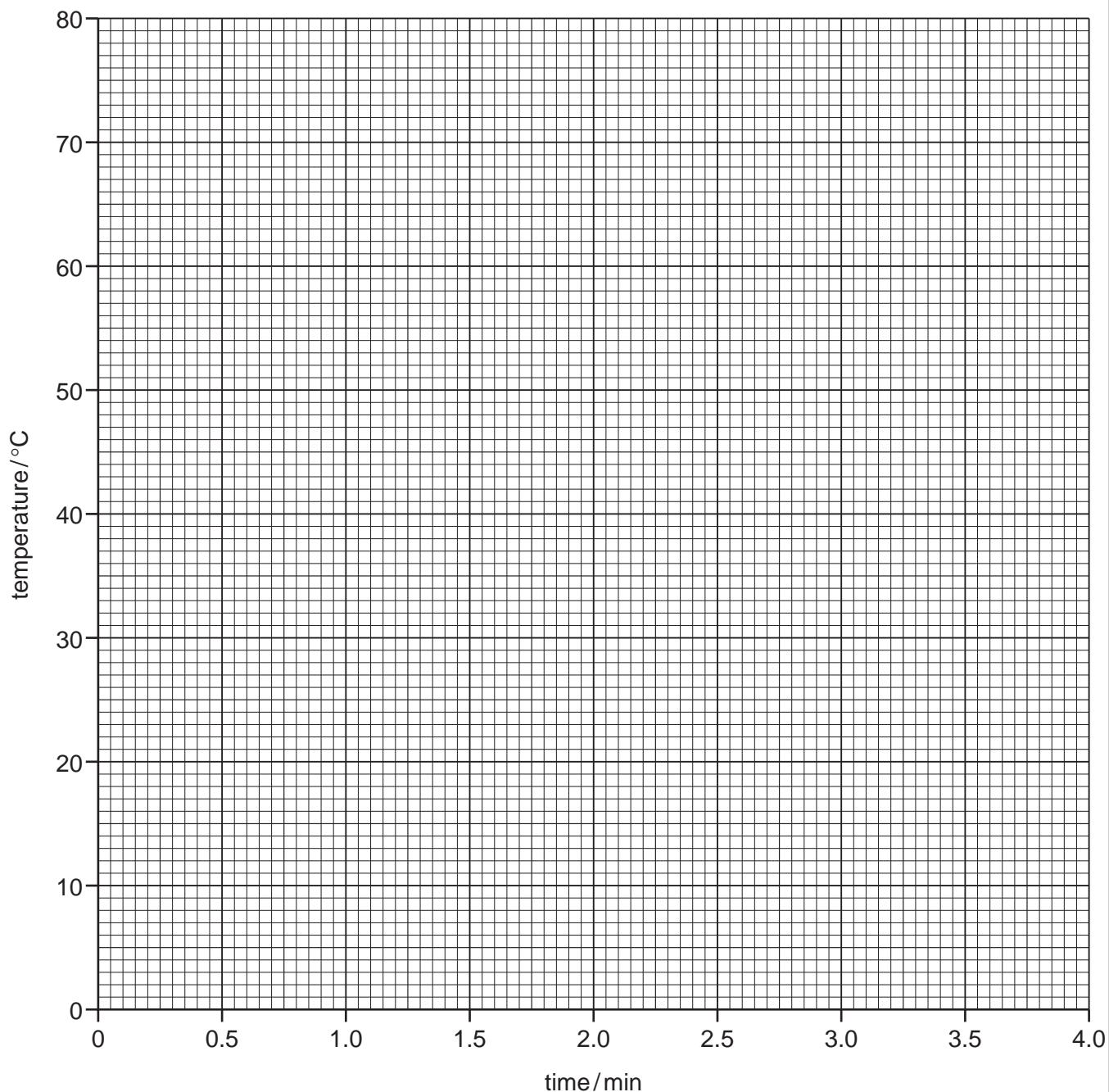
(b) Experiment 2

Repeat Experiment 1 using 5 g of the iron powder provided instead of the zinc powder. Record your results in the table below.

| | | | | | | |
|----------------|-----|-----|-----|-----|-----|-----|
| time/min | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 |
| temperature/°C | | | | | | |
| time/min | 3.0 | 3.5 | 4.0 | | | |
| temperature/°C | | | | | | |

[3]

- (c) Plot the results of both experiments on the grid below. Draw two smooth line graphs. Clearly label your graphs.



[5]

- (d) From your graph, work out the temperature of the reaction mixture in Experiment 1 after 1 minute 15 seconds.

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

..... [3]

- (e) What type of chemical reaction occurs when zinc and iron react with aqueous copper(II) sulfate?

..... [1]

(f) (i) Compare the temperature changes in Experiments 1 and 2.

..... [1]

(ii) Suggest an explanation for the difference in temperature changes.

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

(g) Explain how the temperature changes would differ in the experiments if 12.5 cm³ of copper(II) sulfate solution were used.

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

(h) Predict the effect of using lumps of zinc in Experiment 1. Explain your answer.

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

[Total: 21]

- 2 You are provided with three different liquids **P**, **Q** and **R**.
P and **R** are aqueous solutions and **Q** is a pure liquid.
 Carry out the following tests on **P**, **Q** and **R**, recording all of your observations in the table.
 Conclusions must **not** be written in the table.

| tests | observations |
|--|---|
| <p>(a) (i) Add about 1 cm³ of each liquid to separate test-tubes. Describe the colour and smell of each liquid.</p> <p>(ii) Using a teat pipette, add a few drops of each liquid to separate pieces of Universal Indicator paper. Describe the colour and the pH.</p> | <p>P</p> <p>Q</p> <p>R [2]</p> <p>P</p> <p>Q</p> <p>R [2]</p> |
| <p>(b) To about 2 cm³ of each liquid, add a piece of magnesium ribbon. Test the gas given off by liquid P.</p> | <p>P</p> <p>..... [3]</p> <p>Q [1]</p> <p>R [1]</p> |
| <p>(c) To about 2 cm³ of each liquid, add a marble chip.</p> | <p>P [1]</p> <p>Q [1]</p> <p>R [1]</p> |
| <p>(d) To about 5 cm³ of liquid P add a spatula measure of copper oxide. Heat the mixture to boiling. Leave to settle for 1 minute.</p> <p>Decant off the liquid and add 1 cm³ of dilute nitric acid and 1 cm³ of aqueous barium nitrate to this liquid.</p> | <p>..... [1]</p> <p>..... [1]</p> |
| <p>(e) Add about 2 cm³ of liquid Q to a boiling tube. Heat the liquid to boiling and use a thermometer to record the constant temperature of the vapour produced just above the surface of the liquid.</p> | <p>temperature°C [1]</p> |

(f) Identify liquid **P**.

..... [2]

(g) Identify liquid **Q**.

..... [1]

(h) What conclusion can you draw about liquid **R**?

..... [1]

[Total: 19]

NOTES FOR USE IN QUALITATIVE ANALYSIS

Test 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. |
| 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 with dilute nitric acid, then aqueous barium nitrate | white ppt. |

Test for aqueous cations

| <i>cation</i> | <i>effect of aqueous sodium hydroxide</i> | <i>effect of aqueous ammonia</i> |
|--------------------------------|--|--|
| 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. |
| 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

| <i>gas</i> | <i>test and test results</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 |

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