Cambridge IGCSE

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

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|---|---|
| CANDIDATE NAME | |
| CENTRE NUMBER | |
| CANDIDATE NUMBER | |

*6860639257*

**CHEMISTRY** **0620/52**

Paper 5 Practical Test **October/November 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 **10** printed pages and **2** blank pages.


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**1** You are going to investigate what happens when nitric acid reacts with aqueous solutions of two different alkalis, solution **N** and solution **O**.

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

**Instructions**
You are going to carry out two experiments.

**(a)** *Experiment 1*

Use a measuring cylinder to pour 50 $cm^3$ of solution **N** into the polystyrene cup provided. Put the polystyrene cup into a 250 $cm^3$ beaker for support. Measure the initial temperature of the solution and record it in the first row of the table.
Fill the burette with nitric acid to the 0.0 $cm^3$ mark.
Add 5.0 $cm^3$ of nitric acid to solution **N** in the polystyrene cup and stir the solution.
Measure and record the maximum temperature of the solution in the table.
Add a further 5.0 $cm^3$ of nitric acid to the polystyrene cup and stir the solution. Measure and record the maximum temperature of the solution in the table.
Continue to add 5.0 $cm^3$ portions of nitric acid to the polystyrene cup, until a total volume of 40 $cm^3$ of nitric acid has been added. Stir after each addition and measure and record the maximum temperatures in the table.

Pour the solution away and rinse the polystyrene cup.

| volume of nitric acid added / $cm^3$ | maximum temperature of the solution in the polystyrene cup / °C |
|---|---|
| 0.0 | |
| 5.0 | |
| 10.0 | |
| 15.0 | |
| 20.0 | |
| 25.0 | |
| 30.0 | |
| 35.0 | |
| 40.0 | |

[2]

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**(b)** *Experiment 2*

Refill the burette with nitric acid.
Repeat Experiment 1 using solution **O** instead of solution **N**.
Record your results in the table.

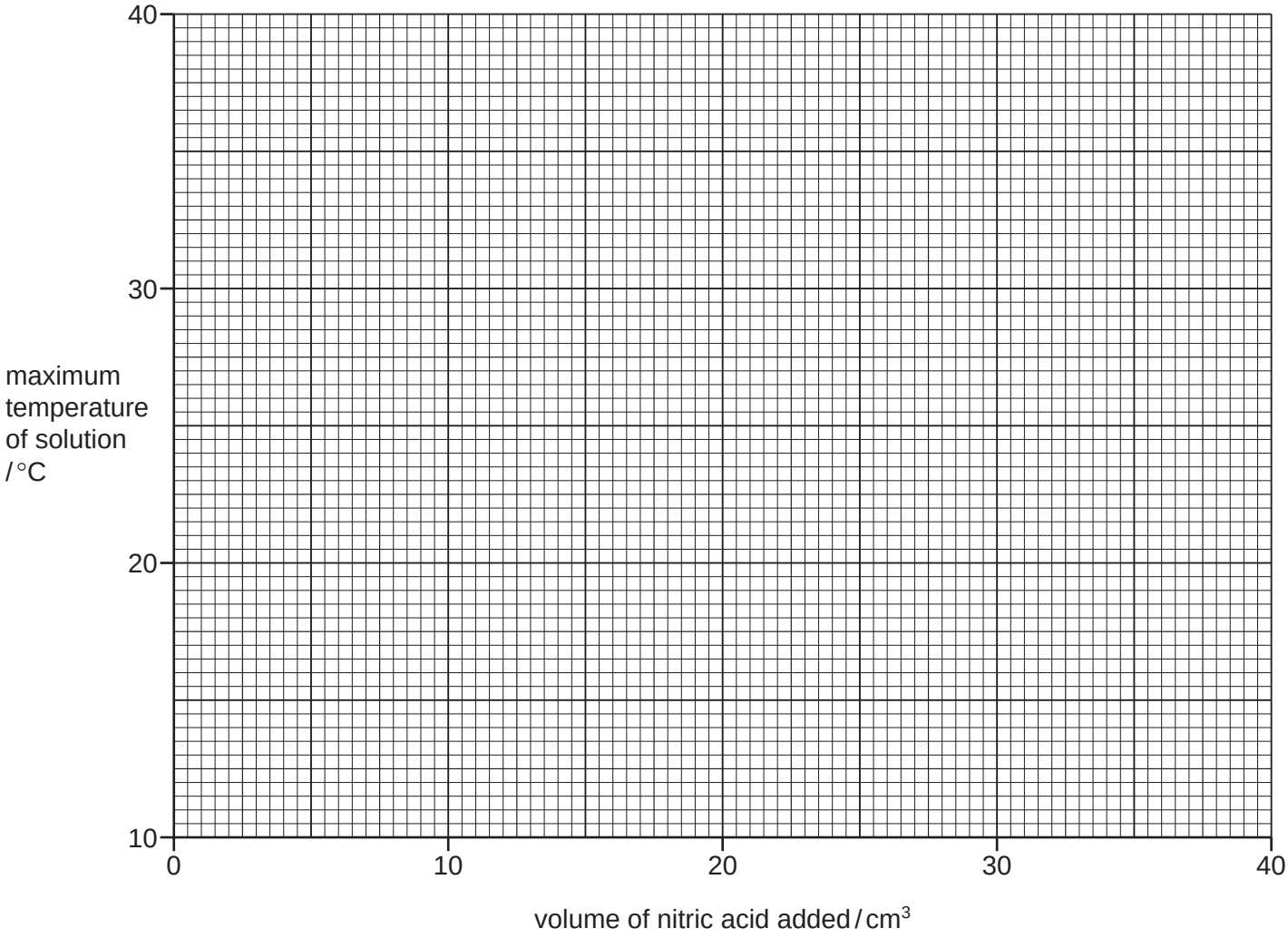
| volume of nitric acid added / $cm^3$ | maximum temperature of the solution in the polystyrene cup / °C |
|---|---|
| 0.0 | |
| 5.0 | |
| 10.0 | |
| 15.0 | |
| 20.0 | |
| 25.0 | |
| 30.0 | |
| 35.0 | |
| 40.0 | |

[2]

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**[Turn over**

**(c)** Plot the results for Experiments 1 and 2 on the grid and draw **two** smooth line graphs. Clearly label your graphs.




[4]

**(d)** **Use your graph** to estimate the maximum temperature of the solution when 13 $cm^3$ of nitric acid were added to 50 $cm^3$ of solution **N** in Experiment 1.

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

..... °C [2]

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**(e)** Name a suitable indicator that could be used in Experiment 1.

..... [1]

**(f)** Solution **N** and solution **O** are the same concentration.

In which experiment is the temperature change greater? Suggest why the temperature change is greater in this experiment.

.....

..... [2]

**(g)** How would the results differ in Experiment 1 if 100 $cm^3$ of solution **N** were used?

.....

..... [1]

**(h)** Suggest why a polystyrene cup is used in these experiments and **not** a copper can.

..... [1]

**(i)** State **one** source of error in the experiments. Suggest an improvement to reduce this source of error.

source of error .....

improvement .....
[2]

[Total: 17]

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**[Turn over**

**2** You are provided with solid **P**, which is a metallic salt.
Carry out the following tests on solid **P**, recording all of your observations at each stage.

**tests on solid P**

**(a)** Describe the appearance of solid **P**.

..... [1]

**(b)** Use a spatula to divide solid **P** into three portions.

**(i)** **test 1**
Heat the first portion of solid **P** in a hard-glass test-tube.
Test any gases given off with cobalt(II) chloride paper.
Record your observations.

.....

.....

..... [3]

**(ii)** **test 2**
Carry out a flame test on the second portion of solid **P**.
Record your observations.

..... [1]

**tests on a solution of P**

Add about 10 $cm^3$ of distilled water to the third portion of solid **P** in a test-tube. Stopper the test-tube and shake it to dissolve solid **P**.

**(c)** Divide the solution into four equal portions in four test-tubes. Carry out the following tests.

**(i)** To the first portion of the solution, add several drops of aqueous sodium hydroxide.
Then add excess aqueous sodium hydroxide to the mixture.
Record your observations.

.....

.....

..... [3]

**(ii)** To the second portion of the solution, add excess aqueous ammonia.
Record your observations.

.....

..... [1]

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**(iii)** To the third portion of the solution, add a few drops of dilute nitric acid and about 1 $cm^3$ of aqueous silver nitrate.
Record your observations.

..... [1]

**(iv)** To the fourth portion of the solution, add a few drops of dilute nitric acid and about 1 $cm^3$ of aqueous barium nitrate.
Record your observations.

.....

..... [2]

**(d)** Solid **P** contains a metal ion.

Suggest what the appearance of solid **P** in **(a)** tells you about the identity of the metal ion.

..... [1]

**(e)** What does **test 1** tell you about solid **P**?

..... [1]

**(f)** What does **test 2** tell you about solid **P**?

..... [1]

**(g)** Identify solid **P**.

.....

..... [2]

[Total: 17]

**3** Agri Limes are mixtures of calcium carbonate and calcium oxide. Farmers use Agri Limes on fields to neutralise acidity.

Plan an investigation to find out which of **two** different Agri Limes, **Q** or **R**, will neutralise more acid. You are provided with common laboratory apparatus and chemicals, including dilute nitric acid.

.....

.....

.....

.....

.....

.....

.....

..... [6]

[Total: 6]

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## 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 |

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**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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