UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER



**CHEMISTRY** **0620/53**

Paper 5 Practical Test **October/November 2012**

**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 | |
|---|---|
| **Total** | |

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

For Examiner's Use

**1** You are going to investigate what happens when aqueous sodium hydroxide reacts with two different acids, **G** and **H**.

**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 20 $cm^3$ of solution **G** into the polystyrene cup provided. Put the cup into a 250 $cm^3$ beaker for support. Measure the initial temperature of the solution and record it in the table below.

Fill the burette with the aqueous sodium hydroxide provided to the 0.0 $cm^3$ mark.
Add 5.0 $cm^3$ of aqueous sodium hydroxide to the solution of **G** in the cup and stir the mixture.

Measure and record the maximum temperature of the solution in the table below. Add a further 5.0 $cm^3$ of aqueous sodium hydroxide to the cup and stir the mixture. Measure and record the maximum temperature of the mixture in the table below.

Continue to add 5.0 $cm^3$ portions of aqueous sodium hydroxide to the cup, until a total volume of 40 $cm^3$ of aqueous sodium hydroxide 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 aqueous sodium hydroxide added / $cm^3$ | maximum temperature of solution in polystyrene cup / °C |
|---|---|
| 0.0 | |
| 5.0 | |
| 10.0 | |
| 15.0 | |
| 20.0 | |
| 25.0 | |
| 30.0 | |
| 35.0 | |
| 40.0 | |

[3]

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**(b)** *Experiment 2*

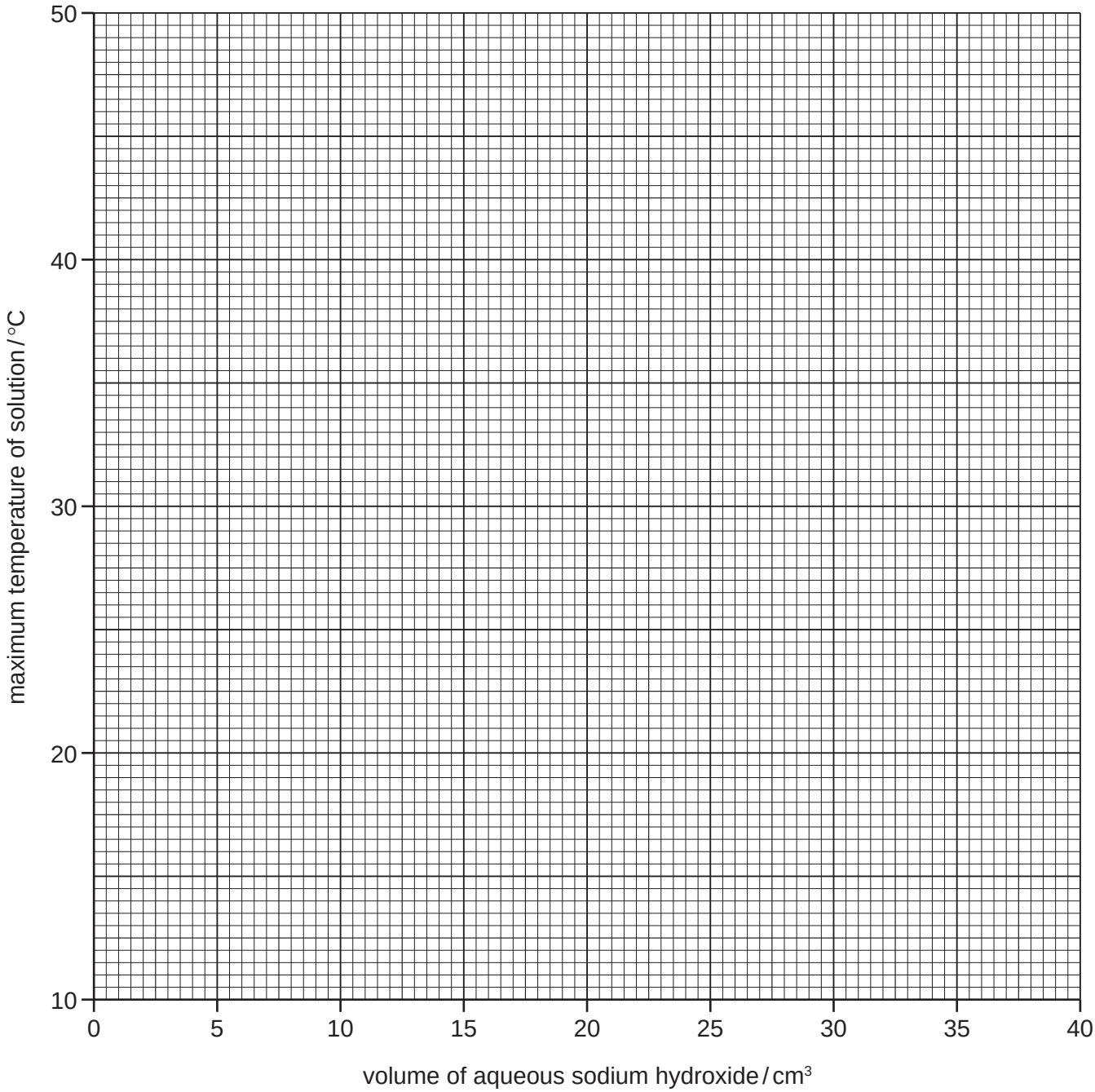
Repeat Experiment 1 using 20 $cm^3$ of solution **H** instead of 20 $cm^3$ of solution **G**. Record your results in the table below.

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

[3]

*For Examiner's Use*

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




[6]

**(d)** **Use your graph** to estimate the maximum temperature of the reaction mixture when 8 $cm^3$ of aqueous sodium hydroxide were added to 20 $cm^3$ of the solution of acid **G**. Show clearly **on the graph** how you worked out your answer.

..... [2]

**(e)** What type of chemical reaction, other than neutralisation, occurs when acid **H** reacts with aqueous sodium hydroxide?

..... [1]

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**(f)** **(i)** In which experiment is the temperature change greater?

..... [1]

**(ii)** Suggest why the temperature change is greater in this experiment.

.....

..... [1]

**(g)** Predict the temperature of the mixture in Experiment 2 after two hours. Explain your answer.

.....

..... [2]

[Total: 19]

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**2** You are provided with two salt solutions, **J** and **K**.
Carry out the following tests on **J** and **K**, recording all of your observations in the table.
Conclusions must **not** be written in the table.

| tests | observations |
|---|---|
| tests on solution **J**<br><br>**(a)** Describe the appearance of **J**. | ..... [1] |
| **(b)** To about 1 $cm^3$ of the solution, add an equal volume of aqueous sodium hydroxide. Leave to stand for five minutes. Note any changes. | .....<br>.....<br>..... [2] |
| **(c)** To about 1 $cm^3$ of the solution, add an equal volume of hydrogen peroxide.<br><br>Test the gas given off. | .....<br>.....<br>..... [3] |
| **(d)** To about 1 $cm^3$ of the solution, add about 1 $cm^3$ of aqueous ammonia. | ..... [1] |
| **(e)** To about 1 $cm^3$ of the solution, add a few drops of dilute nitric acid followed by aqueous silver nitrate. | ..... [1] |
| **(f)** To about 1 $cm^3$ of the solution, add a few drops of dilute nitric acid followed by barium nitrate solution. | ..... [2] |

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| tests | observations |
|---|---|
| <u>tests on solution **K**</u><br><br>**(g)** Describe the appearance of **K**. | ..... [1] |
| **(h)** To about 1 $cm^3$ of the solution, add 5 drops of aqueous sodium hydroxide.<br><br>Now add excess aqueous sodium hydroxide. | .....<br><br>.....<br><br>..... [3] |
| **(i)** To about 1 $cm^3$ of the solution, add about 2 $cm^3$ of aqueous sodium hydroxide and one spatula measure of aluminium powder. Heat the mixture gently.<br><br>Test the gas given off. | .....<br><br>..... [2] |

**(j)** What conclusions can you draw about solution **J**?

.....

..... [3]

**(k)** What conclusions can you draw about solution **K**?

.....

..... [2]

[Total: 21]

## 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. |
| 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

| *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. |
| 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 |