Cambridge
O Level

**Cambridge International Examinations**
Cambridge Ordinary Level

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

*2438209769*

**CHEMISTRY** **5070/31**

Paper 3 Practical Test **May/June 2018**

**1 hour 30 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.
Qualitative Analysis Notes are printed on page 8.
You should show the essential steps in any calculations and record experimental results in the spaces provided on the Question Paper.

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 **6** printed pages and **2** blank pages.

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CAMBRIDGE
International Examinations

**1** **P** is a mixture of dilute nitric acid, $HNO_3$, and dilute sulfuric acid, $H_2SO_4$. You are to determine the concentration of hydrogen ions in **P** by titrating this solution with aqueous sodium carbonate, **Q**.

**Q** is 0.225 mol/dm$^3$ sodium carbonate, $Na_2CO_3$.

**(a)** Put **P** into the burette.

Pipette a 25.0 cm$^3$ (or 20.0 cm$^3$) portion of **Q** into a flask and titrate with **P**, using the indicator provided.

Record your results in the table, repeating the titration as many times as you consider necessary to achieve consistent results.

**Results**

*Burette readings*

| titration number | 1 | 2 | |
|---|---|---|---|
| final reading / cm$^3$ | | | |
| initial reading / cm$^3$ | | | |
| volume of **P** used / cm$^3$ | | | |
| best titration results (✓) | | | |

**Summary**

Tick (✓) the best titration results.

Using the best titration results, the average volume of **P** required was ..... cm$^3$.

Volume of **Q** used was ..... cm$^3$.

[12]

**(b)** **Q** is 0.225 mol/dm$^3$ sodium carbonate.

Using your results from **(a)**, calculate the concentration, in mol/dm$^3$, of hydrogen ions in **P**. Give your answer to three significant figures.

$$CO_3^{2-} + 2H^+ \rightarrow H_2O + CO_2$$

concentration of hydrogen ions in **P** ..... mol/dm$^3$ [2]

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**P** is a mixture of dilute nitric acid, $HNO_3$, and dilute sulfuric acid, $H_2SO_4$.

The concentration of nitric acid in **P** is 0.125 mol/dm$^3$.

**(c)** Using your answer from **(b)**, calculate the number of moles of hydrogen ions in 1.00 dm$^3$ of **P** that are due to sulfuric acid.

moles of hydrogen ions in 1.00 dm$^3$ of **P** due to sulfuric acid ..... [1]

**(d)** Using your answer from **(c)**, calculate the concentration in mol/dm$^3$, of sulfuric acid in **P**.

concentration of sulfuric acid in **P** ..... mol/dm$^3$ [1]

**(e)** **P** was made by mixing equal volumes of the two dilute acids.

Calculate the concentration, in mol/dm$^3$, of the dilute nitric acid used to make **P**.

concentration of dilute nitric acid used to make **P** ..... mol/dm$^3$ [1]

[Total: 17]

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**[Turn over**

**2** You are provided with solution **R** and solid **S**.

Carry out the following tests and record your observations in the table.
You should test and name any gas evolved.

| test no. | test | observations |
|---|---|---|
| **1** | Test a sample of **R** with both red and blue litmus paper. | |
| **2** | **(a)** To 1 cm depth of **R** in a test-tube, add an equal volume of aqueous barium nitrate.<br><br>**(b)** To the mixture from **(a)**, add dilute nitric acid. | |
| **3** | To 2 cm depth of **R** in a test-tube, add a piece of magnesium ribbon. | |
| **4** | Put 2 cm depth of **R** in a boiling tube and warm the liquid until it just begins to boil. To the hot **R**, add **S**, a small amount at a time, until no further reaction takes place.<br><br>Filter the final mixture into a clean boiling tube. Retain the filtrate for tests 5 and 6. | |
| **5** | To half of the filtrate from test 4 in a test-tube, add aqueous sodium hydroxide until no further change occurs. | |

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| test no. | test | observations |
|---|---|---|
| **6** | To the other half of the filtrate from test 4 in a test-tube, add aqueous ammonia until no further change occurs. | |
| **7** | Put a small amount of **S** into a hard glass test-tube and heat the solid. Retain the final solid for test 8. | |
| **8** | **(a)** To 1 cm depth of aqueous hydrogen peroxide in a test-tube, add a little of the final solid from test 7.<br><br>**(b)** To the mixture from **(a)**, add an equal volume of aqueous ammonia. | |

[21]

**Conclusions**

Identify the compound present in **R**. .....

Identify compound **S**. .....

[2]

[Total: 23]

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## QUALITATIVE ANALYSIS NOTES

### Tests 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 add aluminium foil; warm carefully | ammonia produced |
| sulfate ($SO_4^{2-}$) [in solution] | acidify with dilute nitric acid, then add aqueous barium nitrate | white ppt., insoluble in excess dilute nitric acid |

### Tests 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. |
| chromium(III) ($Cr^{3+}$) | green ppt., soluble in excess, giving a green solution | green ppt., insoluble in excess |
| copper(II) ($Cu^{2+}$) | 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 |

### Tests for gases

| *gas* | *test and test result* |
|---|---|
| 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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