Cambridge Assessment International Education

# Cambridge O Level

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

*8167972993*

**CHEMISTRY** **5070/32**

Paper 3 Practical Test **May/June 2022**

**1 hour 30 minutes**

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

**INSTRUCTIONS**

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

**INFORMATION**

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].
- Notes for use in qualitative analysis are provided in the question paper.

| For Examiner's Use | |
|---|---|
| 1 | |
| 2 | |
| Total | |

This document has **8** pages. Any blank pages are indicated.


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**1** **P** is a mixture of equal volumes of dilute hydrochloric acid, HC*l*, and dilute sulfuric acid, $H_2SO_4$.

The concentration of hydrogen ions in **P** is determined by titrating this solution with aqueous sodium carbonate, **Q**.

**Q** is 0.275 mol / $dm^3$ sodium carbonate, $Na_2CO_3$.

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

Pipette 25.0 $cm^3$ of **Q** into a flask and titrate with **P**, using methyl orange indicator.

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 is ..... $cm^3$. [12]

**(b)** **Q** is 0.275 mol / $dm^3$ sodium carbonate.

The ionic equation for the reaction is shown.

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

Use your results from **(a)** to calculate the concentration, in mol / $dm^3$, of hydrogen ions in **P**.

Give your answer to three significant figures.

..... mol / $dm^3$ [2]

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**P** is a mixture of dilute hydrochloric acid, HC*l*, and dilute sulfuric acid, $H_2SO_4$.

The concentration of hydrochloric acid in **P** is 0.135 mol / $dm^3$.

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

..... mol [1]

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

..... mol / $dm^3$ [1]

**(e)** **P** is a mixture of equal volumes of dilute hydrochloric acid, HC*l*, and dilute sulfuric acid, $H_2SO_4$.

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

..... mol / $dm^3$ [1]

**(f)** Write the formulae of the **two** salts formed during this titration.

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

[Total: 18]

**2** You are provided with two solutions, **R** and **S**.

**(a)** Do the following tests on **R** and record your observations in the table.

| test no. | test | observations |
|---|---|---|
| **1** | **(i)** To 1 cm depth of **R** in a test-tube, add an equal volume of aqueous silver nitrate and leave to stand.<br><br>**(ii)** To the mixture from **(i)**, add 1 cm depth of dilute nitric acid. | |
| **2** | **(i)** To 1 cm depth of **R** in a test-tube, add aqueous sodium hydroxide until a change is seen.<br><br>**(ii)** To the mixture from **(i)**, add excess aqueous sodium hydroxide. | |
| **3** | **(i)** To 1 cm depth of **R** in a test-tube, add a small amount of ascorbic acid and mix well.<br><br>**(ii)** To the mixture from **(i)**, add aqueous sodium hydroxide until no further change is seen. | |
| **4** | **(i)** To 1 cm depth of **R** in a test-tube, add an equal volume of aqueous potassium iodide.<br><br>**(ii)** To the mixture from **(i)**, add 1 or 2 drops of starch indicator. | |

[9]

**(b) Conclusion**

The cation in **R** responsible for the observations in test **2** is ..... . [1]

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**(c)** Do the following tests on **S** and record your observations in the table.

Test and name any gas evolved.

| test no. | test | observations |
|---|---|---|
| **1** | **(i)** To 1 cm depth of **S** in a test-tube, add an equal volume of aqueous barium nitrate.<br><br>**(ii)** To the mixture from **(i)**, add 1 cm depth of dilute nitric acid. | |
| **2** | **(i)** To 1 cm depth of **S** in a test-tube, add aqueous ammonia until a change is seen.<br><br>**(ii)** To the mixture from **(i)**, add excess aqueous ammonia. | |
| **3** | **(i)** To 1 cm depth of **S** in a boiling tube, add aqueous sodium hydroxide until a change is seen.<br><br>**(ii)** To the mixture from **(i)**, add excess aqueous sodium hydroxide.<br><br>**(iii)** Warm the mixture from **(ii)** in the boiling tube. | |

[9]

**(d) Conclusions**

The solid used to prepare solution **S** contains two cations and one anion.

Identify these ions.

cations ..... and .....

anion .....

[3]

[Total: 22]

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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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