



**Cambridge International Examinations**  
Cambridge Ordinary Level

CANDIDATE  
NAME

CENTRE  
NUMBER

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|--|--|--|--|--|

CANDIDATE  
NUMBER

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|--|--|--|--|

**CHEMISTRY**

**5070/32**

Paper 3 Practical Test

**October/November 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.

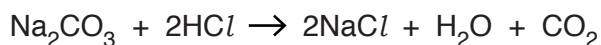
**For Examiner's Use**

|              |  |
|--------------|--|
| <b>1</b>     |  |
| <b>2</b>     |  |
| <b>Total</b> |  |

This document consists of **6** printed pages and **2** blank pages.



- 1 You are to determine the amount of water of crystallisation present in a sample of hydrated sodium carbonate by titrating with hydrochloric acid.



**P** is a solution containing 12.27 g/dm<sup>3</sup> of the sample of hydrated sodium carbonate.

**Q** is 0.110 mol/dm<sup>3</sup> hydrochloric acid.

- (a) Put **Q** into the burette.

Pipette a 25.0 cm<sup>3</sup> (or 20.0 cm<sup>3</sup>) portion of **P** into a flask and titrate with **Q**, 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 <sup>3</sup>           |   |   |  |
| initial reading/cm <sup>3</sup>         |   |   |  |
| volume of <b>Q</b> used/cm <sup>3</sup> |   |   |  |
| best titration results (✓)              |   |   |  |

### Summary

Tick (✓) the best titration results.

Using the best titration results, the average volume of **Q** required was ..... cm<sup>3</sup>.

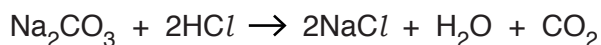
Volume of solution **P** used was ..... cm<sup>3</sup>. [12]

- (b) **Q** is 0.110 mol/dm<sup>3</sup> hydrochloric acid.

Calculate the number of moles of hydrochloric acid present in the average volume of **Q**.

moles of hydrochloric acid in the average volume of **Q** ..... [1]

- (c) Using your answer from (b) and the equation shown, calculate the number of moles of sodium carbonate in the volume of **P** used in the titration.



moles of sodium carbonate in the volume of **P** used ..... [1]

- (d) Using your answer from (c), calculate the concentration, in  $\text{mol/dm}^3$ , of sodium carbonate in **P**.

concentration of sodium carbonate in **P** .....  $\text{mol/dm}^3$  [1]

- (e) Using your answer from (d), calculate the mass, in g, of sodium carbonate in  $1.00\text{dm}^3$  of **P**.  
[ $M_r$ :  $\text{Na}_2\text{CO}_3$ , 106]

mass of sodium carbonate in  $1.00\text{dm}^3$  of **P** ..... g [1]

- (f) Using your answer from (e), calculate the mass of water of crystallisation present in the 12.27 g of the hydrated sodium carbonate used to make **P**.

mass of water of crystallisation present ..... g [1]

- (g) Calculate the percentage by mass of water of crystallisation present in the hydrated sodium carbonate used to make **P**.

percentage by mass of water of crystallisation ..... [1]

[Total: 18]

2 You are provided with solutions **R** and **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 <b>R</b> with red litmus paper and with blue litmus paper.                                                                                                                                    |              |
| 2        | To 1 cm depth of aqueous calcium chloride in a test-tube, add <b>R</b> slowly with mixing until no further change occurs.                                                                                      |              |
| 3        | To 1 cm depth of aqueous chromium(III) chloride in a test-tube, add <b>R</b> slowly with mixing until no further change occurs.                                                                                |              |
| 4        | To 2 cm depth of <b>R</b> in a hard-glass test-tube, add a piece of aluminium foil and warm the mixture gently until the reaction begins.                                                                      |              |
| 5        | <p>(a) To 1 cm depth of <b>R</b> in a boiling tube, add a small amount of sodium nitrate. Warm the mixture gently for about 10 seconds.</p> <p>(b) To the mixture from (a), add a piece of aluminium foil.</p> |              |
| 6        | <p>(a) To 1 cm depth of <b>S</b> in a test-tube, add a few drops of aqueous silver nitrate.</p> <p>(b) To the mixture from (a), add dilute nitric acid.</p>                                                    |              |

| test no. | test                                                                                                                                                                                                                                                                                                                                                                   | observations |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 7        | <p><b>(a)</b> To 1cm depth of <b>S</b> in a test-tube, add an equal volume of dilute sulfuric acid and then one or two drops of aqueous hydrogen peroxide.</p> <p><b>(b)</b> To the mixture from <b>(a)</b>, add an equal volume of aqueous hydrogen peroxide and allow to stand for a few minutes.</p>                                                                |              |
| 8        | <p><b>(a)</b> To 0.5cm depth of acidified aqueous potassium manganate(VII) in a test-tube, add twice the volume of <b>S</b>.</p> <p><b>(b)</b> To the mixture from <b>(a)</b>, add a few drops of starch solution.</p>                                                                                                                                                 |              |
| 9        | <p><b>(a)</b> To 1cm depth of <b>S</b> in a test-tube, add an equal volume of dilute sulfuric acid. To the mixture, add three drops of aqueous potassium iodate solution.</p> <p><b>(b)</b> To the mixture from <b>(a)</b>, add 2cm depth of <b>R</b>.</p> <p><b>(c)</b> To the mixture from <b>(b)</b>, add dilute sulfuric acid until no further change is seen.</p> |              |

[20]

### Conclusions

Identify the anion in each of the solutions.

The anion in **R** is .....

The anion in **S** is .....

[2]

[Total: 22]

**BLANK PAGE**

**BLANK PAGE**

## QUALITATIVE ANALYSIS NOTES

## Tests for anions

| <i>anion</i>                                    | <i>test</i>                                                          | <i>test result</i>                                 |
|-------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------|
| carbonate ( $\text{CO}_3^{2-}$ )                | add dilute acid                                                      | effervescence, carbon dioxide produced             |
| chloride ( $\text{Cl}^-$ )<br>[in solution]     | acidify with dilute nitric acid, then add aqueous silver nitrate     | white ppt.                                         |
| iodide ( $\text{I}^-$ )<br>[in solution]        | acidify with dilute nitric acid, then add aqueous silver nitrate     | yellow ppt.                                        |
| nitrate ( $\text{NO}_3^-$ )<br>[in solution]    | add aqueous sodium hydroxide then add aluminium foil; warm carefully | ammonia produced                                   |
| sulfate ( $\text{SO}_4^{2-}$ )<br>[in solution] | acidify with dilute nitric acid, then add aqueous barium nitrate     | white ppt., insoluble in excess dilute nitric acid |

## Tests for aqueous cations

| <i>cation</i>                      | <i>effect of aqueous sodium hydroxide</i>                  | <i>effect of aqueous ammonia</i>                               |
|------------------------------------|------------------------------------------------------------|----------------------------------------------------------------|
| aluminium ( $\text{Al}^{3+}$ )     | white ppt., soluble in excess giving a colourless solution | white ppt., insoluble in excess                                |
| ammonium ( $\text{NH}_4^+$ )       | ammonia produced on warming                                | —                                                              |
| calcium ( $\text{Ca}^{2+}$ )       | white ppt., insoluble in excess                            | no ppt.                                                        |
| chromium(III) ( $\text{Cr}^{3+}$ ) | green ppt., soluble in excess giving a green solution      | green ppt., insoluble in excess                                |
| copper(II) ( $\text{Cu}^{2+}$ )    | light blue ppt., insoluble in excess                       | light blue ppt., soluble in excess giving a dark blue solution |
| iron(II) ( $\text{Fe}^{2+}$ )      | green ppt., insoluble in excess                            | green ppt., insoluble in excess                                |
| iron(III) ( $\text{Fe}^{3+}$ )     | red-brown ppt., insoluble in excess                        | red-brown ppt., insoluble in excess                            |
| zinc ( $\text{Zn}^{2+}$ )          | white ppt., soluble in excess giving a colourless solution | white ppt., soluble in excess giving a colourless solution     |

## Tests for gases

| <i>gas</i>                       | <i>test and test result</i>      |
|----------------------------------|----------------------------------|
| ammonia ( $\text{NH}_3$ )        | turns damp red litmus paper blue |
| carbon dioxide ( $\text{CO}_2$ ) | turns limewater milky            |
| chlorine ( $\text{Cl}_2$ )       | bleaches damp litmus paper       |
| hydrogen ( $\text{H}_2$ )        | 'pops' with a lighted splint     |
| oxygen ( $\text{O}_2$ )          | relights a glowing splint        |

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cie.org.uk](http://www.cie.org.uk) after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.