



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

CANDIDATE  
NAME

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NUMBER

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**CHEMISTRY**

**5070/32**

Paper 3 Practical Test

**May/June 2010**

**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 ink.

You may use a soft pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.

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 An organic acid has the molecular formula  $C_3H_4O_5$ .

You are required to find by experiment the number of moles of sodium hydroxide that react with 1 mole of this organic acid.

**P** is  $0.300 \text{ mol/dm}^3$  sodium hydroxide.

**Q** is an aqueous solution of the organic acid,  $C_3H_4O_5$ , containing  $18.0 \text{ g/dm}^3$ .

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

Pipette a  $25.0 \text{ cm}^3$  (or  $20.0 \text{ cm}^3$ ) 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 / $\text{cm}^3$           |   |   |  |
| initial reading / $\text{cm}^3$         |   |   |  |
| volume of <b>Q</b> used / $\text{cm}^3$ |   |   |  |
| best titration results (✓)              |   |   |  |

### Summary

Tick (✓) the best titration results.

Using these results, the average volume of **Q** required was .....  $\text{cm}^3$ .

Volume of **P** used was .....  $\text{cm}^3$ .

[12]

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- (b) **P** is 0.300 mol/dm<sup>3</sup> sodium hydroxide.

Calculate the number of moles of sodium hydroxide in the volume of **P** used.

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

- (c) **Q** is an aqueous solution of C<sub>3</sub>H<sub>4</sub>O<sub>5</sub> containing 18.0 g/dm<sup>3</sup>.

Calculate the concentration, in mol/dm<sup>3</sup>, of C<sub>3</sub>H<sub>4</sub>O<sub>5</sub> in **Q**.  
[The relative molecular mass of C<sub>3</sub>H<sub>4</sub>O<sub>5</sub> is 120.]

concentration of C<sub>3</sub>H<sub>4</sub>O<sub>5</sub> in **Q** ..... mol/dm<sup>3</sup> [1]

- (d) Calculate the number of moles of C<sub>3</sub>H<sub>4</sub>O<sub>5</sub> in the average volume of **Q** used in the titration.

moles of C<sub>3</sub>H<sub>4</sub>O<sub>5</sub> ..... [1]

- (e) Using your answers from (b) and (d) calculate the number of moles of sodium hydroxide which react with 1 mole of C<sub>3</sub>H<sub>4</sub>O<sub>5</sub>.

moles of sodium hydroxide ..... [1]

- (f) Using your answer to (e) write an equation for the reaction of the organic acid, C<sub>3</sub>H<sub>4</sub>O<sub>5</sub>, with sodium hydroxide.

.....[2]

[Total: 18]

- 2 You are provided with three solutions **R**, **S**, and **T**. Carry out the following tests and record your observations in the table. You should test and name any gas evolved.

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| test no. | test                                                                                                                                                                                                                          | observations with solution <b>R</b> |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <b>1</b> | <p><b>(a)</b> To 2 cm depth of the solution in a test-tube, add an equal volume of dilute sulfuric acid.</p> <p><b>(b)</b> Add 2 cm depth of aqueous hydrogen peroxide to the mixture from <b>(a)</b> and leave to stand.</p> |                                     |
| <b>2</b> | <p><b>(a)</b> To 2 cm depth of the solution in a test-tube, add a few drops of aqueous silver nitrate.</p> <p><b>(b)</b> Add an equal volume of dilute nitric acid to the mixture from <b>(a)</b>.</p>                        |                                     |
| <b>3</b> | <p><b>(a)</b> To 2 cm depth of the solution in a test-tube, add a few drops of aqueous barium chloride.</p> <p><b>(b)</b> Add an equal volume of dilute hydrochloric acid to the mixture from <b>(a)</b>.</p>                 |                                     |

| observations with solution <b>S</b> | observations with solution <b>T</b> |
|-------------------------------------|-------------------------------------|
|                                     |                                     |
|                                     |                                     |
|                                     |                                     |

[19]

**Conclusion**The formula of the anion present in **R** is .....The formula of the anion present in **S** is .....Suggest the type of element in the compound present in **T**.

.....[3]

[Total: 22]

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## 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 lead(II) 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.                             |

## 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., or very slight white ppt.                             |
| 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 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                                             |
| sulfur dioxide ( $\text{SO}_2$ ) | turns acidified aqueous potassium dichromate(VI) from orange to green |