



Cambridge O Level

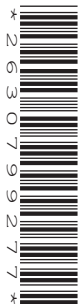
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CHEMISTRY

5070/32

Paper 3 Practical Test

October/November 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.

1 **P** is a sample of dilute nitric acid.

P is prepared by adding 5.0 cm³ of concentrated nitric acid to distilled water and making the total volume of the solution up to 250 cm³ with distilled water.

Q is 0.316 mol/dm³ sodium hydroxide.

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

Pipette 25.0 cm³ 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

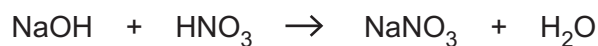
Tick (✓) the best titration results.

Using the best titration results the average volume of **P** required is cm³.

[12]

(b) **Q** is 0.316 mol/dm³ sodium hydroxide.

The equation for the reaction is shown.



Use your result from (a) to calculate the concentration, in mol/dm³, of nitric acid in **P**.

Give your answer to three significant figures.

..... mol/dm³ [2]

- (c) **P** is prepared by adding 5.0 cm^3 of concentrated nitric acid to distilled water and making the total volume of the solution up to 250 cm^3 with distilled water.

Use your answer from (b) to calculate the number of moles of nitric acid in 5.0 cm^3 of concentrated nitric acid.

..... mol [1]

- (d) Use your answer from (c) to calculate the concentration, in mol/dm^3 , of concentrated nitric acid.

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

- (e) Use your answer from (d) to calculate the mass, in g, of nitric acid, HNO_3 , in 1 dm^3 of concentrated nitric acid.

[M_r : HNO_3 , 63]

..... g [1]

[Total: 17]

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 and name any gas evolved.

| test no. | test | observations |
|----------|---|--------------|
| 1 | <p>(i) To 1 cm depth of R in a test-tube, add aqueous sodium hydroxide until a change is seen.</p> <p>(ii) To the mixture from (i), add excess aqueous sodium hydroxide.</p> | |
| 2 | <p>(i) To 1 cm depth of R in a test-tube, add aqueous ammonia until a change is seen.</p> <p>(ii) To the mixture from (i), add excess aqueous ammonia.</p> <p>(iii) Put 1 cm depth of aqueous hydrogen peroxide in a boiling tube. Add the mixture from (ii) to this boiling tube.</p> | |
| 3 | <p>(i) To 1 cm depth of R in a test-tube, add an equal volume of dilute nitric acid.</p> <p>(ii) Pour half of the mixture from (i) into a test-tube and add an equal volume of aqueous barium nitrate or barium chloride.</p> <p>(iii) To the other half of the mixture from (i), add an equal volume of aqueous silver nitrate.</p> | |

[11]

(b) **Conclusion**

A solid is used to prepare solution **R**.

The name of the solid is

[1]

(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 | <p>(i) To 1 cm depth of S in a test-tube, add aqueous sodium hydroxide until a change is seen.</p> <p>(ii) To the mixture from (i), add excess aqueous sodium hydroxide.</p> | |
| 2 | <p>(i) To 1 cm depth of S in a test-tube, add aqueous ammonia until a change is seen.</p> <p>(ii) To the mixture from (i), add excess aqueous ammonia.</p> <p>(iii) Put 1 cm depth of aqueous hydrogen peroxide in a boiling tube.</p> <p>Add the mixture from (ii) to this boiling tube.</p> | |
| 3 | <p>(i) To 1 cm depth of S in a test-tube, add an equal volume of dilute nitric acid.</p> <p>(ii) Pour half of the mixture from (i) into a test-tube and add an equal volume of aqueous barium nitrate or barium chloride.</p> <p>(iii) To the other half of the mixture from (i), add an equal volume of aqueous silver nitrate.</p> | |

[10]

(d) **Conclusion**

A solid is used to prepare solution **S**.

The name of the solid is

[1]

[Total: 23]

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QUALITATIVE ANALYSIS NOTES

Tests for anions

| <i>anion</i> | <i>test</i> | <i>test result</i> |
|---|--|--|
| 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

| <i>cation</i> | <i>effect of aqueous sodium hydroxide</i> | <i>effect of aqueous ammonia</i> |
|------------------------------------|--|--|
| 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

| <i>gas</i> | <i>test and test result</i> |
|----------------------------------|----------------------------------|
| 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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