| Centre Number | Candidate Number |
|---|---|
| | |

Candidate Name _____

**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**General Certificate of Education Ordinary Level**

# CHEMISTRY 5070/3

PAPER 3 Practical Test

**MAY/JUNE SESSION 2002**

1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
As listed in Instructions to Supervisors

**wTIME** 1 hour 30 minutes

## INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.

Answer **both** questions.

Write your answers in the spaces provided on the question paper.

You should show the essential steps in any calculation and record all experimental results in the spaces provided on the question paper.

## INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

Qualitative Analysis notes for this paper are printed on page 8.

| FOR EXAMINER'S USE | |
|---|---|
| 1 | |
| 2 | |
| TOTAL | |

**This question paper consists of 6 printed pages and 2 blank pages.**



UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

**[Turn over**

**1** **P** is a solution of either hydrochloric acid (HC*l*) or sulphuric acid ($H_2SO_4$). You are to identify the acid, and determine its concentration by titrating it against solution **Q** which is 0.100 mol/dm$^3$ sodium hydroxide.

**(a)** Identification of the acid in **P**

Carry out the following tests on solution **P** and record your observations in the table.

| Test no. | Test | Observations |
|---|---|---|
| **1** | To a portion of **P**, add an equal volume of aqueous lead(II) nitrate. | |
| **2** | To a portion of **P**, add an equal volume of aqueous silver nitrate. | |
| **3** | To a portion of **P**, add an equal volume of aqueous barium nitrate. | |

The acid present in **P** is ..... [4]

**(b)** Determination of the concentration of the acid in **P**

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 these results, the average volume of **P** required was ..... $cm^3$.

Volume of solution **Q** used was ..... $cm^3$. [12]

**(c)** **Q** is 0.100 mol / $dm^3$ sodium hydroxide.
Using your results from **(b)**, calculate the concentration, in mol / $dm^3$, of the acid in **P**.

Concentration of acid in **P** ..... mol / $dm^3$. [3]



**[Turn over**

**2** You are provided with two solutions **R** and **S** which contain the same transition metal. Carry out the following tests and record your observations in the table. You should test and name any gas evolved.

**Tests on Solution R**

| Test no. | Test | Observations |
|---|---|---|
| **1** | **(a)** To a portion of solution **R**, add an equal volume of aqueous barium nitrate and allow the mixture to stand for a few minutes.<br><br>**(b)** Add nitric acid to the mixture from **(a)**. | |
| **2** | **(a)** To a portion of solution **R**, add aqueous sodium hydroxide until a change is seen.<br><br>**(b)** Add excess aqueous sodium hydroxide to the mixture from **(a)**.<br><br>**(c)** To a portion of the mixture from **(b)**, add an equal volume of aqueous hydrogen peroxide and warm **gently**. | |

[10]

**Conclusion**

The negative ion present in **R** is ..... [1]

**Tests on Solution S**

| Test no. | Test | Observations |
|---|---|---|
| **3** | **(a)** To a portion of solution **S**, add aqueous sodium hydroxide until a change is seen.<br><br>**(b)** To a portion of the mixture from **(a)**, add an equal volume of aqueous barium nitrate and allow the mixture to stand for a few minutes.<br><br>**(c)** To the mixture from **(b)**, add nitric acid. | |
| **4** | To a small portion of solution **S**, add an equal volume of dilute sulphuric acid followed by an equal volume of aqueous hydrogen peroxide. | |

[9]

**Conclusions**

Transition metals form coloured compounds. Suggest another property of transition metals shown by these tests.

property ..... [1]

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# NOTES FOR USE IN QUALITATIVE ANALYSIS

## Test 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 lead(II) nitrate | yellow ppt. |
| nitrate ($NO_3^-$) [in solution] | add aqueous sodium hydroxide then aluminium foil; warm carefully | ammonia produced |
| sulphate ($SO_4^{2-}$) [in solution] | acidify with dilute nitric acid, then add aqueous barium nitrate | white ppt. |

## Test 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. or very slight white ppt. |
| 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 |

## Test 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 |
| sulphur dioxide ($SO_2$) | turns aqueous potassium dichromate(VI) from orange to green |