| Centre Number | Candidate Number | Name |
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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

**CHEMISTRY** **5070/03**

Paper 3 Practical Test

May/June 2006

**1 hour 30 minutes**

Candidates answer on the Question Paper.
Additional Materials: As listed in the Instructions to Supervisors.

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a pencil for any diagrams, graphs or rough work.
Do not use staples, paper clips, highlighters, glue or correction fluid.
You may use a calculator.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.
Qualitative analysis notes are printed on page 8.
You should show the essential steps in any calculation and record experimental results in the spaces provided on the question paper.

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

This document consists of **7** printed pages and **1** blank page.

**1** Compound **X** is an oxidising agent. An acidified solution of **X** oxidises potassium iodide to iodine which can be titrated with sodium thiosulphate.

Solution **P** was prepared by dissolving 1.70 g of compound **X** in 1.00 $dm^3$ of distilled water.

You are to determine the relative molecular mass of **X**.

Solution **Q** is 0.100 mol/$dm^3$ sodium thiosulphate, $Na_2S_2O_3$.

**(a)** Fill the burette with solution **Q**.

Pipette a 25.0 $cm^3$ (or 20.0 $cm^3$) portion of **P** into a flask and add about a test-tubeful of dilute sulphuric acid followed by about a test-tubeful of aqueous potassium iodide. The solution should turn red-brown. **Do not add the starch indicator at this stage.**

Add **Q** from the burette until the red-brown colour fades to pale yellow, **then** add a few drops of the starch indicator. This will give a dark blue solution. Continue adding **Q** slowly from the burette until one drop of **Q** causes the blue colour to disappear, leaving a colourless solution. 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 **Q** used / $cm^3$ | | | |
| best titration results (✓) | | | |

**Summary**

Tick (✓) the best titration results.

Using these results, the average volume of **Q** required was ……. $cm^3$.

Volume of **P** used was ……. $cm^3$.

[12]

**(b)** **Q** is 0.100 mol/dm$^3$ sodium thiosulphate.

**One** mole of **X** reacts with potassium iodide to produce iodine. The iodine produced reacts with **two** moles of sodium thiosulphate.

Calculate the concentration, in mol/dm$^3$, of **X** in solution **P**.

Concentration of **X** in solution **P** is …… mol/dm$^3$. [2]

**(c)** **P** contains 1.70 g/dm$^3$ **X**.

Using your answer to **(b)**, calculate the relative molecular mass of **X**.

Relative molecular mass of **X** is …… [2]





**[Turn over**

**2** You are provided with solid **R** and solution **S** both of which contain a compound of the same transition metal. Carry out the following experiments and record your observations in the table. You should test and name any gas evolved.

Tests on solid **R**

| test no. | test | observations |
|---|---|---|
| **1** | Add a portion of aqueous hydrogen peroxide to a small sample of **R**. | |
| **2** | Add 1-2 $cm^3$ of concentrated hydrochloric acid to a sample of **R** and warm **gently**. | |

[9]

Tests on solution **S**

| test no. | test | observations |
|---|---|---|
| **3** | **(a)** To a portion of **S,** add aqueous sodium hydroxide until a change is seen.<br><br>**(b)** Add excess aqueous sodium hydroxide to the mixture from **(a)** and allow to stand for a few minutes, shaking occasionally.<br><br>**(c)** To a portion of the mixture from **(b)**, add a few drops of aqueous hydrogen peroxide. | |
| **4** | **(a)** To a portion of **S**, add an equal volume of aqueous silver nitrate.<br><br>**(b)** Add dilute nitric acid to the mixture from **(a)**. | |
| **5** | **(a)** To a portion of **S**, add an equal volume of aqueous barium nitrate.<br><br>**(b)** Add dilute nitric acid to the mixture from **(a)**. | |





**[Turn over**

| test no. | test | observations |
|---|---|---|
| **6** | To a portion of acidified potassium manganate(VII), add an equal volume of solution **S**. | |

[12]

**Conclusions**

In test **1**, solid **R** is acting as ……

In test **2**, solid **R** is acting as ……

The anion (negative ion) present in solution **S** is …… [3]

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# NOTES FOR USE IN QUALITATIVE ANALYSIS

## 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 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. |

## 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. 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 |

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