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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
 Joint Examination for the School Certificate
 and General Certificate of Education Ordinary Level

CHEMISTRY

5070/03

Paper 3 Practical Test

October/November 2004

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: as listed in Instructions to Supervisors

READ THESE INSTRUCTIONS FIRST

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.

If you are using semi-micro methods in Question 2, you should modify the instructions to suit the size of apparatus and the techniques you are using.

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.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

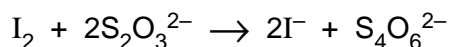
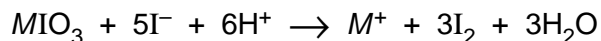
Stick your personal label here, if provided.

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1	
2	
TOTAL	

This document consists of **8** printed pages.



- 1 Solution **P** was prepared by dissolving 3.30 g of a compound MIO_3 in 1.00 dm³ of water. An acidified solution of MIO_3 oxidises potassium iodide to iodine which can be titrated with sodium thiosulphate.



You are to determine the relative molecular mass of MIO_3 and hence identify M .

Q is 0.100 mol/dm³ sodium thiosulphate.

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

Pipette a 25.0 cm³ (or 20.0 cm³) 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 cm³.

Volume of solution **P** used was cm³.

[12]

- (b) **Q** is 0.100 mol/dm^3 sodium thiosulphate.
One mole of MIO_3 reacts with potassium iodide to produce iodine. The iodine produced reacts with six moles of sodium thiosulphate.
Calculate the concentration, in mol/dm^3 , of MIO_3 in solution **P**.

Concentration of MIO_3 in **P** is mol/dm^3 . [2]

- (c) **P** contains 3.30 g/dm^3 MIO_3 .
Using your answer to (b), calculate the relative molecular mass of MIO_3 .

Relative molecular mass of MIO_3 is [1]

- (d) Using your answer to (c), and the Periodic Table provided on page 5, calculate the relative atomic mass of M .

Relative atomic mass of M is [1]

- (e) Using your answer to (d) and the Periodic Table suggest an identity for the metal M .

Metal M is

Question 2 starts on page 6.

- 2 You are provided with solutions **R**, **S** and **T** which contain the same anion. Carry out the following experiments on each solution and record your observations in the table. You should test and name any gas evolved.

Test no.	Test	Observations with solution R
1	<p>(a) To a portion of the solution, add aqueous sodium hydroxide until a change is seen.</p> <p>(b) Add excess aqueous sodium hydroxide to the mixture from (a).</p> <p>(c) To a portion of the mixture from (b) in a boiling tube, add an equal volume of aqueous hydrogen peroxide.</p>	
2	<p>(a) To a portion of the solution, add aqueous ammonia until a change is seen.</p> <p>(b) Add excess aqueous ammonia to the mixture from (a).</p>	
3	<p>(a) To a portion of solution R, add aqueous barium nitrate and leave the mixture to stand for a few minutes.</p> <p>(b) Add nitric acid to the mixture from (a).</p>	
4	<p>(a) To a portion of solution R, add aqueous silver nitrate and leave the mixture to stand for a few minutes.</p> <p>(b) Add nitric acid to the mixture from (a).</p>	

Conclusions

The anion (negative ion) present in **R** is

[1]

Observations with solution S	Observations with solution T	Test no.
		1
		2
DO NOT CARRY OUT		3
THESE TESTS FOR S AND T.		4

[22]

CHEMISTRY PRACTICAL 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 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

<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. 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

<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
sulphur dioxide (SO_2)	turns aqueous potassium dichromate(VI) green

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