

Centre Number	Index Number	Name
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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.

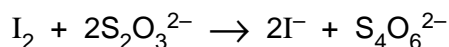
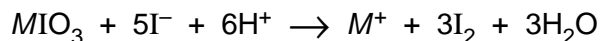
Stick your personal label here, if provided.

For Examiner's Use	
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.

DATA SHEET
The Periodic Table of the Elements

I		II		Group										VII	VIII	IX	
				III	IV	V	VI	VII	0								
1	1																2
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Li Lithium	Be Beryllium	B Boron	C Carbon	N Nitrogen	O Oxygen	F Fluorine	Ne Neon	Na Sodium	Mg Magnesium	Al Aluminium	Si Silicon	P Phosphorus	S Sulphur	Cl Chlorine	Ar Argon	K Potassium	Ca Calcium
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Na Sodium	Mg Magnesium	Mn Manganese	Fe Iron	Co Cobalt	Ni Nickel	Cu Copper	Zn Zinc	Ga Gallium	Ge Germanium	As Arsenic	Se Selenium	Br Bromine	Kr Krypton	Rb Rubidium	Sr Strontium	Y Yttrium	Zr Zirconium
39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
K Potassium	Ca Calcium	Tc Technetium	Ru Ruthenium	Rh Rhodium	Pd Palladium	Ag Silver	Cd Cadmium	In Indium	Sn Tin	Sb Antimony	Te Tellurium	I Iodine	Xe Xenon	Rb Rubidium	Sr Strontium	Y Yttrium	Zr Zirconium
85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102
Rb Rubidium	Sr Strontium	Re Rhenium	Os Osmium	Ir Iridium	Pt Platinum	Au Gold	Hg Mercury	Tl Thallium	Pb Lead	Bi Bismuth	Po Polonium	At Astatine	Rn Radon	Rb Rubidium	Sr Strontium	La Lanthanum	Hf Hafnium
133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
Cs Caesium	Ba Barium	Fr Francium	Ra Radium	Ac Actinium	Th Thorium	Pa Protactinium	U Uranium	Np Neptunium	Pu Plutonium	Am Americium	Cm Curium	Bk Berkelium	Cf Californium	Es Einsteinium	Fm Fermium	Md Mendelevium	No Nobelium
55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
Fr Francium	Ra Radium	La Lanthanum	Ce Cerium	Pr Praseodymium	Nd Neodymium	Pm Promethium	Sm Samarium	Eu Europium	Gd Gadolinium	Tb Terbium	Dy Dysprosium	Ho Holmium	Er Erbium	Tm Thulium	Yb Ytterbium	Lu Lutetium	Rn Radon
87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104
Fr Francium	Ra Radium	Ac Actinium	Th Thorium	Pa Protactinium	U Uranium	Np Neptunium	Pu Plutonium	Am Americium	Cm Curium	Bk Berkelium	Cf Californium	Es Einsteinium	Fm Fermium	Md Mendelevium	No Nobelium	Lr Lawrencium	Rn Radon

*58-71 Lanthanoid series
†90-103 Actinoid series

Key

a	X
b	

 a = relative atomic mass
 X = atomic symbol
 b = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

- 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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