UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME	

CENTRE NUMBER							CANDIDATE NUMBER					

2122167915

CHEMISTRY **5070/31**

Paper 3 Practical Test **October/November 2012**

1 hour 30 minutes

Candidates answer on the Question Paper

Additional Materials: As listed in the Confidential Instructions

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black ink.
You may use a soft pencil for any diagrams, graphs or rough work.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Qualitative Analysis Notes are printed on page 8.
You should show the essential steps in any calculations and record experimental results in the spaces provided on the question paper.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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1	
2	
Total	

This document consists of **6** printed pages and **2** blank pages.

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1 **P** is an aqueous solution prepared by reacting a metal oxide, MO, with an excess of hydrochloric acid, HCl. In preparing **P**, 3.36 g of the metal oxide was completely reacted in 1.00 dm^3 of 0.200 mol / dm^3 hydrochloric acid, an excess.

$$MO + 2HCl \rightarrow MCl_2 + H_2O$$

You are to determine by titration the amount of acid remaining in **P**.

Q is 0.0640 mol / dm^3 sodium hydroxide, NaOH.

(a) 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 **Q** used was .... cm^3.

[12]

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(b) **Q** is 0.0640 mol/dm^3 sodium hydroxide, NaOH.

Using your results from **(a)**, calculate the concentration, in mol/dm^3, of hydrochloric acid in **P**.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

concentration of hydrochloric acid in **P** .... mol/dm^3 [2]

(c) Before reaction with the metal oxide, 1.00 dm^3 of the acid contained 0.200 moles of hydrochloric acid. Using your answer from **(b)**, calculate the number of moles of acid that reacted with 3.36 g of the metal oxide, MO.

moles of hydrochloric acid that reacted with the metal oxide ....[1]

(d) Using your answer to **(c)**, deduce the number of moles of metal oxide, MO, that reacted with the hydrochloric acid.

moles of metal oxide that reacted with the hydrochloric acid ....[1]

(e) Using your answer to **(d)** and the mass of metal oxide, 3.36 g, calculate the relative atomic mass of the metal M in the metal oxide, MO.
[Relative atomic mass of oxygen, O, is 16.]

relative atomic mass of M ....[1]

[Total: 17]

2 You are provided with solid **R** and solution **S**.

Carry out the following tests and record your observations in the table.
You should test and name any gas evolved.

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test no.	test	observations
1	Put a small amount of **R** in a hard-glass test-tube and heat the solid.	
2	To 1 cm depth of aqueous sodium hydroxide in a test-tube, add a small amount of **R**. Gently warm the mixture.	
3	Dissolve a small amount of **R** in 2 cm depth of distilled water in a test-tube. To the solution add a few drops of aqueous silver nitrate. Keep this mixture for use in tests **4** and **5**.	
4	Transfer about half of the mixture from test **3** to a test-tube and add dilute nitric acid.	
5	To the remainder of the mixture from test **3**, add aqueous ammonia until no further change is seen.	
6	To 1 cm depth of **S** in a test-tube, add aqueous sodium hydroxide until no further change is seen. Allow the final mixture to stand for a few minutes.	

test no.	test	observations
7	**(a)** To 1 cm depth of **S** in a test-tube, add an equal volume of aqueous hydrogen peroxide. **(b)** Pour the mixture from **(a)** into a boiling tube and then add aqueous sodium hydroxide.	
8	**(a)** To 1 cm depth of **S** in a test-tube, add an equal volume of aqueous barium chloride. **(b)** Add dilute nitric acid to the mixture from **(a)**.	
9	To 1 cm depth of acidified potassium manganate(VII) in a test-tube, add an equal volume of **S**.	

[19]

Conclusions

The formulae of two ions in **R** are ....

and ....

The formulae of two ions in **S** are ....

and .... [4]

[Total: 23]

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QUALITATIVE ANALYSIS NOTES

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 silver nitrate	yellow ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulfate (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 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
sulfur dioxide (SO_2)	turns acidified aqueous potassium dichromate(VI) from orange to green