UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CHEMISTRY **5070/32**

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.

For Examiner's Use	
1	
2	
Total	

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

1 **P** is an aqueous solution prepared by reacting a metal carbonate, MCO_3, with an excess of dilute sulfuric acid, H_2SO_4. In preparing **P**, 5.04 g of the metal carbonate was completely reacted in 1.00 dm^3 of 0.100 mol / dm^3 sulfuric acid, an excess.

$$MCO_3 + H_2SO_4 \rightarrow MSO_4 + H_2O + CO_2$$

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

Q is 0.0800 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]

(b) **Q** is 0.0800 mol / dm^3 sodium hydroxide, NaOH.

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

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

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

(c) Before reaction with the metal carbonate, 1.00 dm^3 of the acid contained 0.100 mole sulfuric acid. Using your answer from **(b)**, calculate the number of moles of acid that reacted with 5.04 g of the metal carbonate, MCO_3.

moles of sulfuric acid that reacted with the metal carbonate ..... [1]

(d) Using your answer to **(c)**, deduce the number of moles of metal carbonate, MCO_3, that reacted with the sulfuric acid.

moles of metal carbonate that reacted with the sulfuric acid ..... [1]

(e) Using your answer to **(d)** and the mass of metal carbonate, 5.04 g, calculate the relative atomic mass of metal M in the metal carbonate, MCO_3.
[Relative formula mass of carbonate, CO_3, is 60.]

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

[Total: 17]

2 You are provided with solution **R**.

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

test no.	test	observations
1	**(a)** To 1 cm depth of **R** in a test-tube, add aqueous sodium hydroxide until a change is seen. **(b)** Add excess aqueous sodium hydroxide to the mixture from **(a)**. Keep this mixture for use in tests **2** and **3**.	
2	To 1 cm depth of the mixture from test **1** in a test-tube, add dilute hydrochloric acid until no further change occurs.	
3	Transfer the remainder of the mixture from test **1** to a boiling tube and warm gently.	
4	To 1 cm depth of **R** in a test-tube, add aqueous ammonia.	
5	To 1 cm depth of **R** in a test-tube, add a few drops of litmus solution.	

test no.	test	observations
6	To 2 cm depth of **R** in a test-tube, add a small amount of sodium carbonate powder.	
7	To 2 cm depth of **R** in a test-tube, add a piece of magnesium ribbon.	
8	**(a)** To 1 cm depth of **R**, add an equal volume of aqueous barium chloride. **(b)** To the mixture from **(a)**, add dilute nitric acid.	

[19]

Conclusions

The formulae of four ions in solution **R** are .....

.....

.....

..... [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