UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CHEMISTRY **5070/31**

Paper 3 Practical Test **October/November 2013**

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.
Electronic calculators may be used.
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 which contains a mixture of sodium carbonate, Na_2CO_3, and sodium hydroxide, NaOH.

The concentration of sodium carbonate in **P** is 0.0200 mol / dm^3.

You are to determine by titration the volume of dilute hydrochloric acid, **Q**, needed to neutralise a volume of **P**, and then calculate the concentration of sodium hydroxide present.

Q is 0.200 mol / dm^3 hydrochloric acid, HC*l*.

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

Pipette a 25.0 cm^3 (or 20.0 cm^3) portion of **P** into a flask and titrate with **Q**, 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 **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 0.200 mol/dm^3 hydrochloric acid, HCl.
Calculate the number of moles of hydrochloric acid present in your average volume of **Q**.

moles of hydrochloric acid present .....[1]

(c) The concentration of sodium carbonate, Na_2CO_3, in **P** is 0.0200 mol/dm^3.
Calculate the number of moles of sodium carbonate present in your volume of **P**.

moles of sodium carbonate present .....[1]

(d) Using your answer to **(c)**, deduce the number of moles of hydrochloric acid which react with the sodium carbonate present in your volume of **P**.

$$Na_2CO_3 + 2HCl \longrightarrow 2NaCl + H_2O + CO_2$$

moles of hydrochloric acid which react with the sodium carbonate .....[1]

(e) Using your answers to **(b)** and **(d)**, calculate the number of moles of hydrochloric acid which react with the sodium hydroxide in your volume of **P**.

moles of hydrochloric acid which react with the sodium hydroxide .....[1]

(f) Using your answer to **(e)**, calculate the concentration, in mol/dm^3, of sodium hydroxide in **P**.

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

concentration of sodium hydroxide in **P** ..... mol/dm^3 [1]

[Total: 17]

2 You are provided with solutions **R** and **S**.

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 an equal volume of aqueous barium nitrate. **(b)** To the mixture from **(a)**, add dilute nitric acid.	
2	To 2 cm depth of **R** in a test-tube, add a piece of magnesium ribbon.	
3	To 2 cm depth of **R** in a test-tube, add a small amount of solid magnesium carbonate.	
4	**(a)** To 1 cm depth of **S** in a test-tube, add a few drops of aqueous silver nitrate. **(b)** To the mixture from **(a)**, add dilute nitric acid.	

test no.	test	observations
5	**(a)** To 1 cm depth of **S** in a test-tube, add an equal volume of **R**. To the mixture, add a little solid manganese(IV) oxide. Mix well then filter off some of the liquid into another test-tube. **(b)** To the filtrate from **(a)**, add a few drops of starch solution.	
6	**(a)** To 1 cm depth of **S** in a test-tube, add an equal volume of aqueous copper(II) sulfate. **(b)** To the mixture from **(a)**, add an equal volume of **R**, then a little solid sodium sulfite.	
7	**(a)** To 1 cm depth of **S** in a test-tube, add an equal volume of dilute hydrochloric acid. To the mixture, add a few drops of aqueous potassium iodate(V) solution. **(b)** To the mixture from **(a)**, add aqueous sodium hydroxide. **(c)** To the mixture from **(b)**, add **R**.	

[20]

Conclusions

Identify a cation and an anion present in **R**.

A cation present in **R** is .....

An anion present in **R** is .....

S contains a sodium compound. Write the formula of the sodium compound in **S**.

The formula of the sodium compound in **S** is ..... [3]

[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 add 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