UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3236105264

CHEMISTRY **5070/03**

Paper 3 Practical Test **October/November 2009**

1 hour 30 minutes

Candidates answer on the Question Paper

Additional Materials: As listed in the Instructions to Supervisors.

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 pen.
You may use a 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 **7** printed pages and **1** blank page.

For Examiner's Use

1 **P** is a solution containing an impure sample of sodium carbonate. The impurity is another sodium compound. You are to identify the impurity and then determine, by titration with hydrochloric acid, the amount of sodium carbonate present in the impure sample.

P contains 6.00 g of the impure sodium carbonate in 1.00 dm^3.
Q is 0.100 mol/dm^3 hydrochloric acid.

(a) Identification of the impurity in **P**.

Carry out the following tests on solution **P** and record your observations in the table.

test no.	test	observations
1	**(a)** To a portion of **P**, add an equal volume of aqueous barium nitrate. **(b)** Add dilute nitric acid to the mixture from **(a)**.	
2	**(a)** To a portion of **P**, add a few drops of aqueous silver nitrate. **(b)** Add dilute nitric acid to the mixture from **(a)**.	

The formula of the impurity present in **P** is ..... [5]

(b) Determination of the concentration of the sodium carbonate in **P**.

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 solution **P** used was .....cm^3.

[12]

(c) **Q** is 0.100 mol/dm^3 hydrochloric acid.

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Using your results from **(b)**, calculate the concentration, in mol/dm^3, of the sodium carbonate in **P**.

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

concentration of sodium carbonate in **P** ..... mol/dm^3. [2]

(d) Using your answer from **(c)**, calculate the mass of sodium carbonate present in 1.00 dm^3 of solution **P**.
[The relative formula mass of sodium carbonate is 106.]

mass of sodium carbonate present in 1.00 dm^3 of solution **P**.....g [1]

(e) Using your answer from **(d)**, calculate the percentage by mass of sodium carbonate in the impure sample.

percentage by mass of sodium carbonate in the impure sample ..... [1]

[Total: 21]

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2 You are provided with three solutions **R**, **S**, and **T**. 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 with solution **R**
1	**(a)** To a portion of the solution, add aqueous ammonia until a change is seen. **(b)** Add excess aqueous ammonia to the mixture from **(a)**.	
2	**(a)** To a portion of the solution, add aqueous sodium hydroxide until a change is seen. **(b)** Add excess aqueous sodium hydroxide to the mixture from **(a)**. **(c)** Add aqueous hydrogen peroxide to the mixture from **(b)**.	
3	To a portion of the solution, add an equal volume of dilute sulfuric acid and then add a few drops of aqueous potassium manganate(VII).	

observations with solution **S**	observations with solution **T**

[17]

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Conclusion

The formula of the cation present in solution **R** is .....

The formula of the cation present in solution **S** is ..... [2]

[Total: 19]

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.
iodine (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 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 (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 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
sulfur dioxide (SO_2)	turns aqueous potassium dichromate(VI) from orange to green