UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

3428426087

CHEMISTRY **5070/32**

Paper 3 Practical Test **October/November 2011**

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.

For Examiner's Use

1 Solid calcium carbonate is sometimes found on indoor surfaces which are in contact with water. This solid is called *scale*. Hydrochloric acid can be used as a scale-remover. It removes the scale by reacting with the carbonate.

You are to determine the concentration of the acid in the scale-remover by titrating a diluted solution of the acid with aqueous sodium carbonate.

P is dilute hydrochloric acid. It has been made by adding distilled water to 100 cm^3 of scale-remover until the volume was 1 000 cm^3.

Q is 0.0500 mol/dm^3 sodium carbonate.

(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 0.0500 mol/dm^3 sodium carbonate.

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

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

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

(c) Using your answer from **(b)** and information given in the question, calculate the concentration of hydrochloric acid in the scale-remover.

concentration of hydrochloric acid in scale-remover .... mol/dm^3 [1]

(d) A bottle of the scale-remover contains 2 000 cm^3 of the hydrochloric acid solution. Using your answer from **(c)**, calculate the maximum mass of calcium carbonate that can be removed by treatment with a bottle of the scale-remover.
The relative formula mass of calcium carbonate is 100.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

mass of calcium carbonate removed .... g [1]

[Total: 16]

2 You are provided with solid **R** and solutions **S** and **T**, all of which contain different compounds of the same transition metal.
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	To 2 cm depth of aqueous hydrogen peroxide in a test-tube, add a small amount of **R**.	
2	To 2 cm depth of aqueous potassium iodide in a test-tube, add an equal volume of dilute sulfuric acid. Add a small amount of **R** to the test-tube and mix well. Allow the mixture to stand.	
3	**(a)** To 2 cm depth of aqueous iron(II) sulfate in a test-tube, add an equal volume of dilute sulfuric acid. Add a small amount of **R** to the test-tube. Warm the mixture gently for about 20 seconds, then filter the warm mixture and collect the filtrate. **(b)** To the filtrate from **(a)**, add aqueous sodium hydroxide until no further change occurs.	
4	**(a)** To 2 cm depth of **S** in a test-tube, add an equal volume of dilute nitric acid. **(b)** To the mixture from **(a)**, add a few drops of aqueous silver nitrate.	

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test no.	test	observations
5	**(a)** To 2 cm depth of **S** in a boiling-tube add aqueous sodium hydroxide until no further change occurs. **(b)** To the mixture from **(a)**, add aqueous hydrogen peroxide.	
6	To 2 cm depth of **T** in a test-tube, add an equal volume of dilute sulfuric acid. To the mixture add aqueous hydrogen peroxide until no further change occurs.	
7	**(a)** To 2 cm depth of **T** in a test-tube, add an equal volume of aqueous sodium hydroxide and then a small amount of **R**. Mix the contents of the test-tube for about 20 seconds. Filter the mixture and collect the filtrate. **(b)** To the filtrate from **(a)**, add dilute sulfuric acid.	

[21]

Conclusions

Identify the anion in **S**

The anion in **S** is ....

In Tests **2** and **3** **R** is acting as ....

In Test **6** solution **T** is acting as .... [3]

[Total 24]

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