UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CHEMISTRY **5070/03**

Paper 3 Practical Test **May/June 2009**

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

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.

1 Vinegar is an acidic aqueous solution.
P is a solution prepared by taking 150 cm^3 of vinegar and diluting the solution by adding distilled water until the total volume is 1.00 dm^3.

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The amount of acid present in solution **P** can be determined by titrating a volume of aqueous sodium hydroxide of known concentration with **P**, using phenolphthalein as the indicator. Phenolphthalein turns from pink to colourless at the end-point.

Solution **Q** is 0.100 mol/dm^3 sodium hydroxide.

(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 phenolphthalein 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 solution **Q** used was .....cm^3.

[12]

(b) **Q** is 0.100 mol/dm^3 sodium hydroxide.

Using your results from **(a)**, calculate the number of moles of hydrogen ions, H^+, in 1.00 dm^3 of **P**.

moles of hydrogen ions in 1.00 dm^3 of **P** ..... [2]

(c) Using your answer from **(b)**, determine the number of moles of hydrogen ions, H^+, in 150 cm^3 of vinegar.

moles of hydrogen ions in 150 cm^3 of vinegar ..... [1]

(d) Assuming the only acid present in the vinegar is ethanoic acid, CH_3COOH, calculate the mass, in grams, of ethanoic acid present in 150 cm^3 of the vinegar.
[The relative formula mass of ethanoic acid is 60.]

mass of ethanoic acid present in 150 cm^3 of vinegar .....g [1]

(e) Given that 1.00 cm^3 of the vinegar has a mass of 1.00 g, calculate the percentage by mass of ethanoic acid in the vinegar.

percentage by mass of ethanoic acid in vinegar ..... [1]

[Total: 17]

For Examiner's Use

[Turn over

2 Carry out the following experiments on the aqueous solution **R** and the solid sodium salt **S** and record your observations in the table. You should test and name any gas evolved.

For Examiner's Use

Tests on solution R

test no.	test	observations
1	**(a)** To a portion of solution **R**, add aqueous sodium hydroxide until a change is seen. **(b)** Add excess aqueous sodium hydroxide to the mixture from **(a)**.	
2	**(a)** To a portion of solution **R**, add aqueous ammonia until a change is seen. **(b)** Add excess aqueous ammonia to the mixture from **(a)**.	
3	**(a)** To a portion of solution **R**, add an equal volume of dilute nitric acid. **(b)** Add aqueous silver nitrate to the mixture from **(a)**.	
4	**(a)** To a portion of solution **R**, add an equal volume of dilute nitric acid. **(b)** Add aqueous barium nitrate solution to the mixture from **(a)**.	

Tests on solid S

For Examiner's Use

test no.	test	observations
5	To a portion of dilute hydrochloric acid add a small amount of solid **S**.	
6	**(a)** Put 1 cm depth of solid **S** in a hard-glass test-tube and heat strongly for about 3 to 4 minutes. You should test the gas evolved. Leave the test-tube and contents to cool. **(b)** To a portion of dilute hydrochloric acid add some of the solid residue from **(a)**.	
7	To a portion of aqueous copper(II) sulfate solution add a small amount of solid **S** and mix well.	
8	Put 1 cm depth of solid **S** in a hard-glass test-tube and then add to it an equal amount of solid ammonium chloride. Heat the mixture.	
9	**(a)** Dissolve a small amount of solid **S** in a portion of solution **R**. **(b)** Warm the mixture from **(a)**.	

[20]

[Turn over

Conclusions

For Examiner's Use

Identify the anion in **R**.

The anion in **R** is .....

S is a sodium salt. Suggest two other elements present in **S**.

..... and ..... [3]

[Total: 23]

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NOTES FOR USE IN QUALITATIVE ANALYSIS

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