UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CHEMISTRY **5070/31**

Paper 3 Practical Test **May/June 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.

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1	
2	
Total	

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

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1 Ethanedioic acid, $H_2C_2O_4$, forms crystals which are hydrated and have the formula $H_2C_2O_4.\mathbf{x}H_2O$.

P is a solution containing 9.45 g of $H_2C_2O_4.\mathbf{x}H_2O$ in 1.00 dm^3 of solution.
Q is 0.150 mol / dm^3 sodium hydroxide, NaOH.

You are to determine the value of **x** in the formula $H_2C_2O_4.\mathbf{x}H_2O$ by titrating **Q** with **P**.

(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 0.150 mol/dm^3 sodium hydroxide.
Using your results from **(a)**, calculate the concentration, in mol/dm^3, of the ethanedioic acid, $H_2C_2O_4$, in **P**.

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$$H_2C_2O_4 + 2NaOH \longrightarrow Na_2C_2O_4 + 2H_2O$$

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

(c) Using your answer from **(b)**, calculate the concentration, in g/dm^3, of ethanedioic acid, $H_2C_2O_4$, in **P**.
[The relative formula mass of ethanedioic acid is 90.]

concentration of ethanedioic acid in **P** ..... g/dm^3 [1]

(d) Using your answer from **(c)**, calculate the mass of water in 9.45 g of hydrated ethanedioic acid, $H_2C_2O_4.\mathbf{x}H_2O$.

mass of water ..... g [1]

(e) Calculate the value of **x** in the formula $H_2C_2O_4.\mathbf{x}H_2O$.
[The relative formula mass of H_2O is 18.]

value of **x** ..... [2]

[Total: 18]

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

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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 a few drops of aqueous silver nitrate. **(b)** Add dilute nitric acid to the mixture from **(a)**.	
2	To 1 cm depth of aqueous iron(III) chloride in a test-tube, add an equal volume of **R**.	
3	**(a)** To 1 cm depth of **R** in a test-tube, add an equal volume of aqueous acidified potassium dichromate(VI). **(b)** Add aqueous sodium thiosulfate to the mixture from **(a)** until no further change is seen.	
4	**(a)** To 1 cm depth of **S** in a test-tube, add an equal volume of dilute sulfuric acid and then one or two drops of **R**. **(b)** To the mixture from **(a)** add an equal volume of **R** and allow to stand for a few minutes.	

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test no.	test	observations
5	**(a)** To 1 cm depth of aqueous iron(II) sulfate in a test-tube, add an equal volume of **S**. **(b)** Add aqueous sodium hydroxide to the mixture from **(a)**.	
6	To 2 cm depth of aqueous acidified potassium manganate(VII) in a test-tube, add an equal volume of **S**.	
7	**(a)** To 1 cm depth of **S** in a test-tube, add a small amount of copper powder. **(b)** Add aqueous ammonia to the mixture from **(a)**.	

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[19]

Conclusions

Identify the anion present in **R**.

The anion in **R** is ……..

In test **5(a)**, **S** is acting as …… .

In test **6**, **S** is acting as …… .

[3]

[Total: 22]

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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

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