UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5470461786

CHEMISTRY **5070/31**

Paper 3 Practical Test **May/June 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.

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1 A type of rust remover is an aqueous solution of phosphoric acid, H_3PO_4.
P is a solution prepared by taking 100 cm^3 of this rust remover and diluting the solution by adding distilled water until the total volume is 1.00 dm^3.

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The amount of phosphoric acid present in solution **P** can be determined by titrating a volume of aqueous sodium hydroxide of known concentration with **P**, using an indicator.

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 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]

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

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Using your results from **(a)**, calculate the number of moles of phosphoric acid, H_3PO_4, in 1.00 dm^3 of **P**.

$$2NaOH + H_3PO_4 \rightarrow Na_2HPO_4 + 2H_2O$$

moles of phosphoric acid in 1.00 dm^3 of **P** ..... [2]

(c) Calculate the mass, in grams, of phosphoric acid present in 100 cm^3 of the rust remover. The relative formula mass of phosphoric acid is 98.

mass of phosphoric acid present in 100 cm^3 of rust remover ..... g [1]

(d) Given that 1 cm^3 of the rust remover has a mass of 1.03 g, calculate the percentage by mass of phosphoric acid in the rust remover.

percentage by mass of phosphoric acid in the rust remover ..... [1]

[Total: 16]

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[Turn over

2 You are provided with solutions **R** and **S**.
Carry out the following tests and record your observations in the table.

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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 small amount of solid magnesium carbonate.	
3	**(a)** To 2 cm depth of **R** in a test-tube, add a small amount of zinc powder. **(b)** To the mixture from **(a)**, add a few drops of **S**.	
4	**(a)** To 2 cm depth of **S** in a test-tube, add aqueous ammonia until no further change occurs. **(b)** To the mixture from **(a)**, add **R** until no further change occurs.	

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test no.	test	observations
5	**(a)** To the boiling tube containing citric acid powder, add 1 cm depth of **S**. Mix until all the solid dissolves. **(b)** To the mixture from **(a)**, add an equal volume of aqueous sodium hydroxide. **(c)** To the mixture from **(b)**, add a small amount of solid glucose. Warm the mixture gently until the liquid just begins to bubble. Leave the boiling tube and contents to stand.	
6	**(a)** To 1 cm depth of **S** in a test-tube, add an equal volume of aqueous barium nitrate. **(b)** To the mixture from **(a)**, add dilute nitric acid.	

[21]

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Conclusions

Identify the anion in both **R** and **S**.

The anion is …….

Identify the cation in **R** and the cation in **S**.

The cation in **R** is …… .

The cation in **S** is …… .

[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

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