Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2255465487

CHEMISTRY **5070/31**

Paper 3 Practical Test **May/June 2014**

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 an HB pencil for any diagrams, graphs or rough work.
Do not use staples, paper clips, 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 **8** printed pages.

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1 Reactions between alkalis and acids are exothermic. The change in temperature when aqueous sodium hydroxide is added to dilute hydrochloric acid of known concentration can be used to determine the concentration of the alkali.

P is 1.50 mol/dm^3 hydrochloric acid.
Q is aqueous sodium hydroxide.

(a) (i) Put **P** into a burette and use it to measure 10 cm^3 of **P** into a plastic cup. Measure the temperature of **P** to the nearest 0.5 °C and record the value in column D of the table.

(ii) Using a measuring cylinder, measure 40 cm^3 of **Q** as accurately as possible. Pour this volume of **Q** into the plastic cup containing **P**. Stir, using the thermometer, and measure the highest temperature reached. Record the value in column E of the table.

(iii) Empty the plastic cup and rinse it with water.

(iv) Repeat the procedure described in **(i)** to **(iii)** but using the different volumes of **P** and **Q** given in columns B and C of the table for experiments 2 to 7.

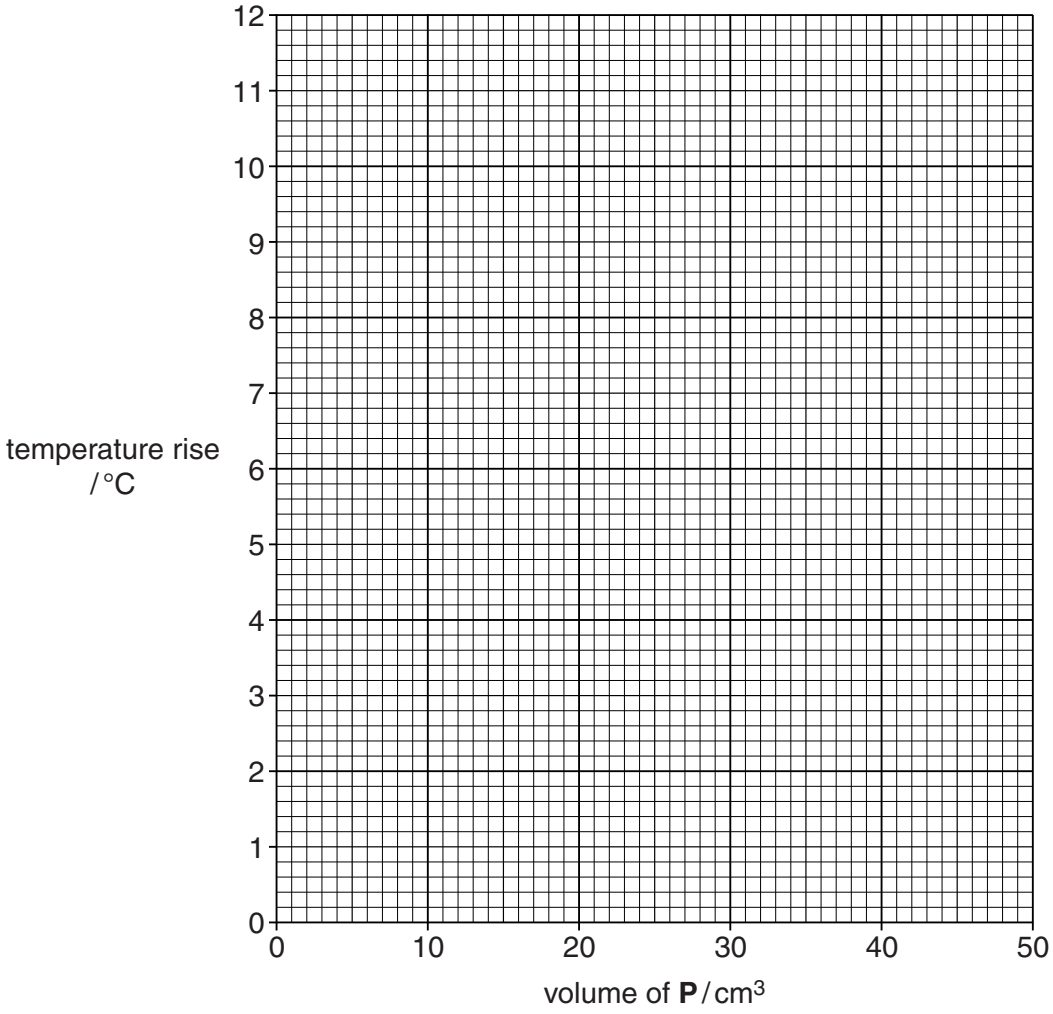
(v) For each experiment, calculate the temperature rise and record the value in column F.

A	B	C	D	E	F
experiment number	volume of **P** /cm^3	volume of **Q** /cm^3	initial temperature of **P** /°C	highest temperature of mixture /°C	temperature rise /°C
1	10	40			
2	15	35			
3	20	30			
4	25	25			
5	30	20			
6	35	15			
7	40	10			

[14]

(b) Plot a graph of temperature rise (column F) against volume of **P** (column B) on the grid opposite. Using these points, draw two intersecting straight lines. [2]

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(c) From the graph, read the volume of **P** where the two lines cross.

volume of **P** ..... cm^3 [1]

(d) Calculate the number of moles of hydrochloric acid present in the volume of **P** you gave as an answer to **(c)**.

moles of hydrochloric acid ..... [1]

(e) Deduce the number of moles of sodium hydroxide which react with the number of moles of hydrochloric acid you gave as an answer to **(d)**.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

moles of sodium hydroxide ..... [1]

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[Turn over

(f) Calculate the concentration, in mol/dm^3, of the aqueous sodium hydroxide, **Q**.

concentration of **Q** ..... mol/dm^3 [2]

[Total: 21]

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Question 2 begins on page 6.

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

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	To 2 cm depth of **R** in a test-tube, add a piece of magnesium.	
2	**(a)** To 1 cm depth of **R** in a test-tube, add a few drops of aqueous silver nitrate. **(b)** To the mixture from **(a)**, add dilute nitric acid.	
3	To 2 cm depth of **R** in a boiling tube, add an equal volume of **S** and warm the mixture **gently**. Place over the mouth of the boiling tube, a piece of filter paper which has been soaked in acidified aqueous potassium manganate(VII).	
4	To 1 cm depth of aqueous iodine in a test-tube, add **S**.	
5	To 2 cm depth of aqueous silver nitrate in a test-tube, add a few drops of **S** and leave to stand until no further change is seen.	

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6	**(a)** To 1 cm depth of aqueous iron(III) chloride in a test-tube, add an equal volume of **S** and mix well. **(b)** To the mixture from **(a)**, add aqueous sodium hydroxide until no further change occurs.	

[16]

Conclusions

Give the formula for a cation and the formula for an anion in **R**.

A cation in **R** is …….. and an anion in **R** is …….. .

In Tests **4** and **6**, **S** is acting as …….. . [3]

[Total: 19]

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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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