Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY **5070/03**

Paper 3 Practical Test

May/June 2004

1 hour 30 minutes

Candidates answer on the Question Paper.
Additional Materials:
As listed in the Instructions to Supervisors.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a pencil for any diagrams, graphs or rough work.
Do not use staples, paper clips, highlighters, glue or correction fluid.
You may use a calculator.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.
Qualitative analysis notes are printed on page 8.
You should show the essential steps in any calculation and record experimental results in the spaces provided on the question paper.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

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1	
2	
TOTAL	

This document consists of **7** printed pages and **1** blank page.

1 The reaction between hydrochloric acid and sodium hydroxide is exothermic.

P is 2.0 mol/dm^3 hydrochloric acid.
Q is aqueous sodium hydroxide of unknown concentration.

The concentration of sodium hydroxide in **Q** can be found by mixing different volumes of **P** and **Q** and measuring the increase in temperature.

(a) (i) Put **P** into the burette and measure out 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 **C** of the table.

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

A	**B**	**C**	**D**	**E**
volume of **P**/cm^3	*volume of* **Q**/cm^3	*initial temperature of* **P**/°C	*highest temperature of mixture*/°C	*temperature rise*/°C
10	40			
20	30			
30	20			
40	10			

[12]

(b) Plot a graph of temperature rise (column **E**) against volume of **P** (column **A**) on the grid opposite. Using these points, draw two straight lines. These lines should cross.

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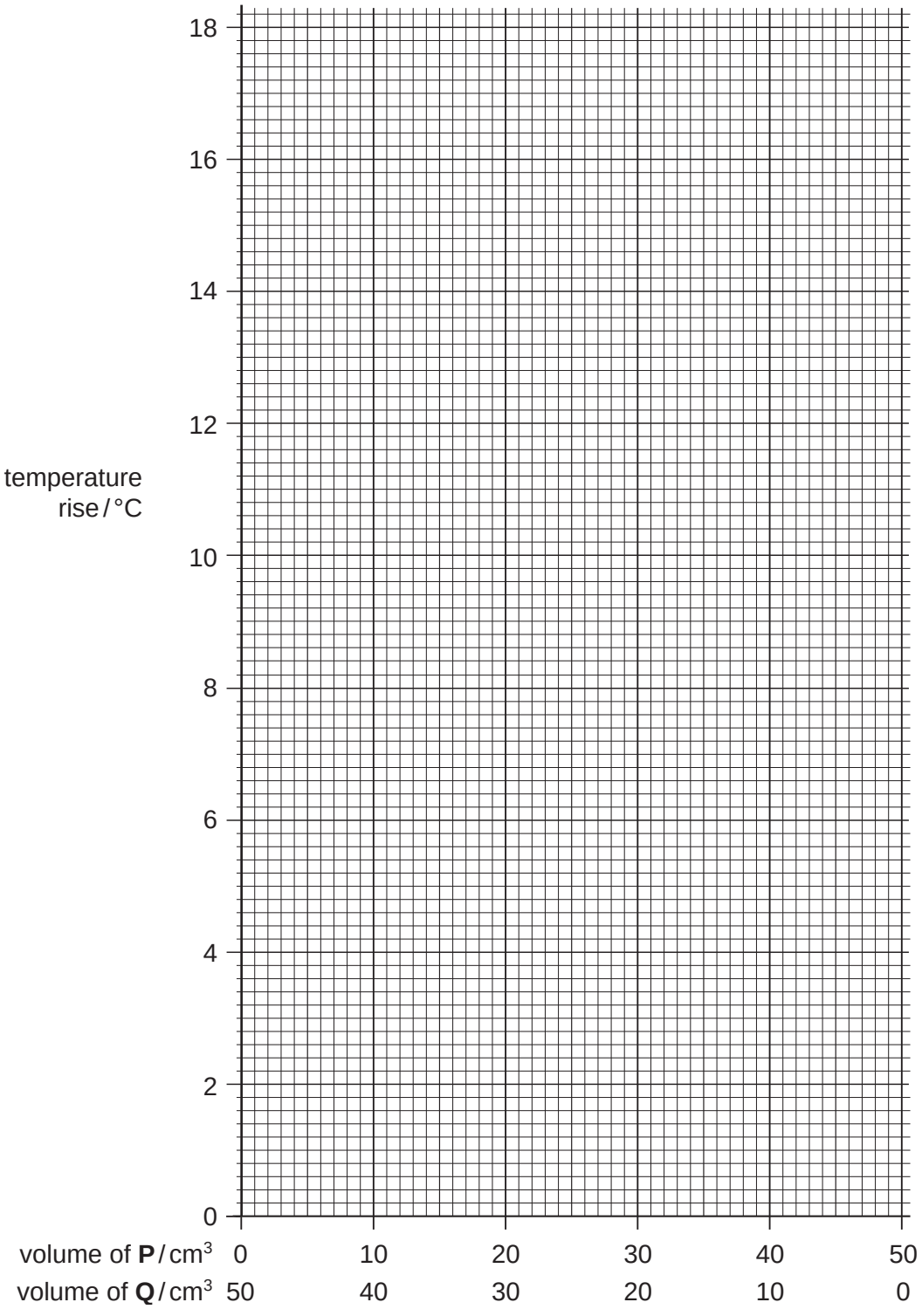

[3]

(c) From the graph, what is the largest temperature rise which could occur?

Largest temperature rise is ..... °C [1]

(d) Read from the graph, the volumes of both **P** and **Q** which produce the largest temperature rise. These volumes of **P** and **Q** react together to form a neutral solution.

Volume of **P** is ..... cm^3

Volume of **Q** is ..... cm^3 [1]

(e) **P** is 2.0 mol/dm^3 hydrochloric acid.
Using your answers to (**d**), calculate the concentration, in mol/dm^3, of sodium hydroxide in **Q**.

Concentration of sodium hydroxide in **Q** is …… mol/dm^3 [2]

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

Test No.	Test	Observations
1	Put a portion of **S** into a boiling-tube and **warm gently**.	
2	**(a)** To a portion of **S**, slowly add hydrochloric acid until a change is seen. **(b)** Add excess hydrochloric acid to the mixture from **(a)**.	
3	**(a)** To a portion of **S**, add an equal volume of aqueous barium nitrate and allow the mixture to stand for a few minutes. **(b)** Add nitric acid to the mixture from **(a)**.	

4	**(a)** To a portion of **S**, add an equal volume of water and then add aqueous silver nitrate. **(b)** Add dilute nitric acid to the mixture from **(a)**.	
5	**(a)** To a portion of **S**, add an equal volume of aqueous potassium iodide. **(b)** To a portion of the mixture from **(a)** add an equal volume of dilute hydrochloric acid and allow the mixture to stand for a few minutes. **(c)** Add aqueous sodium thiosulphate to the mixture from **(b)**.	

[19]

Conclusions

Give the formulae of two ions present in **S**.

The ions present in **S** are ..... and ..... [2]

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.
iodide (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 aluminium foil; warm carefully	ammonia produced
sulphate (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 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
sulphur dioxide (SO_2)	turns aqueous potassium dichromate(VI) from orange to green