Centre Number	Index Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
Joint Examination for the School Certificate
and General Certificate of Education Ordinary Level

CHEMISTRY **5070/03**

Paper 3 Practical Test

October/November 2003

1 hour 30 minutes

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

READ THESE INSTRUCTIONS FIRST

Write your name, Centre number and candidate number in the spaces at the top of this page.

Answer **both** questions.
Write your answers in the spaces provided on the question paper.
You should show the essential steps in any calculation and record all experimental results in the spaces provided on the question paper.
If you are using semi-micro methods in Question 2, you should modify the instructions to suit the size of apparatus and the techniques you are using.
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.

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 **8** printed pages.

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1 You are provided with a solid **T** and a solution **S**. **S** was prepared by adding **T** to 1.00 dm³ of 0.500 mol/dm^3 hydrochloric acid. You are to identify **T** and determine the mass of **T** which had been added to the hydrochloric acid.

(a) Identification of solid **T**

Carry out the following tests on solid **T** and record your observations in the table. You should test and name any gas evolved.

Test no.	Test	Observations
1	Put your sample of **T** into a boiling tube and slowly add dilute hydrochloric acid, until the boiling tube is about one third full. When the reaction has finished, allow any solid to settle and pour the solution into a clean test-tube. Use this solution for **Test 2** and **Test 3**.	
2	**(a)** To a portion of the mixture from **Test 1**, add aqueous sodium hydroxide until a change is seen. **(b)** Add excess aqueous sodium hydroxide to the mixture from **(a)**.	

Test no.	Test (continued)	Observations (continued)
3	**(a)** To a portion of the mixture from **Test 1**, add aqueous ammonia until a change is seen. **(b)** Add excess aqueous ammonia to the mixture from **(a)**.	

[10]

Conclusion

Solid **T** is .... [1]

(b) Use the data given in the table below to calculate the relative molecular mass of **T**.

element	A_r	element	A_r
H	1	Cl	35.5
C	12	Ca	40
N	14	Fe	56
O	16	Cu	63.5
Na	23	Zn	65
Al	27	I	127
S	32	Pb	207

The relative molecular mass of **T** is .... [1]

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(c) Determination of the concentration of the hydrochloric acid in **S**

R is 0.100 mol/dm^3 sodium hydroxide.

Put **S** into the burette.
Pipette a 25.0 cm^3 (or 20.0 cm^3) portion of **R** into a flask and titrate with **S** 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 **S** used / cm^3			
Best Titration results (✓)			

Summary

Tick (✓) the best titration results.
Using these results, the average volume of **S** required was .... cm^3.

Volume of solution **R** used was .... cm^3. [12]

(d) **R** is 0.100 mol/dm^3 sodium hydroxide.
Using your results from **(c)**, calculate the concentration, in mol/dm^3, of the hydrochloric acid in **S**.

Concentration of hydrochloric acid in **S** is .... mol/dm^3. [2]

(e) **S** was prepared by adding **T** to 1.00 dm^3 of 0.500 mol/dm^3 hydrochloric acid. Ca… the number of moles of hydrochloric acid which had reacted with **T**.

Number of moles of hydrochloric acid which had reacted with **T** .... moles [1]

(f) One mole of **T** reacts with two moles of hydrochloric acid.
Using your answer to **(e)**, calculate the number of moles of **T** which had been added to 1.00 dm^3 of hydrochloric acid to produce solution **S**.

Number of moles of **T** added .... moles [1]

(g) Using your answers to **(b)** and **(f)**, calculate the mass of **T** which had been added to 1.00 dm^3 of hydrochloric acid to produce solution **S**.
(If you did not obtain a value for the relative molecular mass of **T** in **(b)** you may assume that the M_r is 140)

Mass of **T** added .... g [1]

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2 Carry out the following tests on solution **P**, which contains three ions.
Record your observations in the table.
You should test and name any gas evolved.

Test no.	Test	Observations
1	**(a)** To a portion of solution **P**, 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)**.	
2	**(a)** To a portion of solution **P**, add aqueous sodium hydroxide until a change is seen. **(b)** Add excess aqueous sodium hydroxide to the mixture from **(a)** and leave to stand for a few minutes.	
3	Transfer a portion of the mixture from **Test 2** to a clean boiling tube and **warm gently**.	

Test no.	Test (continued)	Observations (continued)
4	**(a)** To a portion of solution **P**, add an equal volume of aqueous hydrogen peroxide. **(b)** To a portion of the mixture from **(a)** add aqueous sodium hydroxide until a change is seen.	

[8]

Conclusion

The formulae of three ions present in **P** are ....

and ....

and .... [3]

CHEMISTRY PRACTICAL 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 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.
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
sulphur dioxide (SO_2)	turns aqueous potassium dichromate(VI) green