Centre Number	Candidate Number

Candidate Name ______________________________

CAMBRIDGE INTERNATIONAL EXAMINATIONS

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

CHEMISTRY 5070/3

PAPER 3 Practical Test

OCTOBER/NOVEMBER SESSION 2002

1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
As listed in Instructions to Supervisors

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

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.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

Question **1** carries 40% of the total marks and Question **2** carries 60%.

Qualitative Analysis notes are printed on page 8.

FOR EXAMINER'S USE	
1	
2	
TOTAL	

This question paper consists of 6 printed pages and 2 blank pages.

(NH) S12642/2

University of Cambridge
Local Examinations Syndicate

1 Solutions of iron(II) sulphate are oxidised slowly to iron(III) sulphate when exposed to the air.

P is a solution which initially contained 0.125 mol/dm^3 iron(II) sulphate dissolved in dilute sulphuric acid. This solution has been left exposed to the air and some of it has been oxidised.

You are to determine the actual concentration of iron(II) sulphate in **P** by titrating it with potassium manganate(VII) and hence determine the percentage of iron(II) sulphate which has been oxidised.

No indicator is necessary since the products of the reaction are almost colourless and one drop of potassium manganate(VII) in excess produces an easily seen pale pink colour.

Q is 0.0200 mol/dm^3 potassium manganate(VII).

(a) Put solution **Q** into the burette. Because the colour of **Q** is so intense, you may find it easier to read the top of the meniscus for all measurements of **Q**.

Pipette a 25.0 cm^3 (or 20.0 cm^3) portion of **P** into a flask and titrate with **Q**. At first the purple colour disappears rapidly. As the titration proceeds, this disappearance is less rapid. At the end-point, one drop of **Q** produces a pink colour that does not disappear on swirling.

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 **Q** used / cm^3			
Best titration results (✓)			

Summary

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

Volume of solution **P** used was .... cm^3.

[12]

(b) **Q** is 0.0200 mol/dm^3 potassium manganate(VII).
Five moles of iron(II) sulphate react with one mole of potassium manganate(VII).
Using your results from **(a)**, calculate the concentration, in mol/dm^3, of the iron(II) sulphate in **P**.

Concentration of iron(II) sulphate in **P** is .... mol/dm^3. [2]

(c) **P** initially contained 0.125 mol/dm^3 iron(II) sulphate.
Using your answer from **(b)**, calculate the percentage of iron(II) sulphate which has been oxidised.

Percentage of iron(II) sulphate oxidised was ....%. [2]

2 You are provided with a solution **R** which contains a sodium salt. 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 a portion of **R**, add an equal volume of dilute hydrochloric acid and allow the mixture to stand for a few minutes. **(b)** Warm the mixture from **(a)** **gently**.	
2	To a portion of acidified potassium manganate(VII), add an equal volume of solution **R** and leave to stand for a few minutes.	
3	To a portion of aqueous silver nitrate, add a few drops of **R** and leave to stand until no further change is seen.	
4	To a portion of aqueous silver nitrate, add a few drops of **R** and **without delay** add excess solution **R** to the mixture.	

5	**(a)** To a small portion of aqueous iron(III) chloride, add approximately twice the volume of solution **R**. Leave the mixture to stand, shaking it occasionally, until there is no further change. **(b)** To a portion of the mixture from **(a)**, add aqueous sodium hydroxide and leave to stand.	
6	**(a)** To a portion of aqueous copper(II) sulphate, add an equal volume of solution **R**. **(b)** To a portion of the mixture from **(a)** add an equal volume of aqueous sodium hydroxide. **(c)** Add dilute sulphuric acid to the mixture from **(b)**.	

[22]

Conclusions

R is a sodium salt; an element present in the anion (negative ion) is ....

In **Test 5**, **R** is acting as .... [2]

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NOTES FOR USE IN QUALITATIVE ANALYSIS

Test 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.

Test 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

Test for gases

gas	*test and test result*
ammonia (NH_3)	turns damp litmus paper blue
carbon dioxide (CO_2)	turns lime water 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