



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER



**CHEMISTRY**

**5070/03**

Paper 3 Practical Test

**May/June 2007**

**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 on all the work you hand in.  
Write in dark blue or black pen.  
You may use a 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.  
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	
<b>Total</b>	

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

- 1 A solid **M** is an alloy of iron and several other metals. Solution **P** has been prepared by dissolving 6.00 g of **M** in dilute sulphuric acid forming a mixture of metal sulphates and then adding water until the final volume is 1.00 dm<sup>3</sup>. You are to determine the percentage of iron in **M** by titrating solution **P** with potassium manganate(VII).

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<sup>3</sup> 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.

Pipette a 25.0 cm<sup>3</sup> (or 20.0 cm<sup>3</sup>) 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. Repeat the titration as many times as you consider necessary to achieve consistent results.

## Results

### *Burette readings*

titration number	1	2	
final reading / cm <sup>3</sup>			
initial reading / cm <sup>3</sup>			
volume of <b>Q</b> used / cm <sup>3</sup>			
best titration results (✓)			

## Summary

Tick (✓) the best titration results.

Using these results, the average volume of **Q** required was ..... cm<sup>3</sup>.

Volume of solution **P** used was ..... cm<sup>3</sup>.

[12]

- (b) **Q** is  $0.0200 \text{ mol/dm}^3$  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  $\text{mol/dm}^3$ , of iron(II) sulphate in **P**.

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

- (c) Using your answer from (b), calculate the mass of iron, in g, in  $1.00 \text{ dm}^3$  of **P**.  
[ $A_r$ : Fe, 56.0]

Mass of iron in  $1.00 \text{ dm}^3$  of **P** is ..... g. [1]

- (d) Solution **P** was prepared by dissolving 6.00 g of **M** in dilute sulphuric acid and adding water until the final volume was  $1.00 \text{ dm}^3$ .  
Using your answer from (c), calculate the percentage of iron in **M**.

Percentage of iron in **M** is ..... %. [1]

[Total: 16]

- 2 Carry out the following tests on **R**, **S** and **T** and record your observations in the table. You should test and name any gas evolved.

test no.	test	observations with solution <b>R</b>
1	<p><b>(a)</b> To a portion of the solution, add aqueous sodium hydroxide until a change is seen.</p> <p><b>(b)</b> Add excess sodium hydroxide to the mixture from <b>(a)</b>.</p>	
2	To a portion of the solution, add an equal volume of dilute sulphuric acid and allow the mixture to stand for a few minutes.	
3	<p><b>(a)</b> To a portion of the solution, add an equal volume of aqueous ammonium ethanedioate.</p> <p><b>(b)</b> Add dilute nitric acid to the mixture from <b>(a)</b>.</p>	
4	To a portion of the solution, add an equal volume of aqueous silver nitrate.	
5	To a portion of the solution, add an equal volume of aqueous barium nitrate.	

observations with solution <b>S</b>	observations with solution <b>T</b>	test no.
		<b>1</b>
		<b>2</b>
		<b>3</b>
		<b>4</b>
		<b>5</b>

[20]

**Conclusions**

Give the formula of:

- (i) the anion (negative ion) in **R** .....
- (ii) the anion (negative ion) in **S** .....

Give the formula of the cation (positive ion) present in **two** of the solutions **R**, **S** and **T**.

- (i) the cation present in solution ..... is .....
- (ii) the cation present in solution ..... is ..... [4]

[Total: 24]

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## NOTES FOR USE IN QUALITATIVE ANALYSIS

## Test for anions

<i>anion</i>	<i>test</i>	<i>test result</i>
carbonate ( $\text{CO}_3^{2-}$ )	add dilute acid	effervescence, carbon dioxide produced
chloride ( $\text{Cl}^-$ ) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
iodide ( $\text{I}^-$ ) [in solution]	acidify with dilute nitric acid, then add aqueous lead(II) nitrate	yellow ppt.
nitrate ( $\text{NO}_3^-$ ) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulphate ( $\text{SO}_4^{2-}$ ) [in solution]	acidify with dilute nitric acid then add aqueous barium nitrate	white ppt.

## Test for aqueous cations

<i>cation</i>	<i>effect of aqueous sodium hydroxide</i>	<i>effect of aqueous ammonia</i>
aluminium ( $\text{Al}^{3+}$ )	white ppt., soluble in excess giving a colourless solution	white ppt., insoluble in excess
ammonium ( $\text{NH}_4^+$ )	ammonia produced on warming	–
calcium ( $\text{Ca}^{2+}$ )	white ppt., insoluble in excess	no ppt. or very slight white ppt.
copper(II) ( $\text{Cu}^{2+}$ )	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron(II) ( $\text{Fe}^{2+}$ )	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) ( $\text{Fe}^{3+}$ )	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc ( $\text{Zn}^{2+}$ )	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

## Test for gases

<i>gas</i>	<i>test and test result</i>
ammonia ( $\text{NH}_3$ )	turns damp red litmus paper blue
carbon dioxide ( $\text{CO}_2$ )	turns limewater milky
chlorine ( $\text{Cl}_2$ )	bleaches damp litmus paper
hydrogen ( $\text{H}_2$ )	“pops” with a lighted splint
oxygen ( $\text{O}_2$ )	relights a glowing splint
sulphur dioxide ( $\text{SO}_2$ )	turns aqueous potassium dichromate(VI) from orange to green