Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY **5070/03**

Paper 3 Practical Test

October/November 2006

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.

Answer **all** questions.
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.

At the end of the examination, fasten 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.

1 Hydrogen peroxide, H_2O_2, is a widely used bleach.

Solution **P** is acidified hydrogen peroxide and you are to determine its concentration by titrating it 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.

Solution **Q** is 0.0200 mol/dm^3 potassium manganate(VII), $KMnO_4$.

(a) Fill the burette with solution **Q**. 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^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 **P** used was …… cm^3. [12]

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

Five moles of hydrogen peroxide react with **two** moles of potassium manganate(VII).

Using your results from **(a)**, calculate the concentration, in mol/dm^3, of the hydrogen peroxide in **P**.

Concentration of hydrogen peroxide in **P** is …… mol/dm^3. [2]

2 **R** and **S** are solutions of two sodium salts. Carry out the following tests and record your observations in the table. You should test and name, where possible, any gases evolved. After testing the gases, discard the mixtures and wash out the test-tubes. You are not expected to identify **R** and **S**.

Tests on **R**

test no.	test	observations
1	To a portion of **R**, add a few drops of **concentrated** hydrochloric acid and warm the mixture **gently**.	
2	To a portion of acidified aqueous potassium manganate(VII), add an equal volume of **R**.	
3	**(a)** To a portion of **R**, add a **few drops** of aqueous potassium iodide. **(b)** **Carefully** add an equal volume of **dilute** hydrochloric acid to the mixture from **(a)**.	

test no.	test	observations
4	**(a)** To a portion of **R**, add an equal volume of aqueous iron(II) sulphate. **(b)** Warm the mixture from **(a) gently**. **(c)** When no further reaction takes place, allow the mixture from **(b)** to cool. Then, to a portion of this mixture, add aqueous sodium hydroxide until a change is seen.	
5	To a portion of **R**, add an equal volume of aqueous sodium hydroxide and a piece of aluminium foil. Warm the mixture **gently**.	

[13]

[Turn over

Tests on **S**

test no.	test	observations
6	To a portion of acidified aqueous potassium manganate(VII), add an equal volume of **S**.	
7	To a portion of **S**, add a **few drops** of aqueous potassium iodide.	
8	**(a)** To a portion of **S**, add an equal volume of aqueous barium nitrate. **(b)** Add **dilute** hydrochloric acid to the mixture from **(a)**.	
9	**(a)** To a small portion of aqueous iron(III) chloride, add three times the volume of **S**. Divide this mixture into two portions. **(b)** Warm one of the portions of the mixture from **(a) gently**. **(c)** To the other portion of the mixture from **(a)**, add an equal volume of **dilute** hydrochloric acid and warm **gently**. Allow this mixture to cool and then add aqueous sodium hydroxide until a change is seen.	

[10]

Conclusions

Substances can be classified as only oxidising agents, only reducing agents, both oxidising and reducing agents or neither oxidising nor reducing agents. Using your results, tick the appropriate box to classify **R** and the appropriate box to classify **S**.

	R	**S**
only an oxidising agent		
only a reducing agent		
both an oxidising agent and a reducing agent		
neither an oxidising agent nor a reducing agent		

An element present in the anion in **R** is ……. [3]

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