UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CHEMISTRY **5070/31**

Paper 3 Practical Test **May/June 2011**

1 hour 30 minutes

Candidates answer on the Question Paper

Additional Materials: As listed in the Confidential Instructions

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 ink.
You may use a soft pencil for any diagrams or graphs.
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	
Total	

This document consists of **6** printed pages and **2** blank pages.

1 Seaweed can be used as a commercial source of iodine. The amount of iodine present in a sample of seaweed is often stated in parts per million, ppm. For instance, if a sample contains 200 ppm, then there are 200 g of iodine in every 1 000 000 g of seaweed.

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You are provided with an aqueous solution of iodine which has been obtained from seaweed. You are required to determine its concentration by titration with sodium thiosulfate, $Na_2S_2O_3$, using starch as an indicator and then calculate how much iodine is present in the seaweed.

$$2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$$

P is the aqueous solution of iodine.
Q is 0.100 mol/dm^3 sodium thiosulfate.

(a) Put **Q** into the burette.

Pipette a 25.0 cm^3 (or 20.0 cm^3) portion of **P** into a flask.
Add **Q** from the burette until the red-brown colour fades to pale yellow, **then** add a few drops of the starch indicator. This will give a dark blue solution. Continue adding **Q** slowly from the burette until one drop of **Q** causes the blue colour to disappear, leaving a colourless solution.
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 0.100 mol/dm^3 sodium thiosulfate.

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

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concentration of iodine in **P** ..... mol/dm^3 [2]

(c) Using your answer from **(b)**, calculate the mass, in g, of iodine in 1 dm^3 of **P**.
[The relative atomic mass of iodine is 127.]

mass of iodine in 1 dm^3 of **P** ..... g [1]

(d) If all the iodine present in 1 dm^3 of **P** was obtained from 15 000 g of seaweed, calculate the amount, in ppm, of iodine present in the seaweed.

amount of iodine present in the seaweed ..... ppm [1]

[Total: 16]

[Turn over

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

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test no.	test	observations
1	To 2 cm depth of **R** in a test-tube, add a small amount of solid calcium carbonate.	
2	**(a)** To 1 cm depth of **R** in a test-tube, add a few drops of aqueous silver nitrate. **(b)** To the mixture from **(a)**, add aqueous ammonia until no further change occurs.	
3	**(a)** To 2 cm depth of **R** in a test-tube, add a piece of magnesium ribbon. **(b)** To the mixture from **(a)**, when the reaction has finished, add **S** until no further change occurs.	

test no.	test	observations
4	To 2 cm depth of aqueous zinc sulfate in a test-tube, add **S** until no further change occurs.	
5	**(a)** To 2 cm depth of aqueous chromium(III) chloride in a test-tube, add **S** until no further change occurs. **(b)** To the mixture from **(a)**, add **R** until no further change occurs.	
6	To 2 cm depth of **S** in a test-tube, add a small amount of solid ammonium chloride. Warm the mixture gently.	

[21]

Conclusions

Identify both the cation and anion in **R**.

The cation in **R** is ..... and the anion in **R** is .....

Identify the anion in **S**.

The anion in **S** is ..... [3]

[Total: 24]

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QUALITATIVE ANALYSIS 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 silver nitrate	yellow ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide then add aluminium foil; warm carefully	ammonia produced
sulfate (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 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
sulfur dioxide (SO_2)	turns acidified aqueous potassium dichromate(VI) from orange to green