Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

9594419832

CHEMISTRY **5070/31**

Paper 3 Practical Test **October/November 2014**

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 pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
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.

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CAMBRIDGE International Examinations

1 The amount of oxygen in a sample of air can be estimated by using the oxygen to produce iodine.

$$O_2 + 4I^- + 4H^+ \rightarrow 2H_2O + 2I_2$$

The amount of iodine produced by the above reaction can then be determined by titration with sodium thiosulfate, $Na_2S_2O_3$, using starch as an indicator.

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

P is an aqueous solution of iodine produced by the reaction of all the oxygen in a sample of air.
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 **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**.

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

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

(c) Using your answer from **(b)**, deduce the number of moles of oxygen required to produce the iodine in 1.00 dm^3 of **P**.

$$O_2 + 4I^- + 4H^+ \rightarrow 2H_2O + 2I_2$$

moles of oxygen ....[1]

(d) Given that the number of moles of oxygen in your answer from **(c)** were present in 3.00 dm^3 of air measured at room temperature and pressure, calculate the percentage by volume of oxygen in this sample of air.
(One mole of gas occupies a volume of 24 dm^3 at room temperature and pressure.)

percentage by volume of oxygen ....[2]

[Total: 17]

2 You are provided with solutions **R** and **S**.
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 1 cm depth of dilute sulfuric acid in a test-tube, add a few drops of methyl orange indicator. **(b)** To the mixture from **(a)**, add **R** until no further change occurs.	
2	To 1 cm depth of aqueous zinc sulfate in a test-tube, add **R** until no further change occurs.	
3	To 2 cm depth of **R** in a test-tube, add a piece of aluminium foil and warm the mixture gently until the reaction begins.	
4	**(a)** To 1 cm depth of **S** in a test-tube, add an equal volume of aqueous silver nitrate. **(b)** To the mixture from **(a)**, add dilute nitric acid.	

test no.	test	observations
5	To 1 cm depth of **S** in a test-tube, add aqueous ammonia until no further change occurs. Retain this mixture for use in Test 6.	
6	To 1 cm depth of aqueous hydrogen peroxide in a boiling tube, add the mixture from Test 5 and mix well. Leave the final mixture to stand.	

[20]

Conclusions

Give the formula of an anion in **R**.

The formula of an anion in **R** is ....

Give the formula of a cation and an anion in **S**.

The formula of a cation in **S** is ....

The formula of an anion in **S** is ....

[3]

[Total: 23]

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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 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