Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CHEMISTRY **5070/32**

Paper 3 Practical Test **October/November 2018**

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.

CAMBRIDGE
International Examinations

[Turn over

1 You are to determine the amount of water of crystallisation present in a sample of hydrated sodium carbonate by titrating with hydrochloric acid.

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$$

P is a solution containing 12.27 g / dm^3 of the sample of hydrated sodium carbonate.

Q is 0.110 mol / dm^3 hydrochloric acid.

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

Pipette a 25.0 cm^3 (or 20.0 cm^3) portion of **P** into a flask and titrate with **Q**, using the indicator provided.

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 the best titration results, the average volume of **Q** required was ..... cm^3.

Volume of solution **P** used was ..... cm^3. [12]

(b) **Q** is 0.110 mol / dm^3 hydrochloric acid.

Calculate the number of moles of hydrochloric acid present in the average volume of **Q**.

moles of hydrochloric acid in the average volume of **Q** ..... [1]

(c) Using your answer from **(b)** and the equation shown, calculate the number of moles of sodium carbonate in the volume of **P** used in the titration.

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$$

moles of sodium carbonate in the volume of **P** used ..... [1]

(d) Using your answer from **(c)**, calculate the concentration, in mol/dm^3, of sodium carbonate in **P**.

concentration of sodium carbonate in **P** ..... mol/dm^3 [1]

(e) Using your answer from **(d)**, calculate the mass, in g, of sodium carbonate in 1.00 dm^3 of **P**. [M_r: Na_2CO_3, 106]

mass of sodium carbonate in 1.00 dm^3 of **P** ..... g [1]

(f) Using your answer from **(e)**, calculate the mass of water of crystallisation present in the 12.27 g of the hydrated sodium carbonate used to make **P**.

mass of water of crystallisation present ..... g [1]

(g) Calculate the percentage by mass of water of crystallisation present in the hydrated sodium carbonate used to make **P**.

percentage by mass of water of crystallisation ..... [1]

[Total: 18]

[Turn over

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	Test a sample of **R** with red litmus paper and with blue litmus paper.	
2	To 1 cm depth of aqueous calcium chloride in a test-tube, add **R** slowly with mixing until no further change occurs.	
3	To 1 cm depth of aqueous chromium(III) chloride in a test-tube, add **R** slowly with mixing until no further change occurs.	
4	To 2 cm depth of **R** in a hard-glass test-tube, add a piece of aluminium foil and warm the mixture gently until the reaction begins.	
5	**(a)** To 1 cm depth of **R** in a boiling tube, add a small amount of sodium nitrate. Warm the mixture gently for about 10 seconds. **(b)** To the mixture from **(a)**, add a piece of aluminium foil.	
6	**(a)** To 1 cm depth of **S** in a test-tube, add a few drops of aqueous silver nitrate. **(b)** To the mixture from **(a)**, add dilute nitric acid.	

test no.	test	observations
7	**(a)** To 1 cm depth of **S** in a test-tube, add an equal volume of dilute sulfuric acid and then one or two drops of aqueous hydrogen peroxide. **(b)** To the mixture from **(a)**, add an equal volume of aqueous hydrogen peroxide and allow to stand for a few minutes.	
8	**(a)** To 0.5 cm depth of acidified aqueous potassium manganate(VII) in a test-tube, add twice the volume of **S**. **(b)** To the mixture from **(a)**, add a few drops of starch solution.	
9	**(a)** To 1 cm depth of **S** in a test-tube, add an equal volume of dilute sulfuric acid. To the mixture, add three drops of aqueous potassium iodate solution. **(b)** To the mixture from **(a)**, add 2 cm depth of **R**. **(c)** To the mixture from **(b)**, add dilute sulfuric acid until no further change is seen.	

[20]

Conclusions

Identify the anion in each of the solutions.

The anion in **R** is ..... .

The anion in **S** is ..... . [2]

[Total: 22]

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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., insoluble in excess dilute nitric acid

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.
chromium(III) (Cr^{3+})	green ppt., soluble in excess giving a green solution	green ppt., insoluble in excess
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