Cambridge O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

CHEMISTRY **5070/31**

Paper 3 Practical Test **October/November 2017**

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

1 The composition of concentrated nitric acid can be determined by diluting a sample of the acid and then titrating aqueous sodium carbonate of known concentration with the diluted acid.

P is dilute nitric acid. It has been prepared by adding 10.0 cm^3 of the concentrated nitric acid to distilled water and then making the total volume of the solution up to 500 cm^3 in a volumetric flask by adding distilled water.

Q is 0.153 mol/dm^3 sodium carbonate.

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

Pipette a 25.0 cm^3 (or 20.0 cm^3) portion of **Q** into a flask and titrate with **P**, 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 **P** used / cm^3			
best titration results (✓)			

Summary

Tick (✓) the best titration results.

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

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

(b) **Q** is 0.153 mol/dm^3 sodium carbonate.

Using your results from **(a)**, calculate the concentration, in mol/dm^3, of nitric acid in **P**. Give your answer to three significant figures.

$$Na_2CO_3 + 2HNO_3 \rightarrow 2NaNO_3 + H_2O + CO_2$$

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

(c) Using your answer from **(b)**, calculate the number of moles of nitric acid in 10.0 cm^3 of concentrated nitric acid.

moles of nitric acid in 10.0 cm^3 of concentrated nitric acid ..... [1]

(d) Using your answer from **(c)**, calculate the concentration, in mol/dm^3, of concentrated nitric acid.

concentration of concentrated nitric acid ..... mol/dm^3 [1]

(e) Using your answer from **(d)**, calculate the mass, in g, of nitric acid in 1 dm^3 of concentrated nitric acid.
[The relative formula mass of nitric acid is 63.]

mass of nitric acid in 1 dm^3 of concentrated nitric acid ..... g [1]

[Total: 17]

[Turn over

2 You are provided with two solutions, **R** and **S**.

(a) Carry out the following tests and record your observations in the table.

You should test and name any gas evolved.

test no.	test	observations with solution **R**	observations with solution **S**
1	**(a)** To 2 cm depth of the solution in a test-tube, add aqueous sodium hydroxide until a change is seen. **(b)** To the mixture from **(a)**, add excess aqueous sodium hydroxide.		
2	**(a)** To 2 cm depth of the solution in a test-tube, add aqueous ammonia until a change is seen. **(b)** To the mixture from **(a)**, add excess aqueous ammonia. Keep the final mixture for use in **(c)**. **(c)** To 1 cm depth of aqueous hydrogen peroxide in a boiling tube, add the final mixture from **(b)**.		

test no.	test	observations with solution **R**	observations with solution **S**
3	**(a)** To 1 cm depth of the solution in a test-tube, add an equal volume of dilute nitric acid.		
	(b) Pour half of the mixture from **(a)** into a test-tube and add an equal volume of aqueous barium nitrate.		
	(c) To the other half of the mixture from **(a)**, add an equal volume of aqueous silver nitrate.		

[21]

(b) Conclusions

Identify the compound in solution **R**.

The compound in solution **R** is ..... .

Identify the compound in solution **S**.

The compound in solution **S** is ..... . [2]

[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., 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