Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

4743477603

CHEMISTRY **5070/31**

Paper 3 Practical Test **May/June 2023**

1 hour 30 minutes

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].
- Notes for use in qualitative analysis are provided in the question paper.

For Examiner's Use	
1	
2	
3	
Total	

This document has **12** pages. Any blank pages are indicated.

[Turn over

1 White vinegar is a colourless solution containing ethanoic acid.

You are provided with two samples of white vinegar labelled **A** and **B**.

You are going to investigate the reaction between these samples and 0.400 mol / dm^3 aqueous sodium hydroxide.

Read all the instructions carefully before starting the experiments.

Instructions

You are going to do **four** titration experiments.

Rinse and fill a burette with **A**.

(a) Experiment 1

- Use a volumetric pipette to add 25.0 cm^3 of 0.400 mol / dm^3 aqueous sodium hydroxide to a conical flask.
- Add five drops of thymolphthalein indicator to the conical flask.
- Record the initial burette reading in Table 1.1.
- Add **A** from the burette while swirling the flask, adding drop by drop near the end-point, until the solution just changes colour.
- Record the final burette reading in Table 1.1.

Experiment 2

- Empty the conical flask and rinse it with distilled water.
- Refill the burette if necessary.
- Repeat Experiment 1.

Complete Table 1.1 with the volume used in each experiment.

Table 1.1

	Experiment 1	Experiment 2
final burette reading / cm^3		
initial burette reading / cm^3		
volume of **A** used / cm^3		

[4]

(b) Experiments 3 and 4

- Pour away any **A** remaining in the burette.
- Rinse and fill the burette with **B**.
- Empty the conical flask and rinse it with distilled water.
- Repeat Experiments 1 and 2 using **B**.
- Record the initial and final burette readings for Experiments 3 and 4 in Table 1.2.
- Complete Table 1.2 with the volumes used in Experiments 3 and 4.

Table 1.2

	Experiment 3	Experiment 4
final burette reading / cm^3		
initial burette reading / cm^3		
volume of **B** used / cm^3		

[2]

(c) State the colour change observed in the flask in each experiment.

from ..... to ..... [1]

(d) Calculate the mean volume of **A** and **B** needed to neutralise 25.0 cm^3 of 0.400 mol / dm^3 aqueous sodium hydroxide.

mean volume of **A** ..... cm^3

mean volume of **B** ..... cm^3
[1]

(e) Suggest why the titrations using **A** and **B** are repeated.

..... [1]

(f) The equation for the reaction between ethanoic acid and sodium hydroxide is shown.

$$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$$

The answer to **(d)** shows the mean volume of **B** used to neutralise 25.0 cm^3 of 0.400 mol / dm^3 aqueous sodium hydroxide.

Calculate the concentration of ethanoic acid in **B**.

Give your answer to an appropriate number of significant figures.

concentration ..... mol / dm^3 [2]

(g) Use your answer to **(f)** to calculate the mass of ethanoic acid in 500 cm^3 of **B**.

[M_r: ethanoic acid, 60]

mass ..... g [2]

(h) Use your answers to **(d)** and **(g)** to calculate the mass of ethanoic acid in 500 cm^3 of **A**.

mass ..... g [1]

(i) Suggest why the conical flask should be rinsed with distilled water and **not** 0.400 mol / dm^3 aqueous sodium hydroxide between titrations.

.....

.....

..... [2]

(j) Some vinegars are brown rather than colourless.

Suggest why this titration method would **not** be suitable for finding the concentration of ethanoic acid in brown vinegar.

..... [1]

[Total: 17]

2 You are provided with solution **W** and solid **X**.

Do the following tests recording all of your observations at each stage.

Tests on solution W

(a) Put 1 cm depth of **W** into a boiling tube. Add 1 cm depth of aqueous sodium hydroxide. Gently warm the mixture.

Test the gas given off.

Describe the test and its result.

Identify the gas.

Keep the mixture for use in **(b)**.

test for gas and result .....

.....

identity of gas .....

[3]

(b) Add 2 cm depth of dilute nitric acid to the mixture from **(a)**.

Then add 1 cm depth of aqueous barium nitrate.

Record your observations.

.....

..... [1]

(c) Identify the cation and the anion in **W**.

cation ..... anion .....

[2]

Tests on solid X

(d) Put one of the samples of **X** into a boiling tube and use a measuring cylinder to add 7 cm^3 of dilute nitric acid.

Record your observations.

Test the gas given off.

Describe the test and its result.

Identify the gas.

Keep the mixture for use in **(e)** and **(f)**.

observations .....

.....

test for gas and result .....

.....

identity of gas .....

.....

[4]

(e) Use a measuring cylinder to transfer 2 cm^3 of the mixture from **(d)** into a test-tube.

Add aqueous sodium hydroxide drop by drop until a change is seen.

Then add a further 2 cm depth of aqueous sodium hydroxide.

Record your observations.

.....

..... [2]

(f) Use a measuring cylinder to transfer 2 cm^3 of the mixture from **(d)** into a test-tube.

Add aqueous ammonia drop by drop until a change is seen.

Then add more aqueous ammonia until a further change is seen.

Record your observations.

.....

.....

..... [3]

(g) Identify the cation and the anion in **X**.

cation ..... anion ..... [2]

[Total: 17]

3 You are not expected to do any experimental work for this question.

Baking powder is used to make cakes rise. When water is added to baking powder, carbon dioxide gas is released.

The longer the baking powder is stored, the less carbon dioxide it releases when water is added.

Plan an investigation to show which of two different samples of baking powder has been stored for longer.

Your plan should include the use of common laboratory apparatus, the two samples of baking powder and water. No other chemicals should be used.

Your plan should include:
- the apparatus needed
- the method to use
- the measurements to take
- the variables to control
- how to use the results to determine which sample has been stored for longer.

You may draw a diagram to help you answer the question.

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[6]

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Notes for use in qualitative analysis

Tests for anions

anion	test	test result
carbonate, CO_3^{2-}	add dilute acid, then test for carbon dioxide gas	effervescence, carbon dioxide produced
chloride, Cl^- [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
bromide, Br^- [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream 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 aluminium foil; warm carefully	ammonia produced
sulfate, SO_4^{2-} [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.
sulfite, SO_3^{2-}	add a small volume of acidified aqueous potassium manganate(VII)	the acidified aqueous potassium manganate(VII) changes colour from purple to colourless

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.
chromium(III), Cr^{3+}	green ppt., soluble in excess	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, ppt. turns brown near surface on standing	green ppt., insoluble in excess, ppt. turns brown near surface on standing
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
sulfur dioxide, SO_2	turns acidified aqueous potassium manganate(VII) from purple to colourless

Flame tests for metal ions

metal ion	flame colour
lithium, Li^+	red
sodium, Na^+	yellow
potassium, K^+	lilac
copper(II), Cu^{2+}	blue-green
calcium, Ca^{2+}	orange-red
barium, Ba^{2+}	light green