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Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2192348885

CHEMISTRY **5070/31**

Paper 3 Practical Test **October/November 2024**

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.

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1 You are provided with:

- an aqueous solution of ethanedioic acid, **X**
- 0.800 mol / dm^3 aqueous sodium hydroxide, NaOH, **Y**.

You are going to investigate the reaction between **X** and **Y**.

Read **all** the instructions carefully before starting the experiments.

Instructions

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

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

(a) Experiment 1

- Use a volumetric pipette to add 25.0 cm^3 of **Y** to a conical flask.
- Add five drops of thymolphthalein indicator to the conical flask.
- Place the conical flask on a white tile.
- Record the initial burette reading in Table 1.1.
- Add **X** 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.

Experiments 2, 3 and 4

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

Calculate the volume used in each experiment and record your values in Table 1.1.

Table 1.1

	experiment number			
	1	2	3	4
final burette reading / cm^3				
initial burette reading / cm^3				
volume of **X** used / cm^3				
best titration results (✓)				

[5]

(b) Tick (✓) the two best titration results in Table 1.1.

Explain your choice.

....

.... [2]

(c) Use the ticked (✓) titration results in Table 1.1 to calculate the average volume of **X** needed to neutralise 25.0 cm^3 of **Y**.

volume .... cm^3 [1]

(d) Calculate the number of moles of NaOH in 25.0 cm^3 of **Y**.

number of moles .... [1]

(e) One mole of ethanedioic acid is neutralised by two moles of sodium hydroxide.

Use your answers from **(c)** and **(d)** to calculate the concentration, in mol/dm^3, of ethanedioic acid in **X**.

Give your answer to **three** significant figures.

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

(f) The formula of ethanedioic acid is $C_2H_2O_4 \cdot nH_2O$.

(i) **X** contains 6.3 g of $C_2H_2O_4 \cdot nH_2O$ in 100 cm^3 of solution.

Use your answer from **(e)** to calculate the relative formula mass, M_r, of $C_2H_2O_4 \cdot nH_2O$.

M_r .... [2]

(ii) Use your answer from **(f)(i)** to deduce the value for n in $C_2H_2O_4 \cdot nH_2O$.

Give your answer to the nearest whole number.

[A_r: H, 1; C, 12; O, 16]

n .... [1]

(g) State why the conical flask is placed on a white tile before **X** is added from the burette.

.... [1]

(h) State why a measuring cylinder is **not** used to measure 25.0 cm^3 of aqueous NaOH in this experiment.

.... [1]

[Total: 17]

Question 2 starts on page 6.

2 You are provided with solid **P** and solution **Q**.

You will do a series of tests on **P** and **Q**.

Tests on solid P

You should:

- record your observations for each of these tests
- test and identify any gases evolved
- describe the gas test used that identifies any gas evolved.

(a) Put the sample of **P** into a boiling tube. Add 2 cm depth of dilute hydrochloric acid.

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

....

....

....

.... [4]

(b) Divide the mixture from **(a)** equally into two boiling tubes.

(i) To the first portion of the mixture from **(a)**, add aqueous sodium hydroxide drop by drop until a change is seen.

Then add excess aqueous sodium hydroxide.

....

....

.... [3]

(ii) To the second portion of the mixture from **(a)**, add aqueous ammonia drop by drop until a change is seen.

Then add excess aqueous ammonia.

....

.... [2]

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

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

Tests on solution Q

You should record your observations for each of these tests.

(d) Do a flame test on **Q**.

flame colour .... [1]

(e) **(i)** To 2 cm depth of **Q** in a test-tube, add 1 cm depth of nitric acid.

.... [1]

(ii) Add 1 cm depth of aqueous silver nitrate to the test-tube from **(e)(i)**.

....

.... [2]

(f) Identify the cation and the anion in **Q**.

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

[Total: 17]

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

Argentan is an alloy containing only zinc, nickel and copper.

Zinc and nickel both react with dilute hydrochloric acid. Copper does **not** react with dilute hydrochloric acid.

Plan an investigation to find the percentage by mass of copper in a powdered sample of argentan.

Your plan must include the use of common laboratory apparatus, argentan and hydrochloric acid. No other chemicals should be used.

Your plan must include:

- the apparatus needed
- the method to use and the measurements to take
- procedures to ensure that the percentage determined is as accurate as possible
- how the measurements are used to determine the percentage by mass of copper in the sample.

You may draw a diagram to help 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
calcium, Ca^{2+}	orange-red
barium, Ba^{2+}	light green
copper(II), Cu^{2+}	blue-green