Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

8997913024

CHEMISTRY **5070/32**

Paper 3 Practical Test **October/November 2020**

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	
Total	

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[Turn over

1 A weak acid has the formula H_3X.

The equation for the reaction between H_3X and sodium hydroxide, NaOH, is shown.

$$3NaOH + H_3X \rightarrow Na_3X + 3H_2O$$

The concentration of $H_3X(aq)$ is determined by titration with NaOH(aq).

Thymolphthalein is used to determine the end-point of the titration.

P is $H_3X(aq)$.

Q is 0.100 mol / dm^3 NaOH(aq).

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

Pipette 25.0 cm^3 of **Q** into a flask and titrate with **P** using three drops of thymolphthalein as the indicator.

The end-point is when the solution remains colourless for 30 seconds.

Record your results in the table.

Repeat the titration as many times as 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 in the table.

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

[12]

(b) **Q** is 0.100 mol / dm^3 NaOH(aq).

Calculate the number of moles of NaOH in 25.0 cm^3 of **Q**.

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

number of moles of NaOH in 25 cm^3 of **Q** ..... [1]

(c) Use your answer from **(b)** to calculate the number of moles of H_3X in the average volume of **P** used.

$$3NaOH + H_3X \longrightarrow Na_3X + 3H_2O$$

number of moles of H_3X ..... [1]

(d) Use your answers from **(a)** and **(c)** to calculate the concentration of H_3X(aq) in **P** in mol / dm^3.

concentration of H_3X(aq) ..... mol / dm^3 [1]

(e) Use your answer from **(d)** to calculate the mass of H_3X in 200 cm^3 **P**.

[M_r: H_3X, 192]

mass of H_3X ..... g [2]

[Total: 17]

[Turn over

2 You are provided with solution **R** and solid **S**.

(a) (i) Do the tests on **R** shown in the table.

Record your observations in the table.

You should test and name any gases evolved.

test no.	test	observations
1	To 1 cm depth of **R** in a test-tube, add a few drops of universal indicator solution. Keep the solution for use in test **2**.	
2	To the solution from test **1**, add aqueous sodium hydroxide until no further change is seen.	
3	To 1 cm depth of **R** in a boiling tube, add 1 cm depth of aqueous sodium hydroxide. Gently warm the mixture. Keep the solution for use in test **4**.	
4	To the solution from test **3**, add 2 cm depth of dilute nitric acid and then add 1 cm depth of aqueous barium nitrate.	

[6]

(ii) Identify the cation responsible for the colour seen in test **1**.

cation ..... [1]

(iii) Identify the cation responsible for the observations in test **3**.

cation ..... [1]

(iv) Identify the anion responsible for the observation in test **4**.

anion ..... [1]

(b) (i) Do the tests on **S** shown in the table.

Record your observations in the table.

You should test and name any gases evolved.

test no.	test	observations
1	To the sample of **S** in a boiling tube, add 3 cm depth of dilute nitric acid. Keep the solution for use in tests **2**, **3** and **4**.	
2	To 1 cm depth of the solution from test **1** in a test-tube, add aqueous sodium hydroxide drop by drop until a change is seen. Add excess aqueous sodium hydroxide.	
3	To 1 cm depth of the solution from test **1** in a test-tube, add aqueous ammonia drop by drop until a change is seen. Add excess aqueous ammonia.	
4	To 1 cm depth of the solution from test **1** in a test-tube, add a few drops of dilute nitric acid and then add 1 cm depth of aqueous silver nitrate.	

[12]

(ii) Identify solid **S**.

solid **S** ..... [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