Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

7286330928

CHEMISTRY **5070/31**

Paper 3 Practical Test **May/June 2021**

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	

This document has **8** pages.

1 Malic acid is a carboxylic acid found in apple juice.

The equation for the reaction between malic acid, $H_2C_4H_4O_5$, and potassium hydroxide, KOH, is shown.

$$2KOH + H_2C_4H_4O_5 \rightarrow K_2C_4H_4O_5 + 2H_2O$$

The concentration of aqueous malic acid is determined by titration with KOH(aq).

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

P is aqueous malic acid.

Q is 0.100 mol / dm^3 KOH(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

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

Summary

Tick (✓) the best titration results.

Use the best titration results to calculate the average volume of **P** required.

.... cm^3
[12]

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

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

.... mol [1]

(c) Use your answer from **(b)** to calculate the number of moles of malic acid, $H_2C_4H_4O_5$, in the average volume of **P** used.

$$2KOH + H_2C_4H_4O_5 \rightarrow K_2C_4H_4O_5 + 2H_2O$$

.... mol [1]

(d) Use your answer from **(c)** to calculate the concentration of malic acid in **P**.

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

.... mol / dm^3 [1]

The average concentration of malic acid in apple juice is 4.5 g / dm^3.

(e) Calculate the average concentration of malic acid, $H_2C_4H_4O_5$, in apple juice in mol / dm^3.

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

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

(f) Use your answers from **(d)** and **(e)** to calculate the average volume of apple juice which contains the same mass of malic acid as 200 cm^3 of **P**.

Give your answer in dm^3.

.... dm^3 [2]

(g) Suggest why accurate titration of apple juice with KOH usually produces an average value higher than your answer from **(e)**.

....

.... [1]

[Total: 20]

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

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

Record your observations in the table.

test no.	test	observations
1	To 1 cm depth of **R** in a test-tube, add aqueous sodium hydroxide drop-by-drop until a change is seen. Add excess aqueous sodium hydroxide.	
2	To 1 cm depth of **R** in a test-tube, add aqueous ammonia drop-by-drop until a change is seen. Add excess aqueous ammonia.	
3	To 1 cm depth of **R** in a test-tube, add 3 drops of dilute nitric acid and then add 1 cm depth of aqueous silver nitrate.	

[6]

Conclusions

(ii) Name the cation in **R**.

cation .... [1]

(iii) Name the anion in **R**.

anion .... [1]

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

Record your observations in the table.

Test and name any gases produced.

Describe the test and the positive result for any gases you named.

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

[9]

Conclusions

(ii) Name the cation responsible for the observations in test **1**.

cation .... [1]

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

cation .... [1]

(iv) Name the anion in **S**.

anion .... [1]

[Total: 20]

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