Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5908814305

CHEMISTRY **5070/31**

Paper 3 Practical Test **May/June 2022**

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. Any blank pages are indicated.

1 **P** is a mixture of equal volumes of dilute hydrochloric acid, HC*l*, and dilute sulfuric acid, H_2SO_4.

The concentration of hydrogen ions in **P** is determined by titrating this solution with aqueous sodium carbonate, **Q**.

Q is 0.275 mol / dm^3 sodium carbonate, Na_2CO_3.

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

Pipette 25.0 cm^3 of **Q** into a flask and titrate with **P**, using methyl orange indicator.

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 is ..... cm^3. [12]

(b) **Q** is 0.275 mol / dm^3 sodium carbonate.

The ionic equation for the reaction is shown.

$$CO_3^{2-} + 2H^+ \rightarrow H_2O + CO_2$$

Use your results from **(a)** to calculate the concentration, in mol / dm^3, of hydrogen ions in **P**.

Give your answer to three significant figures.

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

P is a mixture of dilute hydrochloric acid, HC*l*, and dilute sulfuric acid, H_2SO_4.

The concentration of hydrochloric acid in **P** is 0.135 mol / dm^3.

(c) Use your answer from **(b)** to calculate the number of moles of hydrogen ions from sulfuric acid in 1.00 dm^3 of **P**.

..... mol [1]

(d) Use your answer from **(c)** to calculate the concentration, in mol / dm^3, of sulfuric acid in **P**.

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

(e) **P** is a mixture of equal volumes of dilute hydrochloric acid, HC*l*, and dilute sulfuric acid, H_2SO_4.

Calculate the concentration, in mol / dm^3, of the dilute hydrochloric acid used to make **P**.

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

(f) Write the formulae of the **two** salts formed during this titration.

..... and ..... [1]

[Total: 18]

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

(a) Do the following tests on **R** and record your observations in the table.

test no.	test	observations
1	**(i)** To 1 cm depth of **R** in a test-tube, add an equal volume of aqueous silver nitrate and leave to stand. **(ii)** To the mixture from **(i)**, add 1 cm depth of dilute nitric acid.	
2	**(i)** To 1 cm depth of **R** in a test-tube, add aqueous sodium hydroxide until a change is seen. **(ii)** To the mixture from **(i)**, add excess aqueous sodium hydroxide.	
3	**(i)** To 1 cm depth of **R** in a test-tube, add a small amount of ascorbic acid and mix well. **(ii)** To the mixture from **(i)**, add aqueous sodium hydroxide until no further change is seen.	
4	**(i)** To 1 cm depth of **R** in a test-tube, add an equal volume of aqueous potassium iodide. **(ii)** To the mixture from **(i)**, add 1 or 2 drops of starch indicator.	

[9]

(b) Conclusion

The cation in **R** responsible for the observations in test **2** is ..... . [1]

(c) Do the following tests on **S** and record your observations in the table.

Test and name any gas evolved.

test no.	test	observations
1	**(i)** To 1 cm depth of **S** in a test-tube, add an equal volume of aqueous barium nitrate. **(ii)** To the mixture from **(i)**, add 1 cm depth of dilute nitric acid.	
2	**(i)** To 1 cm depth of **S** in a test-tube, add aqueous ammonia until a change is seen. **(ii)** To the mixture from **(i)**, add excess aqueous ammonia.	
3	**(i)** To 1 cm depth of **S** in a boiling tube, add aqueous sodium hydroxide until a change is seen. **(ii)** To the mixture from **(i)**, add excess aqueous sodium hydroxide. **(iii)** Warm the mixture from **(ii)** in the boiling tube.	

[9]

(d) Conclusions

The solid used to prepare solution **S** contains two cations and one anion.

Identify these ions.

cations ..... and .....

anion .....

[3]

[Total: 22]

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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