Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

3599589322

CHEMISTRY **0620/52**

Paper 5 Practical Test **February/March 2021**

1 hour 15 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.

IB21 03_0620_52/2RP

1 You are going to investigate the reaction between aqueous potassium hydroxide and two different aqueous solutions of hydrochloric acid labelled solution **A** and solution **B**.

Read all of the instructions carefully before starting the experiments.

Instructions
You are going to do two experiments.

(a) *Experiment 1*

- Fill the burette with solution **A**. Run some of solution **A** out of the burette so that the level of solution **A** is on the burette scale.
- Record the initial burette reading in the table.
- Use the measuring cylinder to pour 25 cm^3 of aqueous potassium hydroxide into the conical flask.
- Add five drops of thymolphthalein indicator to the conical flask.
- Slowly add solution **A** from the burette to the conical flask, while swirling the flask, until the solution just changes colour.
- Record the final burette reading in the table and complete the table.

	Experiment 1
final burette reading / cm^3	
initial burette reading / cm^3	
volume of solution **A** added / cm^3	

Experiment 2

- Empty the conical flask and rinse it with distilled water.
- Empty the burette and rinse it with distilled water.
- Rinse the burette with solution **B**.
- Fill the burette with solution **B**. Run some of solution **B** out of the burette so that the level of solution **B** is on the burette scale.
- Record the initial burette reading in the table.
- Use the measuring cylinder to pour 25 cm^3 of aqueous potassium hydroxide into the conical flask.
- Add five drops of thymolphthalein indicator to the conical flask.
- Slowly add solution **B** from the burette to the conical flask, while swirling the flask, until the solution just changes colour.
- Record the final burette reading in the table and complete the table.

	Experiment 2
final burette reading / cm^3	
initial burette reading / cm^3	
volume of solution **B** added / cm^3	

[4]

(b) State the colour change observed in the conical flask at the end-point in Experiment 2.

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

(c) State the colour change observed at the end-point if methyl orange is used as the indicator.

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

(d) Before starting the titration in Experiment 2 the conical flask was rinsed with water.

(i) Explain why the conical flask was rinsed with water.

.... [1]

(ii) The conical flask was **not** then rinsed with aqueous potassium hydroxide.

State how rinsing the conical flask with aqueous potassium hydroxide would change the volume of solution **B** needed. Explain your answer.

....

.... [2]

(e) **(i)** Deduce which aqueous solution of hydrochloric acid, **A** or **B**, is more concentrated. Explain your answer.

....

.... [1]

(ii) Deduce how many times more concentrated this solution of hydrochloric acid is than the other solution of hydrochloric acid.

.... [1]

(f) Explain why Experiment 1 and Experiment 2 should be repeated.

....

.... [1]

(g) Deduce the volume of solution **B** required if Experiment 2 is carried out with 50 cm^3 of aqueous potassium hydroxide.

....

.... [2]

(h) Describe **one** change that could be made to the apparatus to improve the accuracy of the results.

....

.... [1]

(i) Describe what effect using a larger conical flask would have on the results obtained.

.... [1]

[Total: 16]

2 You are provided with two solids, solid **C** and solid **D**.
Do the following tests on the substances, recording all of your observations at each stage.

tests on solid C

(a) Describe the appearance of solid **C**.

.... [1]

(b) Conduct a flame test on solid **C**.
Record your observations.

.... [1]

Transfer the remaining solid **C** to a boiling tube. Add about 1 cm depth of distilled water to the boiling tube containing solid **C**. Place a stopper in the boiling tube and shake the tube to dissolve solid **C** and form solution **C**.

(c) Add 5 cm^3 of aqueous sodium hydroxide slowly to solution **C**.

Keep the product for use in (d).

Record your observations.

.... [1]

(d) Pour about 2 cm depth of the product from **(c)** into a boiling tube. Add a piece of aluminium foil and warm the mixture gently. Test and identify any gas produced.
Record your observations.

....

....

identity of gas ....
[3]

(e) Identify solid **C**.

....

.... [2]

tests on solid D

(f) Place solid **D** in a boiling tube. Add about 10 cm^3 of distilled water to the boiling tube. Place a stopper in the boiling tube and shake the tube to dissolve solid **D** and form solution **D**.

Divide solution **D** into five approximately equal portions in five test-tubes.

(i) To the first portion of solution **D** add aqueous sodium hydroxide dropwise and then in excess.
Record your observations.

....

.... [2]

(ii) To the second portion of solution **D** add aqueous ammonia dropwise and then in excess.
Record your observations.

....

.... [2]

(iii) To the third portion of solution **D** add about 2 cm depth of aqueous sodium carbonate.
Record your observations.

....

.... [2]

(iv) To the fourth portion of solution **D** add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate.
Record your observations.

.... [1]

(v) To the fifth portion of solution **D** add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate.
Record your observations.

.... [1]

(g) Identify solid **D**.

....

.... [2]

[Total: 18]

3 Old concrete contains calcium carbonate. Calcium carbonate reacts with dilute hydrochloric acid.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

Plan an investigation to find which of two lumps of concrete contains the larger percentage of calcium carbonate. Your plan should include how you will use your results to determine which one of the two lumps has the larger percentage of calcium carbonate.

You have access to all common laboratory materials and a supply of dilute hydrochloric acid.

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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	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, then add aqueous barium nitrate	white ppt.
sulfite (SO_3^{2-})	add dilute hydrochloric acid, warm gently and test for the presence of sulfur dioxide	sulfur dioxide produced will turn acidified aqueous potassium manganate(VII) 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	grey-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
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