Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5311402242

CHEMISTRY **0620/52**

Paper 5 Practical Test **May/June 2022**

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.

1 You are going to investigate the reaction between two different solutions of aqueous sodium carbonate, labelled solution **K** and solution **L**, and dilute hydrochloric acid using two different indicators.

Read all of the instructions carefully before starting the experiments.

Instructions
You are going to do two experiments.

(a) *Experiment 1*

- Rinse a burette with water and then with the **dilute hydrochloric acid for Question 1**.
- Fill the burette with the dilute hydrochloric acid. Run some of the dilute hydrochloric acid out of the burette so that the level of the dilute hydrochloric acid is on the burette scale. Record the burette reading in the table.
- Use a measuring cylinder to pour 25 cm^3 of solution **K** into a conical flask.
- Add five drops of methyl orange indicator **and** five drops of thymolphthalein indicator to the conical flask.
- Stand the conical flask on a white tile.
- Slowly add dilute hydrochloric acid from the burette to the conical flask, while swirling the flask, until the solution becomes yellow. This is the first colour change. Record the burette reading in the table.
- Continue to add dilute hydrochloric acid from the burette to the conical flask, while swirling the flask, until the solution changes colour again. This is the second colour change.
- Record the burette reading in the table and complete the table.

	Experiment 1
burette reading at first colour change / cm^3	
final burette reading at second colour change / cm^3	
initial burette reading / cm^3	
volume of dilute hydrochloric acid added for first colour change / cm^3	
total volume of dilute hydrochloric acid added for second colour change / cm^3	

[3]

(b) *Experiment 2*

- Empty the conical flask and rinse it with distilled water.
- Repeat Experiment 1 using solution **L** instead of solution **K**.

	Experiment 2
burette reading at first colour change / cm^3	
final burette reading at second colour change / cm^3	
initial burette reading / cm^3	
volume of dilute hydrochloric acid added for first colour change / cm^3	
total volume of dilute hydrochloric acid added for second colour change / cm^3	

[3]

(c) State the second colour change observed in the conical flask in both experiments.

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

(d) For Experiment 1, compare the volume of dilute hydrochloric acid needed for the first colour change with the volume of dilute hydrochloric acid for the second colour change.

.....

..... [2]

(e) Compare the concentration of solution **K** used in Experiment 1 to the concentration of solution **L** used in Experiment 2.
Explain your answer.

.....

.....

..... [3]

(f) **(i)** Deduce the volume of dilute hydrochloric acid needed for the second colour change when Experiment 2 is repeated using 50 cm^3 of solution **L**.

..... [2]

(ii) State why using 50 cm^3 of solution **L** would cause a problem.

.....

..... [1]

(g) State the advantage of using a pipette instead of the measuring cylinder in these experiments.

..... [1]

(h) Explain why the conical flask was swirled as the dilute hydrochloric acid was added from the burette.

.....

..... [1]

(i) At the start of Experiment 1, the burette was rinsed with water and then with dilute hydrochloric acid.
At the start of Experiment 2, the conical flask was rinsed with water but **not** with solution **L**.

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

.....

..... [1]

(ii) Explain why the conical flask was **not** rinsed with solution **L** in Experiment 2.

.....

..... [1]

[Total: 19]

2 You are provided with solid **M**.
Do the following tests on solid **M**, recording all of your observations at each stage.

tests on solid M

Add about 15 cm^3 of distilled water to the boiling tube containing solid **M**. Stopper the boiling tube and shake the mixture to dissolve solid **M** and form solution **M**. Divide solution **M** into five approximately equal portions in five test-tubes.

(a) Test the pH of the first portion of solution **M**.

pH = ... [1]

(b) To the second portion of solution **M** add aqueous sodium hydroxide gradually until it is in excess and the test-tube is at least half full.

Keep the product for use in (c).

Record your observations.

.....

..... [2]

(c) (i) Transfer the product from **(b)** into a boiling tube. Add a piece of aluminium foil and warm the mixture gently. Test any gas produced.
Record your observations.

.....

..... [2]

(ii) Identify the gas made in **(i)**.

..... [1]

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

..... [1]

(e) (i) To the fourth portion of solution **M** add the zinc powder. Gently shake the test-tube and then leave it to stand and settle for about 5 minutes.

Keep the product for use in (ii).

Record your observations.

.....

..... [1]

(ii) Decant the solution formed in **(i)** into a test-tube.
Add aqueous ammonia gradually to the solution until there is no further change.
Record your observations.

.....

..... [2]

(f) (i) To the fifth portion of solution **M** add the aqueous potassium iodide.

Keep the product for use in (ii).

Record your observations.

..... [1]

(ii) To the product from **(i)** add the aqueous sodium thiosulfate. Gently shake the test-tube.
As soon as you have made your observations pour the contents of the test-tube into the 'stop-bath'.
Record your observations.

..... [1]

(g) Use the results of the tests in **(a)** to **(d)** to identify **three** ions in solution **M**.

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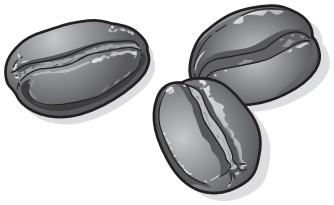
..... [3]

[Total: 15]

3 The diagram shows some coffee beans.



Caffeine occurs naturally in coffee beans. Caffeine is a white crystalline solid. It is very soluble in hot water but much less soluble in cold water.

Plan an investigation to obtain a pure crystalline sample of caffeine from coffee beans.

Assume that all other soluble substances in coffee beans are very soluble in both hot and cold water.

You are provided with coffee beans and common laboratory apparatus.

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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