Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 8 6 7 5 3 4 8 4 3 9 *

CHEMISTRY **0971/62**

Paper 6 Alternative to Practical **May/June 2022**

1 hour

You must answer on the question paper.

No additional materials are needed.

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.

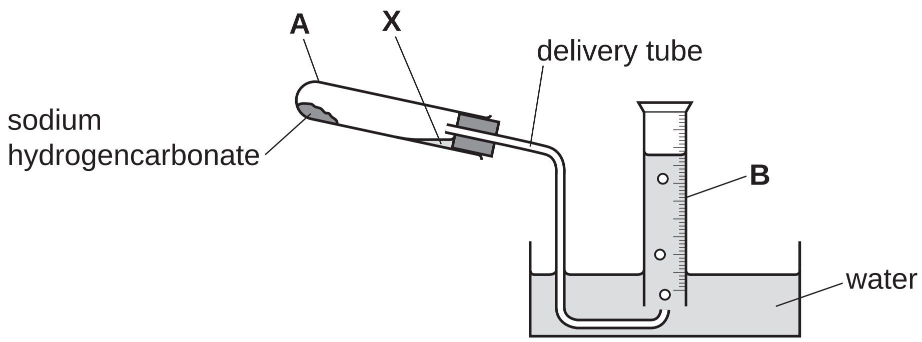
INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Any blank pages are indicated.

1 Sodium hydrogencarbonate decomposes when heated. The products are solid sodium carbonate, water and carbon dioxide.

A student decomposed a sample of sodium hydrogencarbonate using the apparatus shown.



(a) Name the items of apparatus labelled **A** and **B**.

A ....

B ....
[2]

(b) When the sodium hydrogencarbonate was heated, a colourless liquid collected at the point marked **X**.

Suggest the identity of the colourless liquid.

.... [1]

(c) **On the diagram** draw one arrow to show where the apparatus should be heated during the experiment. [1]

(d) State an observation that would indicate the sodium hydrogencarbonate had stopped reacting.

....

.... [1]

(e) Explain why it is important to remove the delivery tube from the water as soon as heating is stopped.

....

....

.... [2]

[Total: 7]

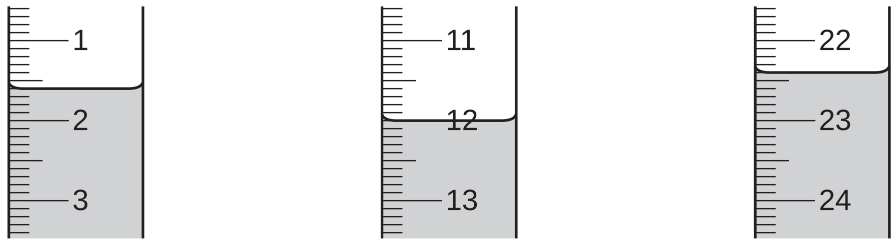
2 A student investigated the reaction between two different solutions of aqueous sodium carbonate, solution **K** and solution **L**, and dilute hydrochloric acid using two different indicators.

Two experiments were done.

Experiment 1

- A burette was rinsed with water and then with the dilute hydrochloric acid.
- The burette was filled with dilute hydrochloric acid. Some of the dilute hydrochloric acid was run out of the burette so that the level of the dilute hydrochloric acid was on the burette scale.
- Using a measuring cylinder, 25 cm^3 of solution **K** was poured into a conical flask.
- Five drops of methyl orange indicator **and** five drops of thymolphthalein indicator were added to the conical flask.
- The conical flask was placed on a white tile.
- Dilute hydrochloric acid was added slowly from the burette to the conical flask, while the flask was swirled, until the solution turned yellow. This is the first colour change.
- More dilute hydrochloric acid from the burette was added to the conical flask, while swirling the flask, until the solution changed colour again. This is the second colour change.

(a) Use the burette diagrams to complete the table for Experiment 1.



initial burette reading | burette reading at first colour change | burette reading at second colour change

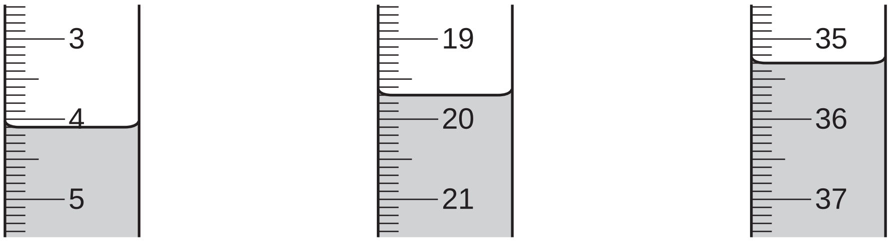
	Experiment 1
burette reading at first colour change / cm^3	
final burette reading at second colour change / cm^3	
initial burette reading / cm^3	
volume of dilute hydrochloric acid added for first colour change / cm^3	
total volume of dilute hydrochloric acid added for second colour change / cm^3	

[3]

(b) *Experiment 2*

- The conical flask was emptied and rinsed with distilled water.
- Experiment 1 was repeated using solution **L** instead of solution **K**.

Use the burette diagrams to complete the table for Experiment 2.



initial burette reading — burette reading at first colour change — burette reading at second colour change

	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 colour change observed at the end-point when dilute hydrochloric acid is added to methyl orange in an alkaline solution.

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]

3 Solid **M** and solid **N** were analysed. Solid **M** was iron(III) nitrate.
Tests were done on each substance.

tests on solid M

Complete the expected observations.

Solid **M** was dissolved in water to form solution **M**. Solution **M** was divided into two approximately equal portions in two test-tubes.

(a) To the first portion of solution **M**, aqueous sodium hydroxide was added gradually until in excess. The product was kept for **(b)**.

observations ....

.... [2]

(b) **(i)** The product from **(a)** was transferred to a boiling tube. A piece of aluminium foil was added and the mixture warmed gently. Any gas produced was tested.

observations ....

.... [1]

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

.... [1]

(c) To the second portion of solution **M**, about 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate were added.

observations .... [1]

tests on solid N

tests	**observations**
test 1 A flame test was carried out on solid **N**.	the flame became red
Solid **N** was dissolved in water to form solution **N**. Solution **N** was divided equally into one test-tube and one boiling tube. **test 2** About 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate were added to the first portion of solution **N** in a test-tube.	no visible change
test 3 About 2 cm depth of dilute hydrochloric acid was added to the second portion of solution **N**. The mixture was warmed and any gas produced was tested.	acidified aqueous potassium manganate(VII) changed from purple to colourless

(d) Identify the gas produced in **test 3**.

.... [1]

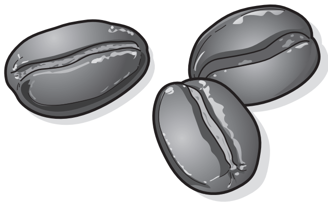
(e) Identify solid **N**.

....

.... [2]

[Total: 8]

4 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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.... [6]

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