Cambridge Assessment International Education

Cambridge IGCSE™ (9 – 1)

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5460713378

CHEMISTRY **0971/51**

Paper 5 Practical Test **May/June 2020**

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. Blank pages are indicated.

1 You are going to investigate the reaction between dilute hydrochloric acid and two different aqueous solutions of sodium carbonate labelled solution **E** and solution **F**.

Read all of the instructions carefully before starting the experiments.

Instructions
You are going to do three experiments.

(a) *Experiment 1*

- Fill the burette up to the 0.0 cm^3 mark with dilute hydrochloric acid.
- Use the measuring cylinder to pour 25 cm^3 of solution **E** into the conical flask.
- Add five drops of thymolphthalein indicator to the conical flask.
- Slowly add dilute hydrochloric acid from the burette to the conical flask, while swirling the flask, until the solution just changes colour.
- Record the burette readings in the table and complete the table.

	Experiment 1
final burette reading / cm^3	
initial burette reading / cm^3	
volume of dilute hydrochloric acid added / cm^3	

Experiment 2

- Empty the conical flask and rinse it with distilled water.
- Refill the burette with dilute hydrochloric acid.
- Repeat Experiment 1 using five drops of methyl orange indicator instead of thymolphthalein indicator.
- Record the burette readings in the table and complete the table.

	Experiment 2
final burette reading / cm^3	
initial burette reading / cm^3	
volume of dilute hydrochloric acid added / cm^3	

Experiment 3

- Empty the conical flask and rinse it with distilled water.
- Refill the burette with dilute hydrochloric acid.
- Use the measuring cylinder to pour 25 cm^3 of solution **F** into the conical flask.
- Add five drops of methyl orange indicator to the conical flask.
- Slowly add dilute hydrochloric acid from the burette to the conical flask, while swirling the flask, until the solution just changes colour.
- Record the burette readings in the table and complete the table.

	Experiment 3
final burette reading / cm^3	
initial burette reading / cm^3	
volume of dilute hydrochloric acid added / cm^3	

[5]

(b) (i) What colour change was observed in the conical flask in Experiment 1?

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

(ii) What colour change was observed in the conical flask in Experiment 2?

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

(c) Compare the volumes of dilute hydrochloric acid added in Experiment 2 and Experiment 3. Explain any difference.

.....

..... [2]

(d) Determine the simplest whole number ratio of volumes of dilute hydrochloric acid used in Experiments 1 and 2.

ratio Experiment 1 : Experiment 2 = ... [1]

(e) What volume of dilute hydrochloric acid would be required if Experiment 3 was repeated using thymolphthalein indicator instead of methyl orange indicator?

volume = ... [2]

(f) The conical flask was rinsed with distilled water between each experiment.

(i) Why was the conical flask rinsed?

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..... [1]

(ii) Why does it **not** matter if a little distilled water is left in the flask after it has been rinsed?

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..... [1]

(g) State **two** sources of error in the experiments. For each error suggest an improvement that would reduce the error.

source of error 1 .....

improvement 1 .....

.....

source of error 2 .....

improvement 2 .....

.....

[4]

[Total: 18]

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

tests on solid G

(a) Place about half of solid **G** in a hard-glass test-tube. Heat the solid gently and then strongly.
Record your observations.

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..... [2]

(b) (i) Place the remaining half of solid **G** in a boiling tube.
Add about 10 cm^3 of dilute sulfuric acid to the boiling tube. Test any gas produced.

Keep the solution formed for use in (c).

Record your observations.

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..... [4]

(ii) Identify the gas produced in **(b)(i)**.

..... [1]

(c) Leave the solution from **(b)** to settle for three minutes. Carefully pour about half of the solution into another boiling tube.
To this portion add aqueous ammonia slowly until in excess.
Record your observations.

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.....

..... [3]

(d) What conclusions can you make about solid **G**?

.....

..... [2]

tests on solid H

(e) Carry out a flame test on solid **H**.
Record your observations.

..... [1]

Add solid **H** to about 10 cm^3 of distilled water in a boiling tube. Stopper the boiling tube and shake it to dissolve solid **H** and form solution **H**.

(f) Add about 1 cm depth of dilute nitric acid and a few drops of aqueous barium nitrate to solution **H**.
Record your observations.

..... [1]

(g) Identify solid **H**.

..... [2]

[Total: 16]

3 Cobalt, manganese and nickel are metals. They react with dilute hydrochloric acid to form hydrogen gas.

Plan an investigation to find the order of reactivity of these three metals.

You are provided with:
- samples of each metal
- dilute hydrochloric acid
- common laboratory apparatus.

Your plan must make it clear how your investigation will be a fair test and how you will use your results to place these metals in order of reactivity.

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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