Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

CHEMISTRY **0620/53**

Paper 5 Practical Test **October/November 2023**

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.

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1 You are going to investigate the reaction between dilute hydrochloric acid and aqueous sodium hydroxide.

Read all of the instructions carefully before starting the experiments.

Instructions
You are going to do **two** experiments.

(a) Experiment 1

- Fill a burette with aqueous sodium hydroxide. Run some of the aqueous sodium hydroxide out of the burette so that the level is on the burette scale.
- Record the initial burette reading in Table 1.1.
- Use a measuring cylinder to pour 25 cm^3 of dilute hydrochloric acid into a conical flask.
- Stand the conical flask on a white tile.
- Add five drops of methyl orange indicator to the conical flask.
- Slowly add aqueous sodium hydroxide from the burette to the conical flask, while swirling the flask, until the solution just changes colour.
- Record the final burette reading in Table 1.1.

View solution

Experiment 2

- Empty the conical flask and rinse it with distilled water.
- Refill the burette with aqueous sodium hydroxide. Run some of the aqueous sodium hydroxide out of the burette so that the level is on the burette scale.
- Record the initial burette reading in Table 1.1.
- Use the measuring cylinder to pour 25 cm^3 of dilute hydrochloric acid into the conical flask.
- Add 0.50 g of powdered calcium carbonate to the conical flask and swirl the flask.
- Stand the conical flask on a white tile.
- Add five drops of methyl orange indicator to the conical flask.
- Slowly add aqueous sodium hydroxide from the burette to the conical flask, while swirling the flask, until the solution just changes colour.
- Record the final burette reading in Table 1.1 and complete the table.

Table 1.1

	Experiment 1	Experiment 2
final burette reading / cm^3		
initial burette reading / cm^3		
volume of aqueous sodium hydroxide added / cm^3		

[4]

(b) (i) State the colour change observed in the conical flask at the end-point in both experiments.

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

(ii) State the colour change observed if thymolphthalein is used in place of methyl orange.

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

(c) When 0.50 g of calcium carbonate is added to the conical flask in Experiment 2, a gas is produced.

Suggest the identity of the gas.

View solution

..... [1]

(d) In Experiment 2, the conical flask is rinsed with water but the burette is **not** rinsed with water.

(i) State why there is no need to rinse the burette with water.

View solution

..... [1]

(ii) Explain why the conical flask is rinsed with water.

View solution

.....

..... [1]

(iii) The conical flask is **not** dried after being rinsed with water.

State how drying the conical flask affects the volume of aqueous sodium hydroxide needed to reach the end-point. Explain your answer.

.....

.....

..... [2]

View solution

(e) (i) Compare the volumes of aqueous sodium hydroxide needed to reach the end-point in Experiment 1 and Experiment 2.

.....

..... [2]

(ii) Explain why different volumes of aqueous sodium hydroxide are needed in Experiment 1 and Experiment 2.

.....

..... [1]

(iii) Calculate the volume of aqueous sodium hydroxide needed to reach the end-point if Experiment 2 is repeated using 0.25 g of calcium carbonate instead of 0.50 g.

View solution

volume of aqueous sodium hydroxide = ... [2]

(f) Describe how the reliability of the results obtained can be confirmed.

View solution

.....

..... [1]

[Total: 17]

Question 2 starts on the next page.

2 You are provided with two substances: solid **I** and solution **J**.
Do the following tests on the substances, recording all of your observations at each stage.

Tests on solid I

(a) Conduct a flame test on solid **I**.

View solution

Record your observations.

..... [1]

Transfer the remaining solid **I** to 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 **I** and form solution **I**. Divide solution **I** into four approximately equal portions in two boiling tubes and two test-tubes.

(b) To the first portion of solution **I** in a boiling tube, add a spatula full of zinc powder followed by about 5 cm depth of dilute sulfuric acid. Leave the tube to stand for one minute.

View solution

Record your observations.

.....

.....

..... [2]

(c) To the second portion of solution **I** in a boiling tube, add aqueous sodium hydroxide dropwise and then in excess.

View solution

Record your observations.

dropwise .....

in excess .....
[2]

(d) To the third portion of solution **I**, add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate.

View solution

Record your observations.

.....

..... [1]

(e) To the fourth portion of solution **I**, add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate. Leave the test-tube to stand for about one minute.

View solution

Record your observations.

.....

..... [1]

(f) Identify the **three** ions in solid **I**.

.....

.....

..... [3]

View solution

Tests on solution J

Divide solution **J** into three approximately equal portions in three test-tubes.

(g) Test the pH of the first portion of solution **J**.

View solution

pH = ... [1]

(h) To the second portion of solution **J**, add the piece of magnesium ribbon. Test and identify any gas produced.

Record your observations.

View solution

.....

.....

identity of gas .....

[3]

(i) To the third portion of solution **J**, add about 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate.

Record your observations.

View solution

.....

..... [1]

(j) Identify solution **J**.

View solution

.....

..... [2]

[Total: 17]

3 You are asked to investigate the effect of temperature on the rate of decomposition of aqueous hydrogen peroxide.

View solution

Aqueous hydrogen peroxide decomposes to make oxygen gas.

$$\text{hydrogen peroxide} \rightarrow \text{water} + \text{oxygen}$$

The reaction is very slow unless a catalyst is added to the hydrogen peroxide.
Manganese(IV) oxide is a catalyst for this reaction.

Plan an investigation to find how the **temperature** of the aqueous hydrogen peroxide affects the rate of the catalysed reaction. Your answer should include an explanation of how your results will tell you how the rate of reaction has changed.

You are provided with aqueous hydrogen peroxide, manganese(IV) oxide and common laboratory apparatus.

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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, then test for carbon dioxide gas	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 with dilute nitric acid, then add aqueous barium nitrate	white ppt.
sulfite, SO_3^{2-}	add a small volume of acidified aqueous potassium manganate(VII)	the acidified aqueous potassium manganate(VII) changes colour 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	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, ppt. turns brown near surface on standing	green ppt., insoluble in excess, ppt. turns brown near surface on standing
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

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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
calcium, Ca^{2+}	orange-red
barium, Ba^{2+}	light green
copper(II), Cu^{2+}	blue-green

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