Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

0341969077

CHEMISTRY **0620/53**

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.

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1 You are going to investigate the reaction between aqueous sodium hydroxide and two different solutions of dilute hydrochloric acid with different concentrations, labelled **Q** and **R**, using two different indicators.

Read all of the instructions carefully before starting the experiments.

Instructions
You are going to do three experiments.

(a) *Experiment 1*

- Fill the burette with dilute hydrochloric acid **Q**. 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 the **aqueous sodium hydroxide for Question 1** into a conical flask.
- Add five drops of methyl orange 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 just changes colour.
- Record the burette reading in the table and complete the table.

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

Experiment 2

- Empty the conical flask and rinse it with distilled water.
- Rinse the burette with distilled water and then with dilute hydrochloric acid **R**.
- Repeat Experiment 1 using dilute hydrochloric acid **R** instead of dilute hydrochloric acid **Q**.

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

Experiment 3

- Empty the conical flask and rinse it with distilled water.
- Repeat Experiment 2 using thymolphthalein indicator instead of methyl orange indicator.

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

[6]

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(b) Determine the simplest whole number ratio of the volumes of dilute hydrochloric acid **R** used in Experiment 2 and Experiment 3.

..... [1]

(c) Use your ratio in **(b)** to deduce the volume of dilute hydrochloric acid **Q** needed when Experiment 1 is repeated using thymolphthalein indicator instead of methyl orange indicator.

volume of hydrochloric acid **Q** = ... [2]

(d) Compare the concentration of dilute hydrochloric acid **Q** used in Experiment 1 to the concentration of dilute hydrochloric acid **R** used in Experiment 2.
Explain your answer.

.....

.....

.....

..... [3]

(e) State how the results change, if at all, if the aqueous sodium hydroxide is warmed before adding the dilute hydrochloric acid. Give a reason for your answer.

effect on results .....

reason .....
[2]

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

..... [1]

(g) Explain why a white tile is used in these experiments.

..... [1]

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[Turn over

(h) At the start of Experiment 2 the burette was rinsed with distilled water and then with dilute hydrochloric acid **R**.

(i) State what was removed from the burette when it was rinsed with distilled water.

..... [1]

(ii) State what was removed from the burette when it was rinsed with dilute hydrochloric acid **R**.

..... [1]

(iii) Explain why the burette does **not** need to be rinsed at the start of Experiment 3.

.....

..... [1]

(i) After the burette was filled with dilute hydrochloric acid at the start of Experiment 1, some of the acid was run out of the burette.

One reason for running the acid out of the burette is to make sure the level of the hydrochloric acid is on the scale.

Give one **other** reason why it is important to run some acid out of the burette after it has been filled for the first time in an experiment.

.....

..... [1]

[Total: 20]

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

tests on solid S

To the boiling tube containing solid **S** add about 20 cm^3 of distilled water. Stopper the boiling tube and shake the mixture to dissolve solid **S** and form solution **T**. Divide solution **T** into six approximately equal portions in six test-tubes.

(a) State the colour change that occurred when distilled water was added to solid **S** to form solution **T**.

from solid **S** ..... to solution **T** ..... [1]

(b) Test the pH of the first portion of solution **T**.

pH = ... [1]

(c) To the second portion of solution **T**, add the strip of magnesium ribbon.
Record your observations.

.....

..... [2]

(d) (i) To the third portion of solution **T**, 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.
Record your observations.

..... [1]

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

..... [1]

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

..... [1]

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[Turn over

(g) To the sixth portion of solution **T**, add aqueous ammonia dropwise and then in excess. Record your observations.

.....

.....

..... [3]

(h) Identify solid **S**.

.....

.....

..... [3]

[Total: 14]

3 When solution **A** and solution **B** are mixed they react slowly to form iodine.
Starch solution is added to the mixture to act as an indicator.
When a certain amount of iodine is made there is a sudden colour change to blue-black.

Plan an investigation to find the effect of temperature on the rate of the reaction between solution **A** and solution **B**.

You are provided with solution **A**, solution **B**, starch solution 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

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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
copper(II) (Cu^{2+})	blue-green

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