Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

CHEMISTRY **0971/52**

Paper 5 Practical Test **October/November 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.

[Turn over

1 You are going to investigate the temperature change when two different aqueous solutions of sodium hydroxide, solution **G** and solution **H**, react with dilute hydrochloric acid.

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 distilled water and then with the dilute hydrochloric acid for Question 1.
- Fill the burette to the 0.00 cm^3 mark with the dilute hydrochloric acid.
- Use a 50 cm^3 measuring cylinder to pour 20 cm^3 of solution **G** into a beaker.
- Use a thermometer to measure the initial temperature of solution **G**. Record the initial temperature in the table.
- Add 5 cm^3 of dilute hydrochloric acid from the burette into the beaker.
- Stir the mixture in the beaker using the thermometer and measure the temperature of the mixture. Record the temperature in the table.
- Add another 5 cm^3 of dilute hydrochloric acid from the burette into the beaker.
- Stir the mixture in the beaker using the thermometer and measure the temperature of the mixture. Record the temperature in the table.
- Continue to add 5 cm^3 portions of dilute hydrochloric acid and record the temperature of the mixture in the table until you have added a total of 35 cm^3 of dilute hydrochloric acid.

Experiment 2

- Repeat Experiment 1 using solution **H** instead of solution **G**.

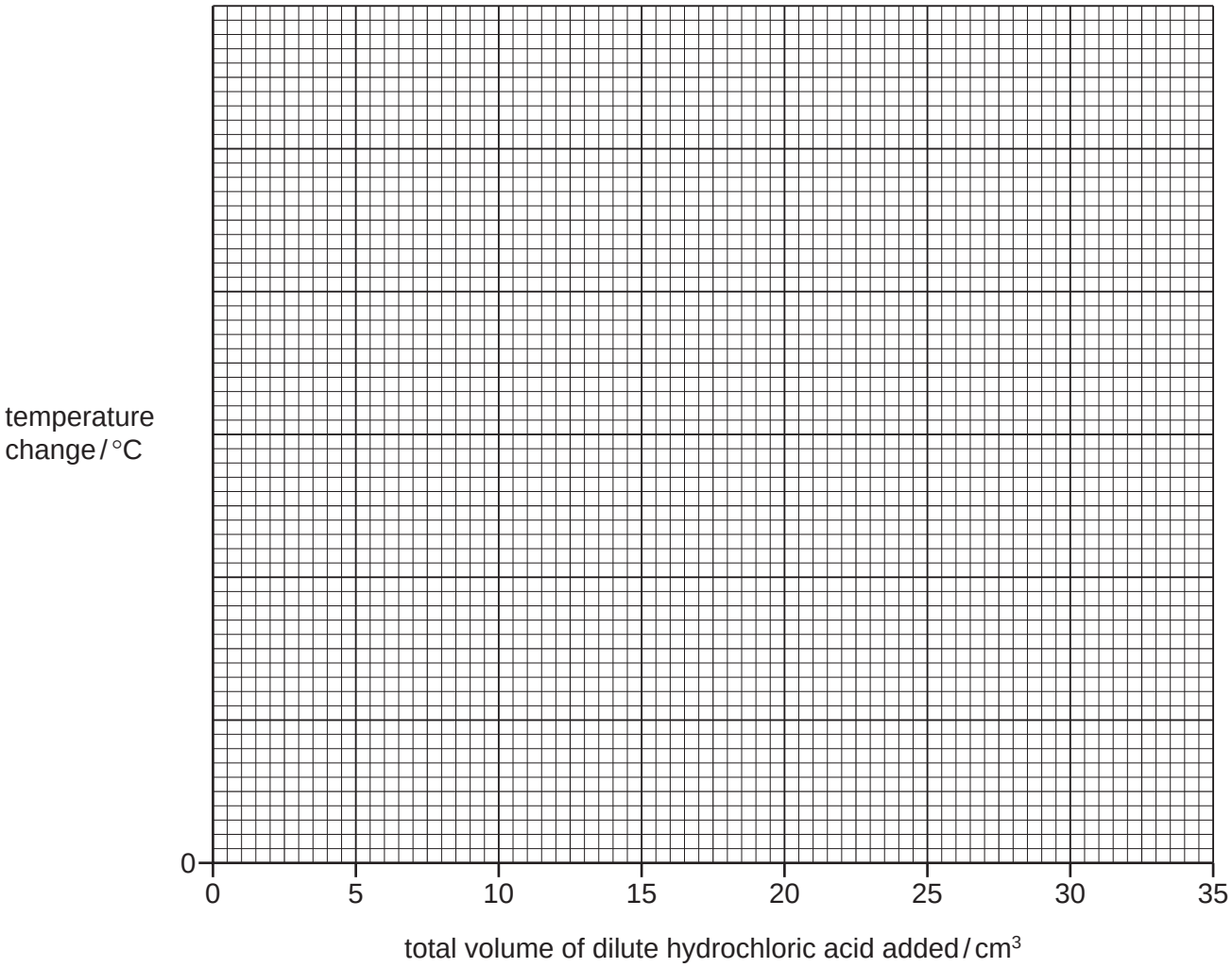
Complete the table.

	Experiment 1 using solution **G**		Experiment 2 using solution **H**	
total volume of dilute hydrochloric acid added / cm^3	temperature / °C	temperature change since start / °C	temperature / °C	temperature change since start / °C
0				
5				
10				
15				
20				
25				
30				
35				

[6]

(b) Complete a suitable scale on the *y*-axis and plot your results from Experiments 1 and 2 on the grid.

Draw **two** smooth line graphs. Both curves must start at (0,0). Clearly label your lines.



[5]

(c) **From your graph**, deduce the temperature change obtained when a total volume of 13 cm^3 of dilute hydrochloric acid is added in Experiment 1.

Show clearly **on the grid** how you worked out your answer.

temperature change = ... °C [2]

(d) Explain why the temperature change decreases towards the end of each experiment.

.....

..... [1]

(e) Explain what conclusion about the concentrations of solution **G** and solution **H** can be made from the results of Experiments 1 and 2.

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..... [2]

(f) Explain how the results obtained would be different if a polystyrene cup is used instead of the beaker.

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..... [2]

(g) Give an advantage and a disadvantage of using a burette rather than a measuring cylinder to add the dilute hydrochloric acid to solution **G** and solution **H**.

advantage .....

.....

disadvantage .....

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[2]

[Total: 20]

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

tests on solid I

(a) To the boiling tube containing solid **I** add 15 cm^3 of the dilute hydrochloric acid for Question 2.
Test any gas produced.

Keep the mixture in the boiling tube for (b).

Record your observations.

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..... [3]

(b) Carry out a flame test on the mixture formed in the boiling tube from **(a)**.
Record your observations.

..... [1]

(c) Identify solid **I**.

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..... [2]

tests on solid J

Add about 10 cm^3 of distilled water to the boiling tube containing solid **J**. Replace the stopper and shake the boiling tube to dissolve solid **J** and form solution **J**. Divide solution **J** into four approximately equal portions in four test-tubes.

(d) To the first portion of solution **J** add aqueous sodium hydroxide dropwise and then in excess.
Record your observations.

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..... [2]

(e) To the second portion of solution **J** add aqueous ammonia dropwise and then in excess.
Record your observations.

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..... [2]

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

..... [1]

(g) To the fourth 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.

..... [1]

(h) Identify solid **J**.

.....

..... [2]

[Total: 14]

3 Hydrogels are powders that absorb water to form hydrated solids. Hydrogels and the hydrated solids formed are insoluble in water.

Plan an investigation to find which hydrogel, **hydrogel A** or **hydrogel B**, is able to absorb the greater mass of water.

You are provided with samples of **hydrogel A**, **hydrogel B**, water 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