Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

CHEMISTRY **0620/53**

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.

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1 You are going to investigate the temperature change when aqueous sodium hydroxide neutralises dilute hydrochloric acid. The equation for the reaction is shown.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

Read all of the instructions carefully before starting the experiments.

Instructions
You are going to do eight experiments.

Experiment 1
- Place the polystyrene cup into the 250 cm^3 beaker for support.
- Use a measuring cylinder to pour 5 cm^3 of aqueous sodium hydroxide into the polystyrene cup.
- Use a measuring cylinder to pour 45 cm^3 of dilute hydrochloric acid into the polystyrene cup.
- Stir the mixture in the polystyrene cup with the thermometer. Record the highest temperature reached in the table in **(a)**.
- Rinse out the polystyrene cup with distilled water.

Experiment 2
- Repeat Experiment 1 using 10 cm^3 of aqueous sodium hydroxide and 40 cm^3 of dilute hydrochloric acid.

Experiment 3
- Repeat Experiment 1 using 15 cm^3 of aqueous sodium hydroxide and 35 cm^3 of dilute hydrochloric acid.

Experiment 4
- Repeat Experiment 1 using 20 cm^3 of aqueous sodium hydroxide and 30 cm^3 of dilute hydrochloric acid.

Experiment 5
- Repeat Experiment 1 using 30 cm^3 of aqueous sodium hydroxide and 20 cm^3 of dilute hydrochloric acid.

Experiment 6
- Repeat Experiment 1 using 35 cm^3 of aqueous sodium hydroxide and 15 cm^3 of dilute hydrochloric acid.

Experiment 7
- Repeat Experiment 1 using 40 cm^3 of aqueous sodium hydroxide and 10 cm^3 of dilute hydrochloric acid.

Experiment 8
- Repeat Experiment 1 using 45 cm^3 of aqueous sodium hydroxide and 5 cm^3 of dilute hydrochloric acid.

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(a) Complete the table.

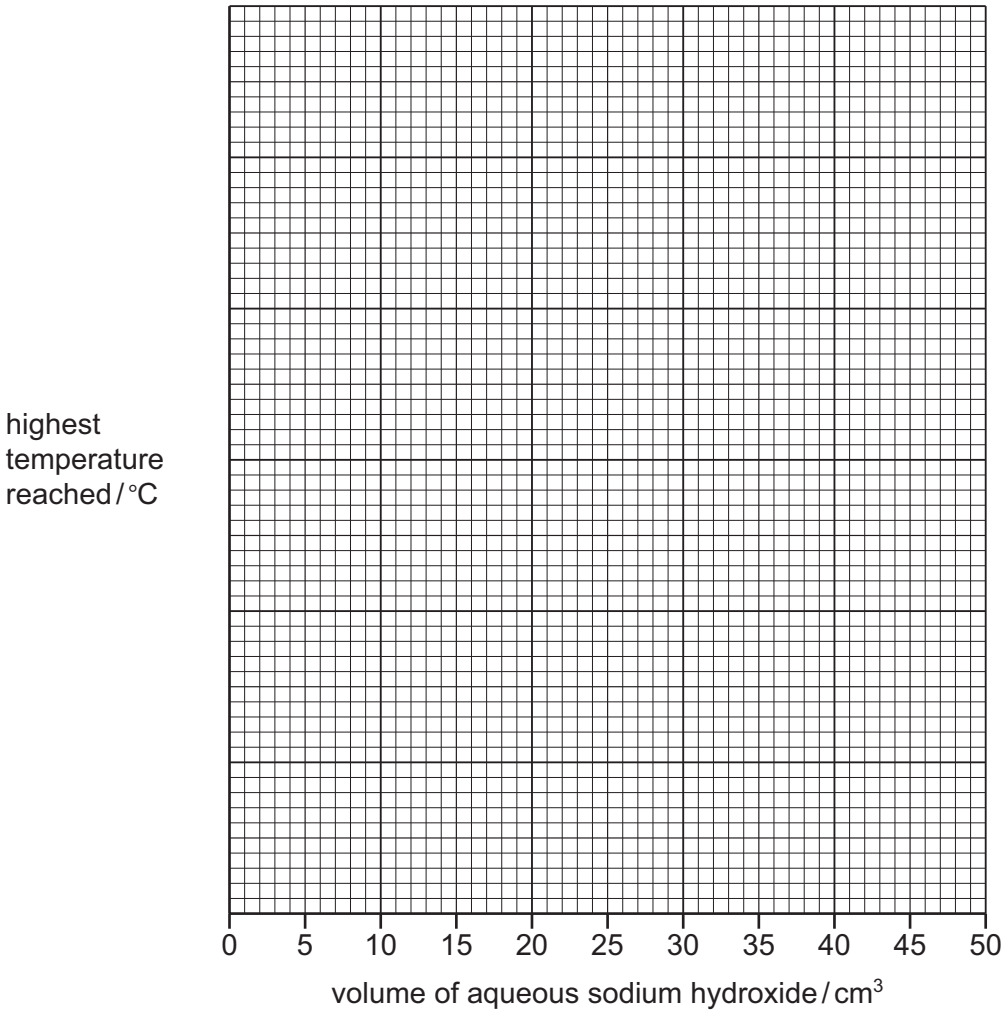
View solution

	Experiment							
	1	2	3	4	5	6	7	8
volume of aqueous sodium hydroxide / cm^3	5	10	15	20	30	35	40	45
volume of dilute hydrochloric acid / cm^3								
highest temperature reached / °C								

[4]

(b) Add a suitable scale to the *y*-axis. Your scale should extend by at least 2 °C above your highest temperature. Plot your results from Experiments 1 to 8 on the grid. Draw **two** straight lines through your points. Extend your straight lines so that they cross.

View solution



[5]

(c) The point on the graph where the two straight lines cross is where all of the aqueous sodium hydroxide reacts with all of the dilute hydrochloric acid to form a neutral solution.

(i) **Use your graph** to deduce the volume of aqueous sodium hydroxide and the volume of dilute hydrochloric acid that react together to produce a neutral solution.
Show your working **on the grid**.

volume of aqueous sodium hydroxide = ... cm^3

volume of dilute hydrochloric acid = ... cm^3
[3]

(ii) **Use your graph** to determine the highest temperature reached if the volumes in **(c)(i)** were mixed together.

highest temperature reached = ... °C [1]

(iii) Which solution, aqueous sodium hydroxide or dilute hydrochloric acid, was the most concentrated?
Use your answer to **(c)(i)** to explain why.

View solution

most concentrated solution .....

explanation .....

.....
[1]

(d) **On the graph**, sketch the lines you would expect to obtain if a copper can was used instead of a polystyrene cup. [2]

View solution

(e) Give **one** advantage and **one** disadvantage of using a burette, instead of a measuring cylinder, to add the dilute hydrochloric acid directly into the polystyrene cup.

advantage .....

.....

disadvantage .....

.....
[2]

View solution

(f) How could the reliability of the results of this investigation be checked?

.....

..... [1]

View solution [Total: 19]

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

tests on solid N

(a) Describe the appearance of solid **N**.

View solution

..... [1]

(b) Add about 10 cm^3 of distilled water to the boiling tube containing solid **N**. Place a stopper in the boiling tube and shake the tube to dissolve solid **N** and form solution **N**.

Divide solution **N** into two approximately equal portions in two boiling tubes.

View solution

(i) To the first portion of solution **N** add aqueous ammonia slowly until it is in excess and no further changes are seen.
Record your observations.

.....

.....

..... [2]

(ii) To the second portion of solution **N** add aqueous sodium hydroxide slowly until it is in excess and no further changes are seen.

View solution

Keep the product for (b)(iii).

Record your observations.

.....

.....

..... [2]

(iii) Pour about 3 cm depth of the product from **(b)(ii)** into a boiling tube. Add a piece of aluminium foil and warm the mixture gently. Test any gas produced.
Record your observations.

View solution

.....

.....

..... [2]

(c) Identify solid **N**.

View solution

.....

..... [2]

tests on solid P

(d) Carry out a flame test on solid **P**.
Record your observations.

View solution

..... [1]

(e) Place solid **P** in 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 **P** and form solution **P**.

View solution

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

(i) To the first portion of solution **P** add about 1 cm depth of dilute nitric acid and a few drops of aqueous silver nitrate.
Record your observations.

..... [1]

(ii) To the second portion of solution **P** add about 1 cm depth of dilute nitric acid and a few drops of aqueous barium nitrate.
Record your observations.

View solution

.....

..... [1]

(iii) Add the third portion of solution **P** to the test-tube containing aqueous bromine.
Record your observations.

View solution

.....

..... [1]

(f) Identify solid **P**.

View solution

.....

..... [2]

[Total: 15]

3 Stayclean and Brightwhite are two brands of washing powder. Both contain sodium carbonate. Sodium carbonate is soluble in water and reacts with dilute sulfuric acid to produce carbon dioxide gas.

Plan an investigation to determine which of the two washing powders, Stayclean or Brightwhite, contains the greatest percentage of sodium carbonate.

You are provided with samples of the two washing powders and common laboratory apparatus and chemicals.

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..... [6]

View solution

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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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