Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

0640498615

CHEMISTRY **0620/51**

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.

1 You are going to investigate the rate of the reaction between sodium metabisulfite and potassium iodate at different temperatures.

Read all of the instructions carefully before starting the experiments.

Instructions
You are going to do five experiments at different temperatures. In each experiment the total volume of liquid is 80 cm^3.

(a) *Experiment 1*

- Use a 100 cm^3 measuring cylinder to pour 70 cm^3 of aqueous potassium iodate into a 250 cm^3 beaker.
- Use the first 10 cm^3 measuring cylinder to pour 5 cm^3 of aqueous starch into the beaker containing the aqueous potassium iodate.
- Use the second 10 cm^3 measuring cylinder to pour 5 cm^3 of aqueous sodium metabisulfite into the beaker. At the same time start the timer.
- Stir the mixture in the beaker with a thermometer and continue to stir until a sudden colour change is seen.
- Stop the timer and record the time in seconds to the nearest whole number in the table.
- Measure the temperature of the mixture in the beaker and record the temperature in the table.
- Rinse the beaker with water.

Experiment 2

- Use the 100 cm^3 measuring cylinder to pour 70 cm^3 of aqueous potassium iodate into a 250 cm^3 beaker.
- Use the first 10 cm^3 measuring cylinder to pour 5 cm^3 of aqueous starch into the beaker containing the aqueous potassium iodate.
- Warm the aqueous potassium iodate and starch mixture over a Bunsen burner until the temperature of the solution is about 35 °C. Carefully remove the beaker from above the Bunsen burner.
- Use the second 10 cm^3 measuring cylinder to pour 5 cm^3 of aqueous sodium metabisulfite into the beaker. At the same time start the timer.
- Stir the mixture in the beaker with the thermometer and continue to stir until a sudden colour change is seen.
- Stop the timer and record the time in seconds to the nearest whole number in the table.
- Measure the temperature of the mixture in the beaker and record the temperature in the table.
- Rinse the beaker with water.

Experiment 3

- Repeat Experiment 2 but warm the aqueous potassium iodate and starch mixture until the temperature of the solution is about 40 °C.

Experiment 4

- Repeat Experiment 2 but warm the aqueous potassium iodate and starch mixture until the temperature of the solution is about 45 °C.

Experiment 5

- Repeat Experiment 2 but warm the aqueous potassium iodate and starch mixture until the temperature of the solution is about 50 °C.

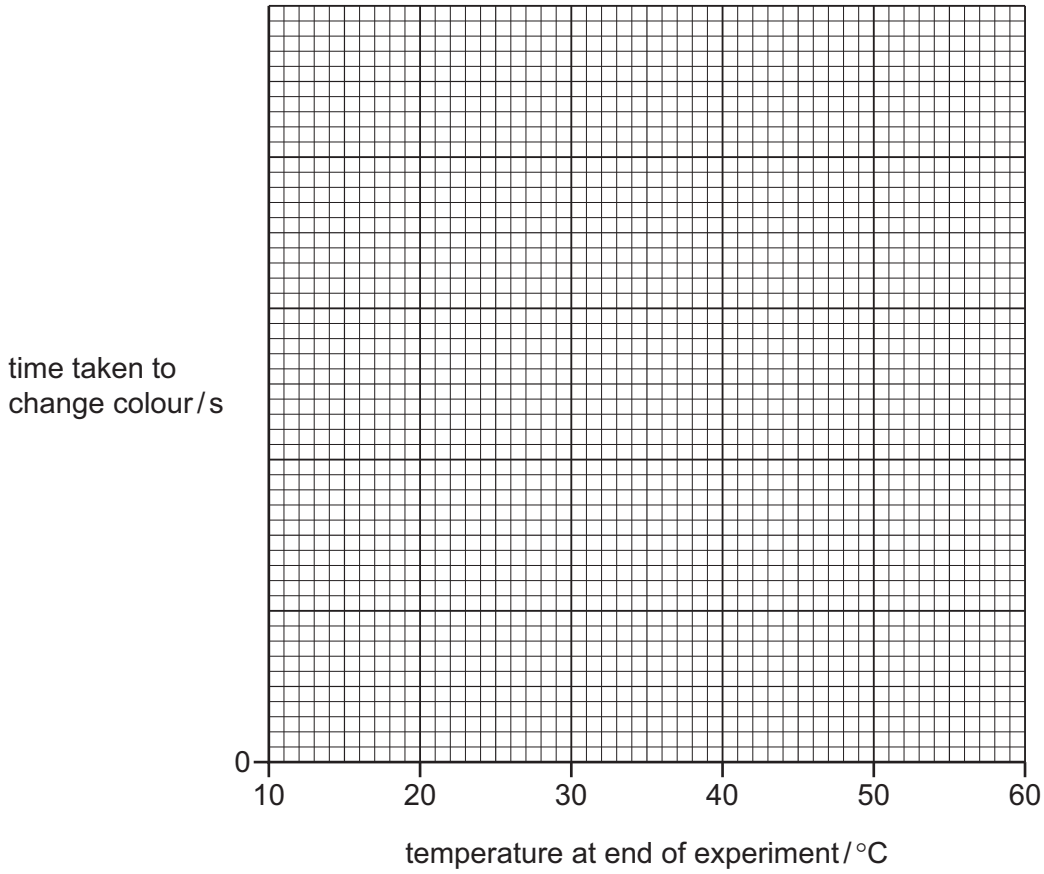
Complete the table.

experiment	1	2	3	4	5
temperature at end of experiment / °C					
time taken to change colour / s					

[5]

(b) Complete a suitable scale on the *y*-axis and plot your results from Experiments 1 to 5 on the grid.

Draw a line of best fit through your points.



[4]

(c) Deduce which experiment had the fastest rate of reaction.

..... [1]

(d) **From your graph**, deduce the time taken for the mixture to change colour at a temperature of 60.0 °C.

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

time taken to change colour = ... [3]

(e) Experiments are often repeated and the results compared to check that they are reliable.

Suggest why this is difficult to do for these experiments.

.....

..... [1]

(f) Suggest why the aqueous potassium iodate is warmed **before** the aqueous sodium metabisulfite is added rather than after it has been added.

.....

..... [1]

(g) A polystyrene cup can be used instead of the beaker in this experiment.

(i) Explain the advantage of transferring the warmed potassium iodate to a polystyrene cup rather than leaving it in the beaker.

.....

.....

..... [2]

(ii) Suggest why it is **not** a good idea to put the aqueous potassium iodate in a polystyrene cup before it is warmed.

.....

..... [1]

(h) Sketch **on the grid** the graph obtained when the experiments are repeated using aqueous potassium iodate of a higher concentration. [1]

[Total: 19]

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

tests on solid N

(a) Carefully add the dilute hydrochloric acid for Question 2 to the boiling tube containing solid **N**. Test any gas produced.

Keep the contents of the boiling tube for use in (b).

Record your observations.

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..... [2]

(b) Filter the mixture formed in the boiling tube in **(a)** into a test-tube until you have about 2 cm depth of filtrate in the test-tube. The filtrate collected is solution **P**. Divide solution **P** into two approximately equal portions in two test-tubes.

(i) To the first portion of solution **P**, add aqueous sodium hydroxide gradually until it is in excess.
Record your observations.

.....

..... [2]

(ii) To the second portion of solution **P**, add aqueous ammonia gradually until it is in excess.
Record your observations.

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..... [2]

(c) Identify solid **N**.

.....

..... [2]

[Turn over

tests on solution O

(d) Carry out a flame test on solution **O**.
Record your observations.

.....

..... [1]

Divide the remaining solution **O** into three approximately equal portions in three test-tubes.

(e) Test the pH of the first portion of solution **O**.

pH = ... [1]

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

..... [1]

(g) To the third portion of solution **O** add aqueous copper(II) sulfate gradually until it is in excess.
Record your observations.

.....

..... [2]

(h) Identify solution **O**.

.....

..... [2]

[Total: 15]

3 Many fizzy drinks contain phosphoric acid. Phosphoric acid reacts with sodium hydrogencarbonate to make carbon dioxide gas.

Value Coke and **Kola Koola** are two fizzy drinks which contain phosphoric acid as the only acid.

Plan an investigation to find which of these two fizzy drinks contains the highest concentration of phosphoric acid.

Include in your answer how your results will tell you which drink contains the highest concentration of phosphoric acid.

You are provided with samples of both fizzy drinks, solid sodium hydrogencarbonate 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