Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

CHEMISTRY **0620/51**

Paper 5 Practical Test **October/November 2021**

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 temperature change when zinc reacts with two different aqueous solutions of copper(II) sulfate, solution **Q** and solution **R**.

Read all of the instructions carefully before starting the experiments.

Instructions
You are going to do two experiments.

(a) *Experiment 1*

View solution

- Place a polystyrene cup into a 250 cm^3 beaker for support.
- Use a measuring cylinder to pour 25 cm^3 of solution **Q** into the polystyrene cup.
- Use a thermometer to measure the initial temperature of solution **Q**. Record this in the space above the table.
- Add 3 g of zinc powder to the polystyrene cup. At the same time start a stop-watch.
- Using the thermometer, continually stir the mixture in the polystyrene cup. Record the temperature every 30 seconds for 240 seconds. Record the temperatures in the table.

initial temperature = ... °C

time / s	30	60	90	120	150	180	210	240
temperature / °C								
temperature change / °C								

- Complete the table by calculating the temperature changes from the initial temperature using the equation:

temperature change = temperature – initial temperature

[3]

(b) *Experiment 2*

View solution

- Empty the polystyrene cup and rinse with distilled water.
- Repeat Experiment 1 using solution **R** in place of solution **Q**.
- Complete the table by calculating the temperature changes from the initial temperature.

initial temperature = ... °C

time / s	30	60	90	120	150	180	210	240
temperature / °C								
temperature change / °C								

[3]

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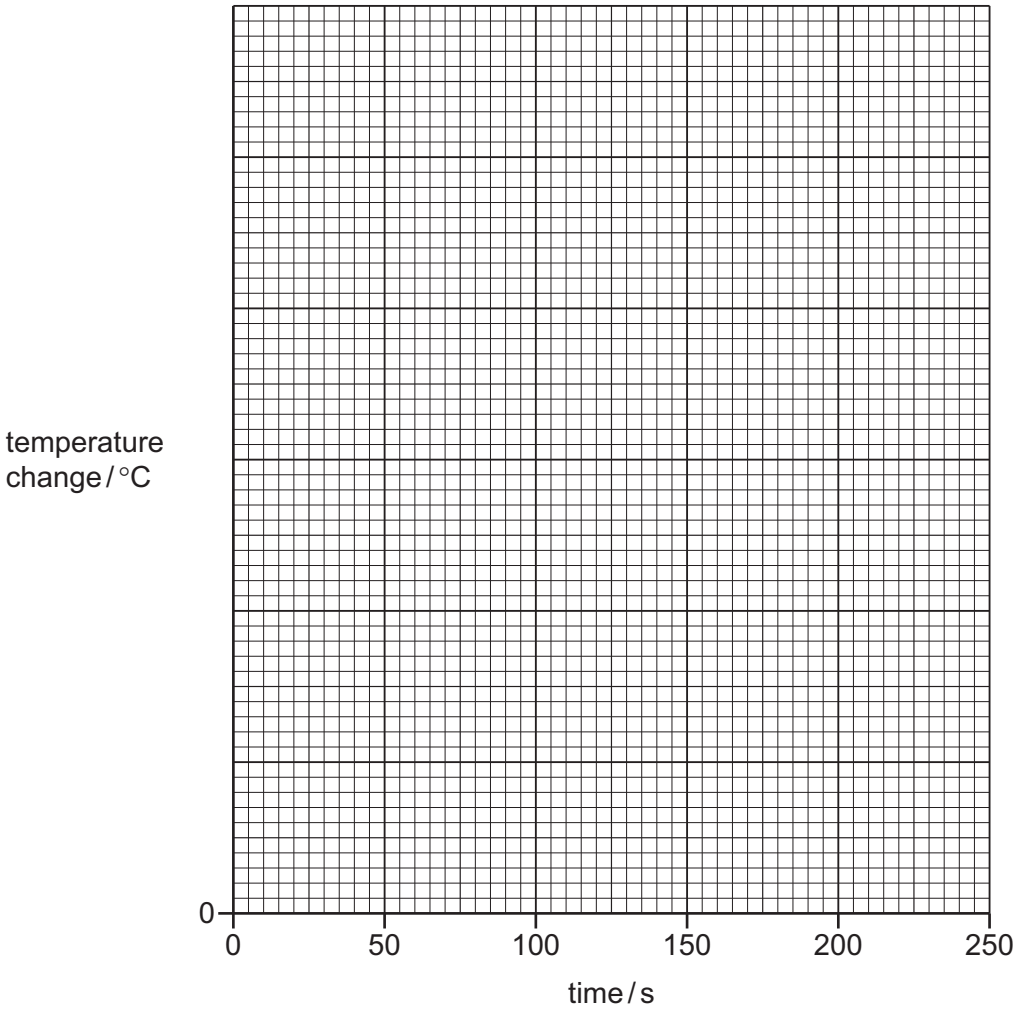
(c) Complete a suitable scale on the *y*-axis and plot your results from Experiment 1 and Experiment 2 on the grid. Draw two curves of best fit. Both curves must start at (0,0). Label your curves.

View solution



[5]

(d) **From your graph**, deduce the temperature change at 110 seconds in Experiment 1.

View solution

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

..... °C [2]

(e) Predict the temperature of the solution in Experiment 2 after 5 hours. Explain your answer.

View solution

.....

..... [2]

(f) **(i)** Suggest why the experiments were done in a polystyrene cup rather than a glass beaker.

..... [1]

(ii) Describe how the results would be different if a glass beaker is used in place of the polystyrene cup.

..... [1]

(g) Suggest **one** change that could be made to the apparatus that would improve the accuracy of the results. Explain why this change would improve the accuracy of the results.

change .....

explanation .....

.....
[2]

[Total: 19]

View solution

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

tests on solid S

(a) To solid **S** in the boiling tube, add about 10 cm^3 of dilute hydrochloric acid.
Test any gas produced.

View solution

Keep the product for (b).

Record your observations.

.....

..... [2]

(b) The solution formed in **(a)** is solution **U**. Decant about 1 cm depth of solution **U** into a test-tube.

To solution **U** add aqueous sodium hydroxide dropwise and then in excess.
Record your observations.

View solution

.....

..... [2]

(c) Identify solid **S**.

View solution

.....

..... [2]

tests on solid T

(d) To solid **T** in the boiling tube, add about 10 cm^3 of distilled water. Place a stopper in the boiling tube and shake the tube to dissolve solid **T** and form solution **T**.

Divide solution **T** into four approximately equal portions in four test-tubes.

View solution

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

.....

..... [2]

(ii) Pour the second portion of solution **T** into the test-tube containing sodium carbonate.
Record your observations.

View solution

.....

..... [2]

(iii) To the third portion of solution **T**, add a 2 cm length of magnesium ribbon.
Record your observations.

View solution

..... [2]

(iv) To the fourth portion of solution **T**, add 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate. Leave the mixture to stand for 5 minutes.
Record your observations.

View solution

..... [1]

(e) Identify solid **T**.

View solution

.....

..... [2]

[Total: 15]

3 Catalysts are substances which increase the rate of a reaction but are unchanged at the end of the reaction.

View solution

Aqueous hydrogen peroxide decomposes slowly to form water and oxygen.

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

Copper(II) oxide is an insoluble solid.

Plan an investigation to find out if copper(II) oxide is a catalyst for the decomposition of hydrogen peroxide. You must include how your results will tell you if copper(II) oxide is a catalyst. You have access to copper(II) oxide, aqueous hydrogen peroxide and all normal 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	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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