

Candidates Name:

Signature:

Random No.

Personal No.

0700809214

(Do not write your School/ Centre Name or Number anywhere on this Booklet.)

545/2

CHEMISTRY

Paper 2

2025

2 Hours

Subject to co-ordination

Uganda Certificate of Education

CHEMISTRY

Paper 2

Practical

2 Hours

INSTRUCTIONS TO CANDIDATES:

This paper consists of **one compulsory** examination item. Answers to this item are to be written in the spaces provided in this booklet. Use **blue or black ink**.

All working must be clearly shown. Graph paper will be provided.

Mathematical table and silent non-programmable scientific calculators may be used.

You are **not** allowed to use reference books (i.e. text books, booklets on qualitative analysis etc.)

Candidates are advised to carefully read the item, make sure they have all the apparatus and chemicals they may need and then **plan** appropriately before starting.

For facilitations & work-books contact
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Innocent Niga

Address, Greenhill Academy
Kampala

Sodium carbonate (baking soda) is commonly used in homes to clean utensils stained with acidic foods.

To help Grace understand this, you have been approached to model the reaction in the laboratory using hydrochloric acid and sodium carbonate solution, which also produces bubbling of carbon dioxide gas.

Teacher can use
0.5M ~~concn~~ Ba^{2+}
1.0M of HCl

- **BA1:** which is sodium carbonate solution 1.0 M of HCl
- **BA2:** which is hydrochloric acid solution to create a similar acidic atmosphere

As a chemistry student,

(a) design an experiment you will use to help Grace verify her observation (*Your design should include; aim, variables, hypothesis, apparatus and materials, procedure, risks and their mitigations*)

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[illegible]

(b) carryout the experiment and record your results. (*A minimum of five readings required.*)

(c) analyse your results and inform Grace accordingly.

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END

Proposed score guide,

should be logically related to experiment and with both key words.

Aim: To investigate how the temperature of the reactants, affects, the time taken for bubbling to stop / the rate of reaction, in the reaction between sodium carbonate and hydrochloric acid.

A=05

2A=05

1A=03

Hypothesis: If the temperature of the reactants increases then the time taken for bubbling to stop will decrease / the rate of reaction will increase.

H=06

Variables:

- Independent Variable:** Temperature of the hydrochloric acid
- Dependent Variable:** Time taken for bubbling to stop / Rate of reaction
- Controlled Variables:** Volume of sodium carbonate (BA1)
Volume of hydrochloric acid (BA2)

2H=06
1H=05

V=06

3V=06

2V=05

1V=04

Words Independent, Dependent & controlled should be seen.

Apparatus and Materials:

Beakers, Thermometer, Stop Clock, Measuring cylinders, Bunsen burner, BA1: Sodium carbonate solution, BA2: Hydrochloric acid solution

Accept alternative apparatus.

Procedure:

- Using a measuring cylinder, 20.0 cm³ of sodium carbonate and 20.0 cm³ of hydrochloric acid were measured and placed into separate beakers.
- The initial temperature of the hydrochloric acid was measured with a thermometer and recorded.
- The two solutions were mixed by pouring the sodium carbonate into the hydrochloric acid while gently swirling the mixture to ensure thorough mixing. The stop clock was started immediately.
- The time taken for bubbling to completely stop was observed and recorded.
- Steps (a) to (d) were repeated at increasing temperatures of hydrochloric acid by heating on a Bunsen burner to: 30°C, 35°C, 40°C, 45°C, 50°C, and 55°C.

P=05

Risks and Mitigation:

Risk	Mitigation
Skin or eye irritation from acid contact.	Wear gloves and safety goggles to protect skin and eyes.
Spills causing slips.	clean spills immediately with a cloth

P_m + P_r + P_c = 3P = 05
P_m + P_r = 2P = 04

P_m = 1P = 01

R=03

For mitigation of risks

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For A → Results in table

→ variable in table with correct units

(b) Results Table:

→ $\frac{2}{3}$ of the required sets of data

Volume of BA1 used 20.0cm^3
Volume of BA2 used 20.0cm^3

Temperature ($^{\circ}\text{C}$)	25.0	30.0	35.0	40.0	45.0	50.0	55.0
Time for Bubbling to Stop (s)	54.0	46.0	38.0	30.0	23.0	18.0	14.0
Rate of Reaction; $1/\text{Time}$ (s^{-1})	0.019	0.022	0.026	0.033	0.044	0.056	0.071

$D=05$

$2D=05$

$1D=04$

✓ D

✓ Im

For Dr → Values of temperature & time to required dps
→ trend; time reduces as temperature increases

$2Dr=05$

$1Dr=04$

$Dr=05$

(c) Data Interpretation

The graph shows a steady increase in rate as temperature rises. For example, at 25°C , the rate is 0.019 s^{-1} , while at 55°C , it increases to 0.071 s^{-1} . This confirms that higher temperatures lead to faster reactions due to more frequent and energetic particle collisions.

✓ Ia

$I=06$

Conclusion → A word for C only if I is correct.

Raising the temperature increases the rate of the reaction between sodium carbonate and hydrochloric acid. Bubbling stops more quickly at higher temperatures.

$C=06$

Recommendation:

$2C=06$

$1C=05$

Grace and others can use warm or hot water when cleaning with baking soda to increase the reaction rate and remove acidic stains more efficiently.

✓ C

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A graph of $\frac{1}{\text{time}}$ against temperature

