

Name: *Marking guide* Stream.....

P525/2
CHEMISTRY
Paper 2
3¹/₄ hours

ST JULIAN HIGH SCHOOL- GAYAZA
END OF TERM I EXAMINATIONS 2026
CHEMISTRY PRACTICAL

S.6 Paper 2

3 hours 15 minutes

Instructions to candidate

The paper consists of **two** items. Attempt both items.

Write your answers in the spaces provided. No additional sheet(s) of paper will be provided.

Reference books on qualitative analysis should not be used.

You are advised to first make all necessary preparations before starting to use the apparatus.

Scorers Use only

Item	scores
1	50
2	50
Total	100

Item 1

A laundry a company uses washing soda containing sodium carbonate to treat hardness in water. The company manager recently bought a new batch of washing soda but is not sure about the percentage purity of sodium carbonate in the batch. The manager told the workers to ascertain the percentage purity of sodium carbonate in the washing soda which must contain at least 80% of sodium carbonate to be effective.

The percentage purity is normally obtained by titrating a solution containing sodium carbonate against a standard solution of hydrochloric acid using a suitable indicator.

However, the workers could not accurately determine the percentage purity of sodium carbonate in the solution of washing soda, so they have come to you for help.

You are provided with the following

FA1 which is a solution containing 6.0 g of washing soda in one litre of distilled water

FA2 which is a solution of 0.1M hydrochloric acid

Methyl orange indicator

Task

Design and carry out an experiment you will use to help the workers.

(Na=23, C=12, O=16)

Aim: An experiment to determine the percentage purity of sodium carbonate in washing soda using standard hydrochloric acid. (0.7)

Hypothesis: The percentage purity of sodium carbonate is 80%. (0.7)

Variables: ~~Volume of FA~~

Independent: Volume of FA1 from the pipette. (0.6)

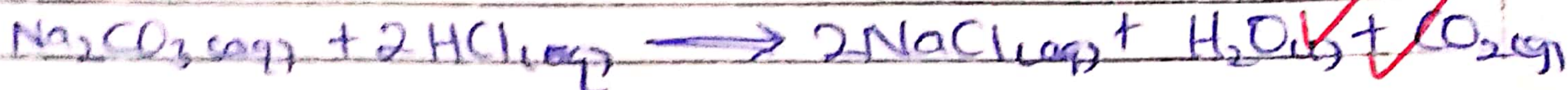
Dependent: Volume of FA2 from the burette.

Controlled: Number of drops of methyl orange indicator used.

Concentration of FA2 (hydrochloric acid)

Data analysis

1000 cm³ of FA2 contained 0.1 moles of HCl
 2500 cm³ of FA2 contain $\left(\frac{0.1 \times 2500}{1000}\right)$ moles
 0.0025 moles of HCl



Mole ratio of HCl: Na_2CO_3 is 2:1.

2 moles of HCl reacted with 1 mole of Na_2CO_3 .
 0.0025 moles of HCl reacted with $\left(\frac{1}{2} \times 0.0025\right)$ moles of Na_2CO_3
 0.00125 moles of Na_2CO_3

25 cm³ of FA1 contained 0.00125 moles of Na_2CO_3 .
 1000 cm³ of FA1 contained $\left(\frac{0.00125 \times 1000}{25}\right)$ moles.

0.05 moles of Na_2CO_3 .
 Molarity of FA1 is 0.05 mol dm⁻³ sodium carbonate.

$$\text{Molar mass of } \text{Na}_2\text{CO}_3 = (23 \times 2) + (12 \times 1) + (16 \times 3) = 106$$

1 mole of Na_2CO_3 weighs 106 g.
 0.05 moles of Na_2CO_3 weigh $\left(\frac{106 \times 0.05}{1}\right)$ g

Concentration of FA1 is 5.3 g L⁻¹

$$\text{Percentage Purity of } \text{Na}_2\text{CO}_3 = \frac{\text{Pure mass of } \text{Na}_2\text{CO}_3}{\text{Total impure mass of } \text{Na}_2\text{CO}_3} \times 100$$

$$= \frac{5.3}{6.0} \times 100$$

$$= 88.33\%$$

Conclusion and recommendation.

Percentage purity of sodium carbonate in the washing soda is 88.33%. Therefore the washing soda is effective for use since its percentage purity is higher than 90%.

Apparatus and Materials:

- Burette
- Pipette
- conical flask
- 2 Beakers.
- Solutions FA1 and FA2.

Risks and Mitigation

- Acids are corrosive and can cause burns when in contact with the skin. This is mitigated by putting on protective gear like lab coats, goggles, gloves and face masks.
- Bases are irritating when in contact with the skin. This is mitigated by using pipette fillers.

Procedure.

- a) FA2 (hydrochloric acid) was poured in the burette up to the zero mark.
- b) 25.00 cm³ of FA1 was pipetted into a clean conical flask.
- c) 3 drops of methyl orange indicator were added to the FA1 in the conical flask.
- d) FA1 in the conical flask was then titrated with FA2 from the burette until the endpoint when the colour of the solution turned from yellow to pink.
- e) procedure a) to d) was repeated to obtain consistent results.
- f) The results were recorded as shown in the table below.

Results.

Volume of pipette used = 25.00 cm³.

Experiment number #	1	2	3
Final burette reading (cm ³)	25.40	35.00	25.00
Initial burette reading (cm ³)	0.00	10.00	0.00
Volume of FA2 used (cm ³)	25.40	25.00	25.00
	20.00	25.00	30.00

Analysis.

Volumes of FA2 used for calculating average volume = 25.00 and 25.00 cm³.

Average volume of FA2 used = $\frac{25.00 + 25.00}{2}$
 $= 25.00 \text{ cm}^3$.

23

24.00 - 26.00 26.00

+ 1.00 cm³
 $\pm 1.00 \text{ cm}^3$

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ITEM 2

Aim: An experiment to identify the cations and anions present in compound B

TEST	OBSERVATION	DEDUCTION
a) Two spatula endfuls of B were heated strongly in a dry boiling tube until no further change.	White solid Yellow residue when hot and white when cold	Ca^{2+} , Ba^{2+} , Mg^{2+} Zn^{2+} , Al^{3+} , Pb^{2+} ZnO , Zn^{2+}
	Colourless gas that turned moist blue litmus paper red and hot acidified potassium dichromate from orange to green.	SO_2 evolved SO_4^{2-} present.
	Colourless condensate that turned anhydrous copper(II) sulphate from white to blue.	Water of crystallisation/R is hydrated
b) Two spatula endfuls of B was added to 10 cm ³ of distilled water and the mixture was shaken and then filtered. The filtrate was divided into seven parts.	Colourless filtrate White residue	Ba^{2+} , Ca^{2+} , Mg^{2+} , Zn^{2+} , Al^{3+} , Pb^{2+} present in both filtrate and residue.
i) To the first part of the filtrate was added sodium hydroxide solution dropwise until in excess.	White precipitate soluble in excess	Al^{3+} , Zn^{2+} , Pb^{2+} present.
ii) To the second part of the filtrate was added aqueous ammonia solution dropwise until in excess.	White precipitate insoluble in excess.	Al^{3+} , Pb^{2+} present.

01

04

02

03

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<p>iii) To the third portion of the filtrate was added 3 drops of dilute sulphuric acid</p>	<p>No observable change</p>	<p>Al^{3+} Present 03</p>
<p>iv) To the fourth part of the filtrate was added aqueous ammonia followed by 3 drops of litmus solution.</p>	<p>Blue-lake solution</p>	<p>Al^{3+} Confirmed present. 03</p>
<p>v) To the fifth part of the filtrate was added 3 drops of Lead(II) nitrate solution.</p>	<p>White precipitate formed.</p>	<p>Cl^-, Br^-, SO_4^{2-} present. (03)</p>
<p>vi) To the sixth part of the filtrate was added 3 drops of silver nitrate solution followed by dilute nitric acid / aqueous ammonia solution</p>	<p>Pale yellow precipitate insoluble in the acid / partially soluble in an aqueous ammonia</p>	<p>Br^- Confirmed present. (03)</p>
<p>vii) To the seventh part of the filtrate was added barium nitrate solution followed by dilute nitric acid.</p>	<p>White precipitate insoluble in the acid.</p>	<p>SO_4^{2-} Confirmed present. (03)</p>
<p>viii) The residue was washed and dissolved in dilute nitric acid.</p>	<p>Dissolved forming colourless solution</p>	<p>Zn^{2+}, Pb^{2+}, Be^{2+}, Ca^{2+}, Mg^{2+} (03)</p>
<p>ix) To the first part of the filtrate solution was added sodium hydroxide solution dropwise until in excess.</p>	<p>White precipitate soluble in excess.</p>	<p>Zn^{2+}, Pb^{2+} (03)</p>

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iii) To the second part of the solution was added aqueous ammonia solution dropwise until in excess.

White precipitate
Soluble in excess

Zn²⁺ Present

03

iv) To the third part of the solution was added a little solid ammonium chloride followed by disodium hydrogen phosphate solution and then excess aqueous ammonia solution

White precipitate
Soluble in excess
ammonia aqueous
ammonia solution

Zn²⁺ confirmed
Present.

03

Conclusion:

The cations in R are:

Al³⁺, Zn²⁺

The anions in R are:

Br⁻, SO₄²⁻

03

50