

EXPERIMENT NO. 1

Metal carbonates react with dilute acids to produce carbon dioxide. You will identify the metal, **M**, in a metal carbonate, M_2CO_3 , by measuring the volume of carbon dioxide produced during the reaction of M_2CO_3 with excess hydrochloric acid.



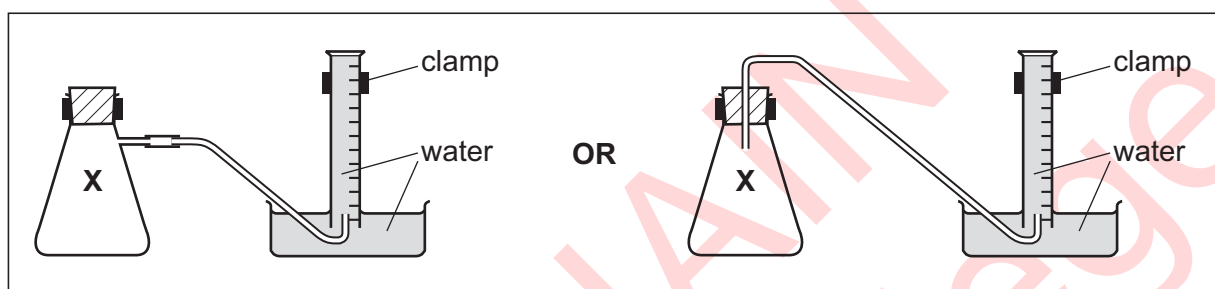
FA 2 is hydrochloric acid, HCl .

FA 4 is M_2CO_3 .

(a) Method

Read **all** instructions before starting your practical work.

The diagrams below may help you in setting up your apparatus.



- Fill the tub with water to a depth of about 5 cm.
- Fill the 250 cm³ measuring cylinder **completely** with water. Hold a piece of paper towel firmly over the top, invert the measuring cylinder and place it in the water in the tub.
- Remove the paper towel and clamp the inverted measuring cylinder so the open end is in the water just above the base of the tub.
- Use the 50 cm³ measuring cylinder to place 50 cm³ of **FA 2** into the reaction flask, labelled **X**.
- Check that the bung fits tightly in the neck of flask **X**, clamp flask **X**, and place the end of the delivery tube into the inverted 250 cm³ measuring cylinder.
- Weigh the container with **FA 4** and record the mass in the space below.
- Remove the bung from the neck of the flask. Tip all the **FA 4** into the acid in the flask and replace the bung **immediately**. Remove the flask from the clamp and swirl it to mix the contents.
- Swirl the flask occasionally until no more gas is evolved. Replace the flask in the clamp.
- Reweigh the container and record the mass, and the mass of **FA 4** used, in the space below.
- When no more gas is collected, measure and record the final volume of gas in the measuring cylinder in the space below.

(b) Calculations

Show your working and appropriate significant figures in the final answer to **each** step of your calculations.

- (i) Use the volume of gas you collected to calculate the number of moles of gas produced. [Assume that 1 mole of gas occupies 24.0 dm³ under these conditions.]

moles of gas = mol

- (ii) Use your answer to (i) to deduce the number of moles of M_2CO_3 used in the reaction.

moles of M_2CO_3 = mol

- (iii) Use your answer to (ii) and the mass of **FA 4** used to calculate the relative formula mass, M_r , of M_2CO_3 .

M_r of M_2CO_3 =

- (iv) Use your answer to (iii) and the Periodic Table to identify metal **M**. Explain your answer.

M is

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[4]

(c) (i) A 250 cm³ measuring cylinder can be read to ± 1 cm³.

Calculate the maximum percentage error in your reading of the volume of gas.

maximum percentage error = %

(ii) It is likely that the volume of carbon dioxide that you collected was less than the theoretical volume.

Give **two** reasons why this volume is likely to be less than the theoretical volume.

In each case, suggest and explain a modification to the practical procedure that could help to reduce the difference in volume.

reason

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modification

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reason

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modification

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[5]

[Total: 11]