

Carbonates

4.8.3.3 · Chemical analysis · revision notes

Carbonate ions are identified by adding dilute acid: the mixture fizzes and the gas turns limewater milky. This ion test is in GCSE Chemistry only (not Combined Science).

Questions ask for the method, the result and equations.

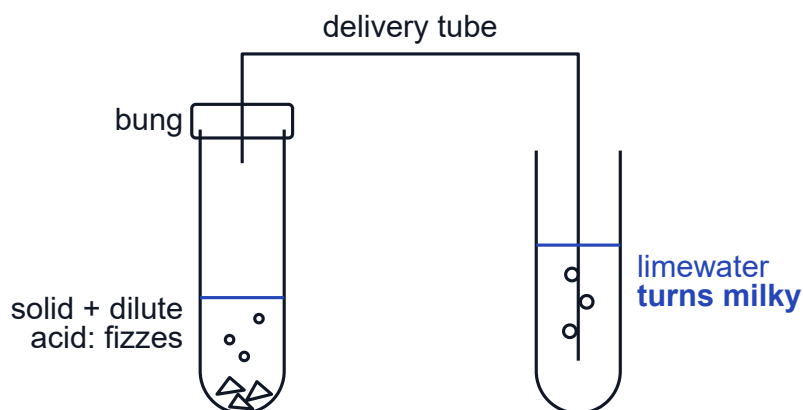
Key facts

- Test: add dilute acid; bubble the gas through limewater
- acid + metal carbonate $\rightarrow$ salt + water + carbon dioxide
- Acid is added before the halide and sulfate tests to remove carbonate ions
- Result: fizzing, and limewater turns milky $\rightarrow$ carbonate ions (CO_3^{2-}) present
- $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$

Notes

The test

- Add **dilute acid**, e.g. dilute hydrochloric acid, to the solid or solution.
- If carbonate ions (CO_3^{2-}) are present, the mixture **fizzes** as carbon dioxide is given off.
- Bubble the gas through **limewater** using a delivery tube. The limewater turns **milky** (cloudy), so the gas is carbon dioxide and a carbonate is present.



The gas bubbles through the limewater

Fizzing plus milky limewater shows a carbonate.

- Fizzing alone is not enough: a metal reacting with acid also fizzes (giving hydrogen). The limewater result proves the gas is carbon dioxide.

Equations

- acid + metal carbonate $\rightarrow$ salt + water + carbon dioxide
- $\text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
- $\text{CuCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{H}_2\text{O} + \text{CO}_2$

Why this matters for the halide and sulfate tests

- Carbonate ions also form precipitates with silver nitrate solution and with barium chloride solution, so they could give a false positive in the halide and sulfate tests.
- That is why dilute acid is added first in those tests: it reacts with any carbonate ions and removes them as carbon dioxide.

How to answer each type of question

Describe the test for carbonate ions and give the result

2 to 3 marks

Grade 3

1. Add dilute acid to the sample.
2. Bubble the gas through limewater.
3. Result: fizzing, and the limewater turns milky.

Example. Describe a test to show that a white powder contains carbonate ions. Give the result.

Model answer. Add dilute hydrochloric acid to the powder (1). Bubble the gas given off through limewater (1). The mixture fizzes and the limewater turns milky / cloudy (1).

Don't lose marks

- ✗ Stopping at 'it fizzes'. You need the limewater test to prove the gas is carbon dioxide.
- ✗ Writing 'the limewater turns white'. Write milky or cloudy.
- ✗ Leaving water out of the products of acid + carbonate.
- ✗ Writing the carbonate ion without its charge. It is CO_3^{2-} .

More tips

Memory tricks

- Carbonate test = 'fizz, then milk': bubbles, then milky limewater.
- Salt names: hydrochloric $\rightarrow$ chloride, sulfuric $\rightarrow$ sulfate, nitric $\rightarrow$ nitrate.
- Every acid + carbonate equation ends '+ H_2O + CO_2 '.

Exam technique

- For full marks, give the observation (fizzing) AND the limewater result.
- Say 'dilute' acid, e.g. dilute hydrochloric acid.
- To identify a whole compound, add a flame test or sodium hydroxide test for the metal ion.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3

Describe the test for carbonate ions

Add dilute acid and bubble any gas given off through limewater.

Grade 3

State the positive result for carbonates

Fizzing, and the gas turns limewater milky (cloudy).

Grade 5

Name the products of acid and carbonate

A salt, water and carbon dioxide.

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