

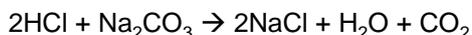
3.1.4 Qualitative analysis

Testing for Negative ions (anions)

Testing for Presence of a carbonate

Add any dilute acid and observe effervescence.

Bubble gas through limewater to test for CO₂ – will turn limewater cloudy

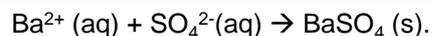


Fizzing due to CO₂ would be observed if a carbonate was present

Testing for presence of a sulfate

Acidified BaCl₂ solution is used as a reagent to test for sulfate ions.

If **barium chloride** is added to a solution that contains sulfate ions a **white precipitate** forms.



Other anions should give a negative result which is no precipitate forming.

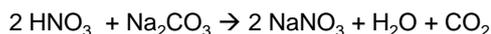
The acid is needed to react with carbonate impurities that are often found in salts which would form a white barium carbonate precipitate and so give a false result.

Sulfuric acid cannot be used to acidify the mixture because it contains sulfate ions which would form a precipitate.

Testing for halide ions with silver nitrate.

This reaction is used as a test to identify which halide ion is present. The test solution is made acidic with **nitric acid**, and then **silver nitrate solution** is added dropwise.

The role of nitric acid is to react with any carbonates present to prevent formation of the precipitate Ag₂CO₃. This would mask the desired observations.

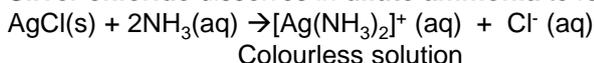


Fluorides produce no precipitate
Chlorides produce a **white** precipitate
 $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$
Bromides produce a **cream** precipitate
 $\text{Ag}^+(\text{aq}) + \text{Br}^-(\text{aq}) \rightarrow \text{AgBr}(\text{s})$
Iodides produce a **pale yellow** precipitate
 $\text{Ag}^+(\text{aq}) + \text{I}^-(\text{aq}) \rightarrow \text{AgI}(\text{s})$

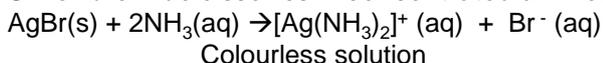
Hydrochloric acid cannot be used to acidify the mixture because it contains chloride ions which would form a precipitate

The silver halide precipitates can be treated with ammonia solution to help differentiate between them if the colours look similar:

Silver chloride dissolves in **dilute ammonia** to form a complex ion



Silver bromide dissolves in **concentrated ammonia** to form a complex ion



Silver iodide does not react with ammonia – it is too insoluble.

The sequence of tests required is carbonate, sulfate then halide. (This will prevent false results of as both BaCO₃ and Ag₂SO₄ are insoluble.)

Testing for positive ions (cations)

Test for ammonium ion NH₄⁺, by the reaction with warm NaOH(aq), forming NH₃ gas

Ammonia gas can be identified by its pungent smell or by turning red litmus paper blue.