A picture containing room, drawing

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| Chemical Investigations |
| Analysing Anions |
| Pupil Guide |

A group of beakers with green liquid in them

Description automatically generated with low confidence

Introduction

Identifying substances is a very important aspect of chemistry.

There are not too many anions (positive ions) that are commonly encountered and here you will find out how to test for: chlorides, bromides, iodides, sulphates, sulphides, carbonates and nitrates.

You will need

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| Your samples | Test tubes & rack |
| Hydrochloric acid (1 mol l-1) | Silver Nitrate (0.1 mol l-1 ) |
| Limewater | Pasteur pipette 1 cm3 and 3 cm3 |
| Barium chloride (0.1 mol l-1) | Ammonia (1.5 mol l-1) |
| Iron II sulphate solution | Sulphuric acid (concentrated) |
| Ammonia solution |  |

The concentrations are not critical here as the tests are qualitative.

Safety

0.4 mol l-1 sodium hydroxide is an irritant. Wear eye protection.

To do

These tests **can** be carried out in any order but this one makes sense.

If you have solids, add a small amount of the solid to a test tube and add a couple of cm3 of distilled water. Then agitate to dissolve.

1. **Carbonates**
2. Add a few cm3 of your sample to a test tube.
3. Add a few cm3 of limewater into a second test tube
4. Add 2 cm3 of 1 Mol l-1 hydrochloric acid to your first test tube
5. If it is a carbonate (or hydrogencarbonate) you will see the formation of bubbles (of carbon dioxide).
6. Once any bubbling is complete, use a 3 cm3 plastic pipette to take a sample of the gas formed:

a. squeeze the pipette bulb and carefully lower the tip so it is just above the liquid surface

b. release the bulb to draw the gas into the pipette;

c. move the pipette of gas to the test tube with your limewater in and put the pipette tip just below the surface of the liquid

d. squeeze the bulb to bubble the gas into the liquid.

1. Look for the limewater turning cloudy – due to a white calcium carbonate precipitate).

This shows that the gas was carbon dioxide and hence that the solution was a carbonate or hydrogencarbonate.

1. **Sulphates**
2. Add a few cm3 of the solution(s) to a test tube.
3. Add a few drops of 0.1 Mol l-1 barium chloride solution and gently agitate the test tube

Presence of a sulphate results in the formation of a white precipitate (barium sulphate).

*(The reason for doing the carbonate one first is that carbonates also give a white precipitate with barium chloride)*

1. **Halides**
2. Add a few cm3 of the solution, to a test tube.
3. Add drops of 0.1 Mol l-1 silver nitrate solution, agitating between drops, until the mixture is just cloudy.

*The precipitate is a silver halide (either the chloride, bromide or iodide)*

1. Observe the colour of the precipitate. Silver chloride is white, the bromide is cream-coloured and the iodide a yellower cream.
2. Add 3 cm3 of 1.5 Mol l-1 ammonia solution to the tube with the precipitate.

If the precipitate dissolves – this shows it is the chloride.

1. If not, Place the test tube in a bath of boiling / a just-boiled water for a minute.

If the precipitate dissolves, either completely or partially, this indicates bromide

If there is no change, it is the iodide

1. **Nitrates**
2. Add a few cm3 of the solution, to a test tube.
3. Add a spatula-tip of iron II sulphate and agitate to dissolve (or add 0.5 – 1 cm3 of a saturated solution of the iron II sulphate)
4. Incline the tube and add slowly down the side about 1.0 cm3 of concentrated sulphuric acid

If it is a nitrate, you will see the formation of a brown ring where the two layers meet. (though it might be more of a brown layer rather than an actual ring)

1. Dispose of carefully by adding to a large volume of water.