Group 2

You might see the name 's-block' used in books, which just refers to the metals in Group 1 and 2.

The 's' is referring to the outer shell of the electronic configuration, so you know that the electronic configuration must end in something 's'.

Trends

Atomic Radius

the atomic radius gets bigger as you go down a group.

This is simply because **extra shells of electrons** are being added, which increases the radius.

Down a group, from element to element, you still have the **same number of outer electrons**, they will just have a different number to indicate which orbital the outer electrons are in i.e. 2s, 3s, 4s etc. as they get bigger.

Group 2 metals are smaller than those in group 1, due to a stronger nuclear charge (extra proton) for the group 2 metals, which means everything is held tighter together.

Electronegativity

electronegativity **decreases** down the group

This is due to the **increased size** and number of shells. Therefore the nucleus cannot attract electrons in a covalent bond so easily.

Melting Point

melting points **decrease** down the group

Again this is related to **size**. Remember melting point really means how strong the bond is i.e. the attraction between the positive ions and the delocalised electrons (see metallic bonding).

Down the group, the metal becomes bigger therefore the electrons are further from the positive ions and the attraction is less → **lower** melting points.

Ionisation

This has been covered already in the ionisation energies tutorial. The further the outer electron is from the nucleus, the weaker the attraction, resulting in the electron being removed more easily.

Ionisation energy decreases down the group.

Reactivity

When reactivity is mentioned for metals, they are specifically talking about **how easily the metal loses its outer electron(s).**

The easier the electron is lost, the more reactive the metal is.

As you go down the group, the atomic radius increases, therefore it becomes easier to lose the outer electrons:

As you go down the group, the **reactivity increases**.

Reactions

Reaction with Water

Metal + Water → Metal Hydroxide + Hydrogen

e.g. Group 1 $2Na + 2H_2O \rightarrow 2NaOH + H_2$

e.g. Group 2 $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

✓ water is acting as an **oxidising agent**.

Solubility Trends

We are talking about ionic compounds with group 1 and 2 metal ions and either a hydroxide or sulphate as the anion.

hydroxides **increase** in solubility down the group

sulphates **decrease** in solubility down the group

Barium sulphate

$BaSO_4$ is very **insoluble** and forms a white precipitate. It is used as a test for sulphate ions. Add $BaCl_2$ → a precipitate of $BaSO_4$. Any acid added before the test is to remove any ions that might interfere with the result.

$BaSO_4$ is used in barium meals in medicine to absorb X-rays. As $BaSO_4$ is insoluble it is not absorbed by the body and is harmless.

Others

$Mg(OH)_2$ is almost **insoluble** and is used in milk of magnesia to neutralise stomach acid or aid indigestion.

$Ca(OH)_2$ is **soluble** and is used to neutralise acidic soil. As it is more soluble than $Mg(OH)_2$, more OH^- ions are produced → a higher pH (more alkaline).

SO_2 is an acidic gas (as is CO_2). To remove SO_2 from flue gases, $CaCO_3$ or CaO is added (acid/base reaction).

Extraction of titanium

Mg is used to reduce Ti from its ore TiO_2

This happens in two steps:

$$\mathbf{TiO_2 + 2Cl_2 + 2C \rightarrow TiCl_4 + 2CO}$$

$$\mathbf{TiCl_4 + 2Mg \rightarrow Ti + 2MgCl_2}$$

Both reactions are redox. In the first equation:

- **C is oxidised** from **0 → +2**
- **Cl is reduced** from **0 → -1**

In the second equation:

- **Mg is oxidised** from **0 → +2**
- **Ti is reduced** from **+4 → 0**