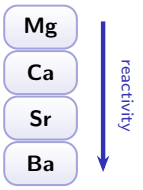
Group 2

A-Level Chemistry ▪ Topic 10

A-Level Chemistry



What we will cover

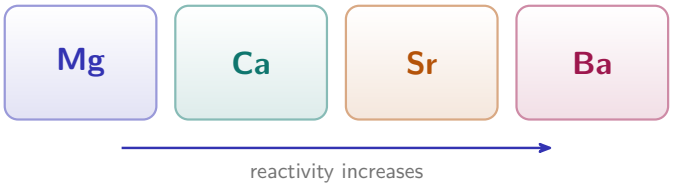
1. Reactivity down the group
2. Reactions of the elements
3. Thermal decomposition
4. Solubility trends

magnesium burns brilliantly

1 The metals

Reactivity down the group

Group 2 metals get more reactive down the group: the outer pair is further from the nucleus and more shielded, so it is lost more easily.



Reactions of the elements

with oxygen: $2Mg + O_2 \rightarrow 2MgO$

with water: $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

with acid: $Mg + 2HCl \rightarrow MgCl_2 + H_2$

Reactions get faster down the group – but with **sulfuric acid** 硫酸 they slow, because the insoluble **sulfate** 硫酸盐 coats the metal.

2 The compounds

Thermal decomposition

small Mg^{2+}: high polarising power — large Ba^{2+}: low polarising power

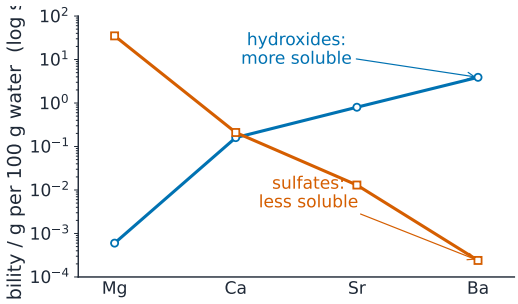
distorts the ion
⇒ **decomposes easily**

barely distorted
⇒ **thermally stable**

Thermal decomposition 热分解:
carbonates → oxide + CO_2;
nitrates → oxide + NO_2 + O_2.

> **Thermal stability** 热稳定性 rises down the group – a larger ion **polarises** 极化 the anion less, so it is harder to break.

Solubility trends



Down Group 2:

- **hydroxides** 氢氧化物 become more soluble ($Ba(OH)_2$ soluble)
- **sulfates** 硫酸盐 become less soluble ($BaSO_4$ insoluble)

3 Recap

Worked example – Group 2 with water

Write the equation for calcium with water, and explain the reactivity trend down Group 2.

- $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$
- Down the group the outer shell is further out and more **shielded** 屏蔽.
- So the two outer electrons are lost more easily – ionisation energy falls.
- Reactivity increases down: Mg slow in cold water, Ca steady fizzing, Ba vigorous.

Group 2 gets more reactive down because it is easier to lose electrons. Group 17 gets *less* reactive down because it is harder to gain them.

Topic 10 – key takeaways

1 Reactivity

increases down the group

2 Reactions

form oxides, hydroxides & salts + H_2

3 Thermal stability

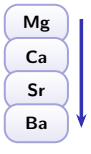
rises down; small ions polarise more

4 Solubility

hydroxides up, sulfates down

Check yourself

1. Which way does reactivity change down Group 2?
2. What does a carbonate decompose into?
3. Which is more soluble, $Mg(OH)_2$ or $Ba(OH)_2$?
4. Why is $BaSO_4$ hard to dissolve?



Answers **1.** increases **2.** the oxide + CO_2 **3.** $Ba(OH)_2$ **4.** sulfate solubility falls down the group