

Group 2 (A Level)

A-Level Chemistry 9701 · Topic 27 revision notes

Everything from the 1 lessons of this topic on a few pages: the key idea of each lesson, the diagram to remember, the points to learn and the traps examiners set. Read it, cover it, test yourself.

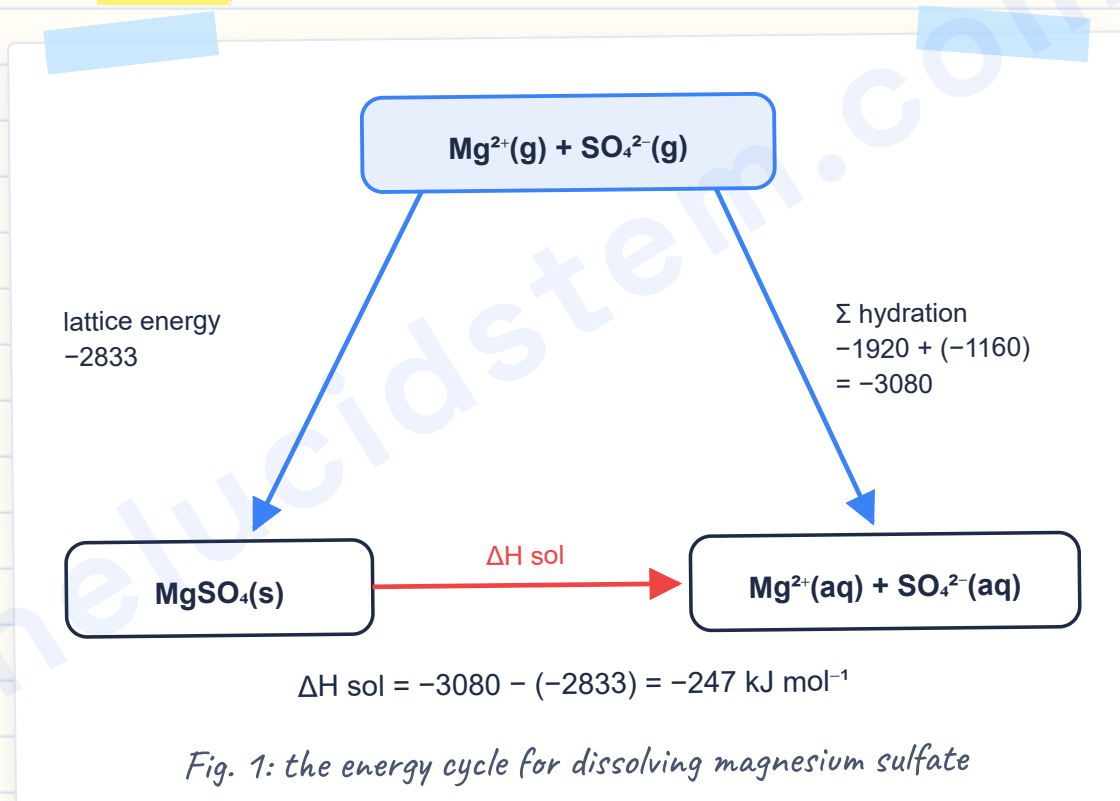
1. Group 2: solubility and thermal stability

thelucidstem.com

1 Group 2: solubility and thermal stability

Syllabus 27.1

Group 2 carbonates and nitrates become **more thermally stable** down the group. A small $2+$ cation such as Mg^{2+} has a high **charge density**, so it has high **polarising power**: it distorts the electron cloud of the large CO_3^{2-} or NO_3^- ion and weakens its C-O or N-O bonds, so less heat is needed to release CO_2 or NO_2 . Larger cations polarise less. Solubility is linked to the **enthalpy change of solution**: $\Delta H_{\text{sol}} = \Sigma \Delta H_{\text{hyd}} - \text{lattice energy}$. Down the group both the lattice energy and the hydration enthalpies become **less exothermic**, but at different rates. For **sulfates** the large anion means the lattice energy changes little while the cation hydration enthalpy falls a lot, so ΔH_{sol} becomes less exothermic and solubility **decreases**. For **hydroxides** the small OH^- means the lattice energy falls faster, so solubility **increases**.



Charge density, then the energy tug of war.

- ✓ **Stability:** small cation, high charge density, polarises the anion, decomposes easily.
- ✓ **Cycle:** $\Delta H_{sol} = \Sigma \Delta H_{hyd} - \text{lattice energy}$.
- ✓ **Sulfates:** big anion, lattice falls slowly, hydration falls fast, less soluble.
- ✓ **Hydroxides:** small anion, lattice falls fast, more soluble.

Watch out!

Both terms get **less exothermic** down the group; the trend depends on which one falls **faster**, so never explain solubility with just one of them. Polarisation is about the **cation distorting the anion**, not the anion being attracted to the cation more strongly. And watch the sign in the cycle: with lattice energy defined as formation (exothermic), $\Delta H_{sol} = \Sigma \Delta H_{hyd}$ **minus** lattice energy, so $-3080 - (-2833) = -247$, not -5913 .