Chemistry with Chloe

AQA A Level Chemistry — 3.1 Physical Chemistry

3.1.8 Thermodynamics

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★ A-LEVEL ONLY — not examined at AS level

3.1.8.1	*Born–Haber cycles. Lattice enthalpy, enthalpy of atomisation, ionisation energy, electron affinity. Enthalpies of solution and hydration.*

Lattice enthalpy: AQA accepts dissociation (endothermic, +) or formation (exothermic, –). Read the question.

Born–Haber cycle (Hess's Law): ΔfH = ΔatH(metal) + ΔatH(non-metal) + IE(s) + EA(s) + ΔLE. Rearrange for the unknown.

Comparing LE: if experimental (Born–Haber) is more exothermic than theoretical (ionic model) → covalent character (cation polarises anion). Smaller, higher-charge cation = more polarising.

ΔsolH = –ΔLE(dissociation) + ΣΔhydH. Draw an energy cycle.

3.1.8.2	*Entropy (ΔS) and Gibbs free energy (ΔG). ΔG = ΔH – TΔS. Feasibility and temperature calculations.*

Entropy (S): measure of disorder. Units: J K■¹ mol■¹.

ΔSsystem = ΣS■(products) – ΣS■(reactants)

Entropy increases: solid → liquid → gas; more moles of gas in products; dissolving.

Gibbs free energy: ΔG = ΔH – TΔS. Feasible when ΔG ≤ 0.

Temperature for feasibility: set ΔG = 0, T = ΔH / ΔS.

Units: MUST ensure ΔH and TΔS are in the same units (convert ΔS from J to kJ by ÷1000).

ΔG < 0 does NOT guarantee the reaction occurs — kinetic barriers may prevent it.

Graph of ΔG vs T: gradient = –ΔS, y-intercept = ΔH.