Competition Corner: Conditions Matter

Entropy and Spontaneity | `g10_u02_w08`

For each data card, use $\Delta G = \Delta H - T\Delta S$ only as a constant-temperature-and-pressure classroom model. Convert entropy units first. A negative ΔG indicates a favorable direction under those stated conditions; it does not predict rate.

1. Card A: $\Delta H = -30.0$ kJ/mol and $\Delta S = -75.0\ \mathrm{J\,mol^{-1}\,K^{-1}}$. Calculate ΔG at 250 K and 500 K. Identify the crossover temperature and explain the sign change in terms of the two contributions.

2. Card B: $\Delta H = +12.0$ kJ/mol and $\Delta S = +60.0\ \mathrm{J\,mol^{-1}\,K^{-1}}$. Do the same at 250 K and 500 K. Compare its temperature pattern with Card A without using the phrase "higher temperature is always better."

3. A report calls Card A "impossible at high temperature because entropy always wants to increase." Diagnose the boundary and sign-model error in two or three sentences. Include what the negative ΔS means and what a positive ΔG does *not* say about microscopic motion.

4. Draft a two-row evidence table comparing a calculated ΔG estimate and an observed rate measurement. Your column headings must make it impossible to confuse thermodynamic favorability with speed; include stated temperature, system boundary, units, and one limitation for each row.