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Entropy, Gibbs energy and spontaneity

Formulas and units, JEE Main. Status: Reviewed on 2026-11-20.

Result	Formula	Units or note
Entropy change (reversible)	delta S = q(rev) / T Valid when: reversible path; q(rev) at constant temperature T in kelvin	J/K (molar: J/(mol K))
Phase change	delta S = delta H(transition) / T(transition) Valid when: reversible phase change at its transition temperature, constant p	J/(mol K) (with delta H in J/mol)
Ideal gas, isothermal	delta S = n R ln(V2/V1) = n R ln(p1/p2) Valid when: ideal gas, isothermal change, any path between same end states	J/K (R = 8.314 J/(mol K))
Entropy of reaction	delta S = sum n S (products) - sum m S (reactants) Valid when: standard molar entropies at the same temperature	J/K per mole of reaction
Second law	delta S(total) = delta S(system) + delta S(surroundings) >= 0; delta S(surr) = -delta H(sys)/T Valid when: surroundings a large reservoir, constant p and T	J/K
Gibbs energy	delta G = delta H - T delta S; spontaneous if delta G < 0 Valid when: constant T and p; delta H and T delta S in same units	kJ (convert delta S from J/K to kJ/K)
Crossover temperature	T = delta H / delta S (when delta G = 0) Valid when: delta H and delta S nearly independent of T; at delta G = 0	K (delta H in J, delta S in J/K)
Delta G and K	delta G (standard) = -R T ln K = -2.303 R T log10 K; delta G = delta G (standard) + R T ln Q Valid when: constant T; K at that T; Q is the reaction quotient	J/mol with R = 8.314 J/(mol K)

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/chemistry/chemical-thermodynamics/entropy-gibbs-energy-and-spontaneity

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