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Hess law and thermochemical equations

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

Result	Formula	Units or note
Hess law	delta H (overall) = sum of delta H of the steps Valid when: same initial and final states, same T and p	kJ per mole of reaction as written
Reversal and scaling	reverse: delta H -> -delta H; multiply by n: delta H -> n delta H Valid when: same conditions; equation reversed or multiplied as written	kJ
From formation enthalpies	delta H = sum n delta H_f (products) - sum m delta H_f (reactants) Valid when: all values at the same temperature, standard states	kJ
From combustion enthalpies	delta H = sum delta H_c (reactants) - sum delta H_c (products) Valid when: complete combustion to the same products, same temperature	kJ
Bond enthalpies	delta H = sum (bonds broken) - sum (bonds formed) Valid when: gas-phase species; mean bond enthalpies, approximate	kJ
Delta H and delta U	delta H = delta U + delta n(g) R T Valid when: ideal gases; constant T; R in J/(mol K)	kJ. When R = 8.314 J/(mol K) and the answer is wanted in kJ, divide delta n(g) R T by 1000 before adding it to delta U in kJ.
Atomization via Hess cycle	delta H(atomization of AB) = -delta H_f(AB) + sum of atomization enthalpies of the elements Valid when: elements to gaseous atoms; scale by stoichiometry	kJ per mole of compound
Change of state in a cycle	delta H (gas product) = delta H (liquid product) + n delta H_vap Valid when: same temperature; n moles of product water formed	kJ
Standard state	delta H_f = 0 for an element in its standard state Valid when: element in its most stable form at 1 bar	kJ/mol
Phase-transition cycle	delta H(sub) = delta H(fus) + delta H(vap) at the same temperature Valid when: same temperature and pressure	kJ/mol
Ionization steps	M(s) giving M n+ (g): sublimation + sum of the first n ionization enthalpies Valid when: gaseous ionization enthalpies; solid metal atomized first	kJ/mol
Hydration from solution data	delta H(hydration of salt) = delta H(solution, anhydrous) - delta H(solution, hydrate) Valid when: both dissolve in large excess water to same solution	kJ/mol

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/chemistry/chemical-thermodynamics/hess-law-and-thermochemical-equations

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