Thermodynamics Formulas

Name	Formula	
1st Law of Thermodynamics	$\Delta E_{universe} = \Delta E_{system} + \Delta E_{surroundings}$	Energy cannot be created nor destroyed – only change forms.
2nd Law of Thermodynamics	$\Delta S_{universe} = \Delta S_{sys} + \Delta S_{surr} \geq 0$	Entropy of the universe is always increasing.
3rd Law of Thermodynamics	$S = K_B \ln W = K_B \ln(1) = 0$	S of a pure crystal at 0K is 0 J/mol·K
Enthalpy	$\Delta H = q$	Enthalpy, ΔH, is the measure of heat energy in a system at constant pressure.
Standard Enthalpy	$\Delta H^\circ = \sum \Delta H^\circ_{f,products} + \sum \Delta H^\circ_{f,reactants}$	Enthalpy change when one mole of a substance is made from its elements in standard conditions. (Enthalpy Change of Formation)
Entropy	$\Delta S = \frac{q_{reversible}}{T}$	Entropy, ΔS, is the measure of disorder in a system. A higher entropy = A greater amount of disorder. Solids < Liquids < Gases.
	$\Delta S_{surroundings} = -\frac{\Delta H_{system}}{T}$	
Standard Entropy	$\Delta S^\circ = \sum \Delta S^\circ_{products} + \sum \Delta S^\circ_{reactants}$	(Standard Molar Entropies)
Gibb's Free Energy	$\Delta G = \sum \Delta G_{products} + \sum \Delta G_{reactants}$	Used to to predict whether a process will occur spontaneously at a constant temperature and pressure.
	$\Delta G = \Delta H - T\Delta S$	
	$\Delta G = \Delta G^\circ + RT \cdot \ln(Q)$	Q = Reaction Quotient R = 8.3145 J/mol·K
Standard Free Energy	$\Delta G^\circ = \sum \Delta G^\circ_{f,products} + \sum \Delta G^\circ_{f,reactants}$	
Specific Heat Capacity, c	$q = mc\Delta T$	The amount of heat energy needed to raise the temperature of 1 gram of a substance by 1℃. Used in "coffee-cup" calorimetry. m = mass in grams. (Specific Heat Capacities)
Heat Capacity, C	$q = C\Delta T$	The amount of energy required to raise the temperature of a substance by 1℃. Used in "bomb" calorimetry.