The Gibbs Free Energy Equations & Relations

$\Delta G = -T\Delta S_{universe}$	Relates Gibbs Free Energy (ΔG) with the entropy of the universe ($\Delta S_{universe}$). By the second law of thermodynamics, $\Delta S_{universe}$ must always increase; therefore, ΔG must be negative for product favored reactions.
$\Delta G = \Delta H - T\Delta S$	Relates ΔG to enthalpy (ΔH) and entropy (ΔS); also known as the "two headed snake" equation. Enthalpy and entropy can combine to make some reactions always product favored ($\Delta G < 0$) or always reactant favored ($\Delta G > 0$); in addition, sometimes enthalpy and entropy "fight" one another, making the final value of ΔG temperature dependent.
$\Delta G = -RT \ln K$	Relates ΔG with the equilibrium constant (K). R = gas constant (8.3145 J K^{-1} mol^{-1}), T = temperature (K). If ΔG is product favored ($\Delta G < 0$), K is greater than 1; if ΔG is reactant favored ($\Delta G > 0$), K is less than 1.
$\Delta G = - nFE$	Relates ΔG with the potential of a chemical cell (E). n = number of electrons transferred, F = Faraday constant (96,485 C mol^{-1}). If ΔG is product favored ($\Delta G < 0$), E is greater than 0 (positive); if ΔG is reactant favored ($\Delta G > 0$), E is less than 0 (negative).
$\Delta G = \Sigma\Delta G_{products} - \Sigma\Delta G_{reactants}$	Used to calculate the Gibbs Free Energy (ΔG) for a reaction using tables of standardized ΔG values. Like enthalpy, ΔG will be zero for elements in their standard states ($O_{2(g)}$, $Mg_{(s)}$, $Br_{2(l)}$, etc. - all will have $\Delta G = 0$).

	ΔG	K	E	$\Delta S_{universe}$
Product Favored	-	> 1	+	+
Reactant Favored	+	< 1	-	-

ΔH	ΔS	ΔG
-	+	- (always product favored)
+	-	+ (always reactant favored)
-	-	Depends on temperature, generally product favored at low T
+	+	Depends on temperature, generally product favored at high T