Chapter 16 – Spontaneity

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April 13, 2021

- Thermodynamically Feasible — Occurs by self
- Enthalpy (ΔH) — Heat flow
- Most exothermic reactions are spontaneous, but not all
- Entropy (ΔS) — Measurement of disorder. Higher value, higher disorder.
- Gas has highest entropy (disorder), with liquid next and then solid
    1. Solid $\rightarrow$ Gas: Disorder Increasing, ΔS is positive.
    2. Gas $\rightarrow$ Solid: Disorder Decreasing, ΔS is negative.
- Gibbs Free Energy (ΔG) — Measurement of doing spontaneous work
    1. $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$
    2. $\Delta G > 0$ — Not Spontaneous
    3. $\Delta G < 0$ — Spontaneous
    4. $\Delta G = 0$ — At equilibrium
- Temperature Effects:

ΔH	ΔS	Spontaneous Under
+	+	High Temp
-	-	Low Temp
-	+	Any Temp
+	-	No Temp

- At non-standard conditions: $\Delta G = \Delta G^\circ + RT\ln(Q)$
- Equilibrium Constant: $\Delta G^\circ = -RT\ln(K)$

- ΔG is large and positive — K is very small, meaning no products are formed, meaning that the reaction is not spontaneous
- Activation energy (E_a) may explain why a reaction doesn't occur
- Adding ΔG — Use non-spontaneous reaction with spontaneous reactions to make it spontaneous (couple reactions, like Hess's law)