Entropy and Phase

- Phase affects entropy

- Solids can have vibrational motion, not translational or rotational
- liquids can have all 3, extent of translational motion limited
- Gases can move in any way

freedom of motion = # of microstates

gas > liquid > solid

Entropy and Complexity

- Entropy increases as complexity increases (complexity of molecular structures)
  - ↳ more bonds, more chances for internal motion (internal vibrational motion)

As T ↓ entropy, S, ↓. Does it go to zero?

$S = k \ln W$ $W = 1$

$S = k \ln(1) = 0$

ordered molecules, not moving

at absolute zero, entropy will be zero

Third Law of Thermodynamics

- Entropy of a pure, perfect crystalline substance at absolute zero is zero $\Rightarrow S(0K) = 0$

Molar Entropies

- standard molar entropies, S°, can be determined for substances at standard conditions
  - ↳ table in textbook (19.1)
  - ↳ standard state listed at standard T (298 K)

$\Delta S = S_{final} - S_{initial}$

$\Delta S^\circ_{rxn} = \Sigma n_{prods} S^\circ_{prods} - \Sigma n_{react} S^\circ_{react}$ n = coefficients

Ex: Calc the standard entropy change for the rxn:

$2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(l)$

Standard molar entropy value are: $CO_2 = 213.8$ J/K, $H_2O(l) = 69.9$ J/K, $O_2 = 205.0$ J/K, $C_2H_6 = 229.5$ J/K