

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 and Complexity

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

As $T \downarrow$ entropy, S , $\downarrow$. Does it go to zero?

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

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

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

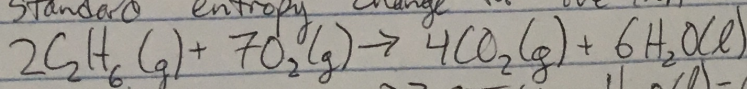
↳ table in textbook (19.1)

↳ standard state listed at standard T (298 K)

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

$$\Delta S^\circ_{\text{rxn}} = \sum n_{\text{prod}} S^\circ_{\text{prod}} - \sum n_{\text{react}} S^\circ_{\text{react}} \quad n = \text{coefficients}$$

Ex: Calc the standard entropy change for the rxn:



standard molar entropy value are: $CO_2 = 213.8 \text{ J/K}$, $H_2O(l) = 69.9 \text{ J/K}$,
 $O_2 = 205.0 \text{ J/K}$, $C_2H_6 = 229.5 \text{ J/K}$