Chapter 19

I. Thermodynamics

A. Thermodynamics the capacity to produce heat or do work

1. Allows a prediction of whether a reaction is spontaneous based on the relative energies of reactants and products

↳ Spontaneous: product - favored

2. no rate kinetics involved

B. Spontaneous

1. Spontaneous reactions proceed without any outside assistance

↳ Processes that are spontaneous in one direction are non-spontaneous in the other

2. First Law of Thermodynamics: energy cannot be created or destroyed, just transferred or transformed

↳ $\Delta E = q + w$

3. Enthalpy the heat lost or absorbed by a system during a constant-pressure process

↳ Plays a role in whether the process is spontaneous

1. $\Delta H < 0$, exothermic

2. $\Delta H > 0$, endothermic

4. Some endothermic processes are spontaneous

a. Entropy plays a role in whether a process is spontaneous

1. Ice melting is some times endothermic and spontaneous when $T > 0^{\circ}C$

C. Entropy, Second Law of Thermodynamics

1. Entropy: ΔS of the universe increases in a spontaneous process; $\Delta S_{sys.} + \Delta S_{sur.} > 0$ (universe)

↳ Work may be used to overcome entropy

↳↳ Multiplicity: # of arrangements

2 $S = k \ln W$ in which $k = 1.38 \cdot 10^{-23}$ J/K, W = # of microstates

Boltsmann's const.