Chapter 14 – Chemical Equilibrium

1. When something reacts, **concentrations change**, **free energy decreases**.
2. Equilibrium is achieved when free energy is at a minimum
3. **Dynamic Equilibrium** – continuation of the forward and backward reactions w/o a change in concentrations
4. **Equilibrium Constant** – $K_c$ and $K_p$
5. **Equilibrium Law** – equations used to calculate $K_p$ and $K_c$
6. **K** – the constant for any system containing the specific products at a certain temperature
   **K is INDEPENDENT of the concentrations of the chemicals**
   If K is large, the reaction proceeds close to completion, and the equilibrium lies far to the right
   If K is small, the reaction doesn't proceed very far, and the equilibrium lies far to the left
7. See the graph of page 525 about [Delta]G and equilibrium. **$\Delta G = \Delta G_0 + RT \ln Q$**
8. **Converting between Kp and Kc = read page 529 and example 14.4.**
   [Delta]Ng = Number of moles of gaseous products – number of moles of gaseous reactants
9. **Heteogeneous Equilibria** – Equilibriums where not all the reactants and products are in the same phase
   When calculating Kc and Kp for heterogeneous equilibria, leave out all solids/liquids (these concentrations don't change). Same for all mass action expressions.
10. **Choosing which constant to use** – use the constant that correctly fits the units of the problem
11. **Le Chatelier's Principle** – If a system at equilibrium is disturbed, the system will try to reduce the disturbance and return to equilibrium. However, it does not undo the disturbance completely
12. **Changes in Concentration** – equilibrium either shifts to the left or right, depending on the reactant
    Add reactants, Kc becomes smaller. Add products, Kc becomes larger
    **Changes in concentration do not affect the value of the constant k**
13. **Changes in Temperature** – Shifts equilibrium in **opposite** direction of heat, concentrations go both up and down
14. **Changes in Pressure and Volume** – matters only for gasses (solids and liquids can't be compressed)
    Decreasing volume causes equilibrium to shift toward the side with the smallest # of gas molecules
    Increasing the volume is decreasing the pressure, increasing the pressure is decreasing the volume
15. **Addition of inert gas**– will slow the reaction down, but the equilibrium point does not change
16. **Addition of a catalyst** – will speed up the reaction, but the equilibrium point does not change
17. Read section 14.6 for more information on this subject
18. Read section 14.7 for examples of equilibrium calculations