Chem 116 Lecture 17
11/4/08 (LL)

Equilibrium Calculations

K is equilibrium constant

Equilibrium Constant (K) - Value that Q reaches when reaction gets to equilibrium

Multiplying Rxns by a Number
 (-1) Flips the products and reactants
(2) Doubles the reaction

Shift – Change final concentrations of products and reactants when equilibrium position moves as a result of a disturbance

le Chatelier's principle: If you start with a system that is at equilibrium, and then disturb it, the system's equilibrium will shift in a way that partially undoes the disturbance

-Concentrations increase when chemicals are added

1st Category Disturbance
 -   Add or remove one chemical in the system (equilibrium has been disturbed)

2nd Category Disturbance
 -   When the size of the box decreases the concentration increases, cut the volume in <u>half</u> then the pressure increases <u>by a factor of 2</u>

 -   So when pressure of a system increases, the system wants to decrease the pressure, to decrease pressure the reaction shifts left or right which ever side of the reaction has less gas molecules

3rd Category Disturbance
 -   Adding an inert gas has no effect on the partial pressure or on the concentrations of the chemicals involved in the equilibrium, however it will increase the total pressure of the system. Since adding an inert gas has no effect on either the partial pressures or the concentrations of any of the chemicals that are in the equilibrium, then inert gases do not shift the equilibrium.

 -   Partial Pressure = (mole fraction)(P_{total})

4th Category Disturbance
 -   An increase in temperature the reaction will shift the reaction. Whether it shifts to make more products or more reactants depends on whether the change (in the forward direction) is endothermic or exothermic)

iclicker Question

A) $2NOCl + heat \leftrightarrows 2\ NO(g) + Cl_2\ (g)$
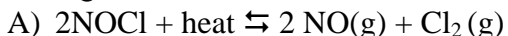
      -Take away heat, reaction would have to shift left to replace some of the heat removed by the disturbance of decreasing T

      - Endothermic, heat on left

B) Increase volume, decrease pressure (system will want to increase pressure in its response)
- In the case of the example given, there will be no change in the system because the number of gas molecules is the same on both sides

C) If you add more $CO_2\ (g)$ reaction shifts to the right to use up some of the CO_2
If you add more C(s) the reaction would stay the same because the reaction is in the gas phase, so concentration of C(s) is irrelevant

D) An increase in temperature, the CO concentration will increase (increase temperature, add heat), need to figure out if the reaction is endothermic or exothermic
-The reaction is endothermic so it shifts right

What patterns do you recognize in these reactions? (Arrhenius Reaction)
      H^+ (acid) cation
      OH^- (base) anion
All Arrhenius acids have H+ as a cation
All Arrhenius bases have OH- as an anion
-All of the reactions have water and salt (ionic) compound, on the product side

$HA \leftrightarrows H+\ +\ A-$ (every Arrhenius acid can be broken down into this)

$B(OH) \leftrightarrows B+\ +\ OH-$ (every Arrhenius base can be broken down into this)