Equilibrium

Applies to reversible reactions- when the rate of forward and reverse reactions become equal

Even though the concentration of reactants and products does not change once equilibrium has been established, the reactants and products are still changing into each other--just at the same rate

Dynamic Equilibrium

Equilibrium Constant K

Magnitude of equilibrium constant indicates whether the equilibrium lies towards the reactants or products.

If the reaction doubles, K is squared... K^2

If the reaction reverses K is inversed...K-1

In a multistep reaction, multiply each K to get the overall... $K_1 x K_2 x K_3$

If a reaction is reversed, then K' $= 1/K$

For two reactions added, the overall K is given by Hess's Law. $\mathbf{K_{overall} = K_1 * K_2}$

Pure solids and liquids are not included in equilibrium expression

K >1, then more products than reactants at equilibrium and vice versa

Kc: When conc. of reactants and products is used

Kp: When partial pressure of the reactants and products is used

Equilibrium expression K

Kc can be changed to Kp according to the equation, $\mathbf{K_p = K_c(RT)^n}$

Reaction Quotient

Q shows reaction progress when the reaction is NOT at equilibrium

At equilibrium, Q=K

reaction proceeds in the direction so Q=K

If Q>K, then reaction proceeds in the reverse direction to achieve equilibrium

If Q <K, then reaction proceeds in the forward direction to achieve equilibrium

RICE Charts

Used to convert initial conc. to equilibrium conc, so K can be calculated

Le Chatelier's Principle

Systems at equilibrium respond to disturbances by countering the effect of the disturbance.

Concentration: Increasing reactant conc. will shift the equilibrium towards the products and vice versa. K unchanged

Catalyst: Increases the rate of forward and reverse reaction the same way, has no impact on equilibrium or K

Volume: Decreasing the volume, increases the pressure shifting the reaction towards lower pressure or lesser moles. K unchanged

Adding an inert gas does not effect equilibrium, since partial pressure of gases is not changed. No effect on K

Change in T changes the value of K. For an exothermic reaction, increasing the T decreases K and vice versa (since K= kf/kr)