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| **Chapter 15 Summary Notes** |
| **Main Concepts** | **Explanations** |
| ***Chemical Equilibrium**** Occurs when rate of forward reaction = rate of reverse reaction. Ex. ***Vapor pressure:*** rate of vaporization = rate of condensation, ***Saturated solution:*** rate of dissociation = rate of crystallization. *Conc. of reactants and products does not have to be equal at the equilibrium, only the rates of forward and reverse rxn become equal.*
* Express concentration in Partial Pressure for gases and molarity for solutes in liquids
* Rate = kforward [A]Rate = kreverse [B]
* $K\_{c}=\frac{K\_{f}}{K\_{r}}$ at equilibrium

-If Kc >1, then more products at equilibrium-If Kc <1, then more reactants at equilibrium-If Kc =1, then almost equal concentrations of products and reactants* There is a spontaneous tendency towards equilibrium.(spontaneous ≠ quickly, spontaneous = always moving towards equilibrium)
* It is possible to force equilibrium one way or the other temporarily by altering the reaction conditions, but once this “stress” is removed, the system will return to its original equilibrium.
* Law of Mass Action : a A + b B ↔ c C + d D
* *Concentrations of pure solids and pure liquids are not included in Keq*

**Summary of the page and Important things to remember:** |    The equilibrium expression is:orFor a heterogeneous equilibrium: CaCO3 (s) ↔ CaO (s) + CO2 (g) |

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| **Chapter 15 Summary Notes Contd.** |
| **Main Concepts** | **Explanations** |
| * ***Converting Kc to Kp***
* ***Reaction Quotient (Q):*** The particular ratio of concentration terms that we write for a particular reaction is called reaction quotient.

For a reaction, A🡪 B, Q= [B]/[A] At equilibrium, Q= K Reaction Direction: Comparing Q and K-Q<K, reaction proceeds to right, until equilibrium is achieved (or Q=K). Why?-Q>K, reaction proceeds to left, until Q=K. Why?* Remember, if you double a rxn, then you square the K value, if you reverse a rxn, then you inverse the K value, if you add two rxns up, then you multiply the K value.
* ***ICE tables*** are used to calculate equilibrium concentrations of the reactants and products from the initial concentrations.
* ***Le Chatelier’s Principle***: A system at equilibrium will tend to undo the stress that is applied on the system. The only “stress” that can change the numerical value of Kc or Kp is temperature. *Addition of an inert gas or catalyst does not impact the equilibrium.*

*-* *Upon addition of a reactant or product, equilibrium shifts to re-establish equilibrium by consuming part of the added substance.**-Upon a decrease in V (thereby increasing P),equilibrium shifts to reduce the number of moles of gas**-* ***Temperature:*** *consider “heat” as a part of the reaction. Upon an increase in T, endothermic reaction is favored (equilibrium shifts to “consume the extra heat”)***Summary of the page and Important things to remember:** | **Where Δn =** = Change in coefficients of products – reactants (gases only!)= (c + d) – (a + b)C:\Users\kavita_gupta\Documents\my documents June 2012\AP Chem\Unit E Kinetics, Equilibria (Ch 14-17)\Notes\Graph for Q and K.pngCredits: Google images**Ex for ICE table:** Enough ammonia is dissolved in 5.00 L of water at 25ºC to produce a solution that is 0.0124 M ammonia. The solution is then allowed to come to equilibrium. Analysis of the equilibrium mixture shows that [OH1-] is 4.64 x 10-4 M. Calculate Keq at 25ºC for the reaction. Ans. 1.81 X 10-5NH3 (aq) + H2O (l) ↔ NH41+ (aq) + OH1- (aq) |