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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] * 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:  or  For 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.png  Credits: 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 10-5  NH3 (aq) + H2O (l) ↔ NH41+ (aq) + OH1- (aq) |