AP Chemistry

Thou Shalt Not Forget

Credit: Dan Reid

**General Equilibrium**

1. Keq = [products]x/[reactants]y … x and y represent the coefficients in the balanced chemical equation.
2. Only (aq) and (g) appear in an equilibrium expression. Use [ ] for Molarity and (Pgas) for atm.
3. A large Keq means that there are more products at equilibrium. A small Keq means there are more reactants at equilibrium.
4. Reversing a reaction? 1/Keq Doubling a reaction? (Keq)2 Adding reactions? Multiply the K’s together
5. Le Chatelier's Principle: It’s all about determining Q!! If Q >Keq , then the reaction shifts to the left, towards the reactants.
6. Catalysts and inert gases DO NOT shift an equilibrium.
7. Changes in pressure (caused by changing the volume of a container) can shift an equilibrium ONLY IF the # of gas particles are different on each side...An increase in the pressure favors a shift in the equilibrium towards the side with LESS moles of gas. (Reminder: As V↓ , P↑)

**Acid-Base Equilibrium**

1. The pH of acids are less than 7, and bases are greater than 7. The pH of pure water is only 7 when the temp. is 25°C.
2. Acids donate [H+]; bases accept [H+].
3. The hydronium ion is H3O+. [H+] is a proton.
4. Strong acids: HNO3 H2SO4 HClO4 HClO3 and HBr, HI, HCl…”NO SO ClO 3, 4, 4, 3 and BrICl”
5. Strong bases: Group 1 hydroxides Group 2 hydroxides \*Some Group II hydroxides are only slightly soluble, but whatever dissolves can completely ionize.
6. pH = −log [H+] [H+] = 10−pH
7. The stronger the acid, the weaker its conjugate base.
8. Acid-Base reactions favor the direction of the “strong side” to the “weak side”...If K>1, then the reactants are stronger.
9. [H+] =Square Root of MaKa…(This shortcut only works if “x” is really small compared to Ma  . Also, don’t use this shortcut if you are given the pH of the solution and you are asked to solve for Ka because the pH can be used to find “x” in the ICE box.)
10. “x” in the ice box calculation is [H+] for a weak acid, and [OH−] for a weak base.
11. % Ionization of a weak acid = [H+] /Ma
12. % ionization increases as the acid concentration decreases...adding more water will increase the amount of ionization.
13. If a salt contains a conjugate base of a weak acid, the salt is going to be slightly basic...CBOWA’s are (-) ions.
14. If a salt contains a conjugate acid of a weak base, the salt is going to be slightly acidic...CAOWB’s are (+) ions.
15. If a salt contains conjugates of strong acid/bases, the ion is neutral. Example -- KBr is a neutral salt (KOH + HBr)
16. A larger Ka value means a stronger acid. A larger Kb means a stronger base.
17. Relative strengths of acids: (a) Smaller cations are more acidic. (b) More (+) charge on the cation makes it more acidic. (c) More oxygens (or more electronegative atoms) on an anion makes it more acidic since the proton is “more ionizable”.

**Additional Aspects of Aqueous Equilibrium: Titrations and Buffers**

1. Buffers are created by a weak acid + CB (salt) or by a weak base + CA (salt).
2. [H+] = MaKa/[salt]...You can use # of moles instead of molarity in this formula.
3. Adding a common ion to a weak acid (or base) decreases the % ionization, and therefore the pH gets closer to 7.
4. MaVa=MbVb ...This is only true at the equivalence point.
5. M1V1 = M2V2 This is not on the formula sheet, but it is extremely useful for dilution calculations.
6. Titrations: Weak acid + Strong Base has a pH at the equivalence point that’s above 7. Weak Base + Strong Acid has a pH at the equivalence point that’s below 7. Strong Acid + Strong Base has a pH =7 at the equivalence point.
7. pH = pKa at the ½ equivalence point for a “weak + strong” titration. Also, when pH = pKa, then [HA] = [A−]
8. More buffer capacity = more moles of weak acid & CB (or weak base and CA).
9. Solubility Equilibrium: 2 ions....Ksp = x2 ; 3 ions...Ksp = 4x3 “x” = Molar Solubility in units of moles/Liter
10. The larger the “x” value, the more soluble the salt is.
11. If Q > Ksp, a precipitate forms.
12. Group I cations, NH4+, and NO3- salts are always soluble in water. These are usually the spectator ions in a chemical reaction.