Checklist for Exam 2 (2020)

Chapter 15. Equilibria

- ❑ I know how to sketch graphs that show the kinetics region becoming the equilibrium region (time vs. concentration.) I know how to include the reaction stoichiometry in these graphs (one A becoming two B, etc.)
- ❑ Given a graph such as the one described above, I can write the chemical equilibrium and determine the equilibrium constant.
- ❑ I can write a K_c and K_p expression for any equilibrium. I know the equation $K_p = K_c(RT)^{\Delta n_g}$ that allows me to interconvert the two.
- ❑ I know how to rearrange K_c or K_p when I write the equilibrium "backwards" or divide/multiply the coefficients, etc.
- ❑ I know how to set up an ICE table, a device used by many of the problems in this and the next chapter. I know I usually work in mol/L unless I can justify that working in moles is acceptable ($\Delta n_g = 0$).
- ❑ I know how to write a Q_c or Q_p expression and how to use it.
- ❑ I can "read" a K_c (K_p) expression and convert it into a chemical equilibrium, complete with long/short arrows. I can describe whether the equilibrium consists of mostly reactants or products given extremely large or small equilibrium constants.
- ❑ Given initial concentrations and an equilibrium constant, I can calculate the equilibrium concentrations for all components.
- ❑ Given initial concentrations and an equilibrium concentration of at least one component, I can calculate the equilibrium constant.
- ❑ I can use Le Châtelier's principle to predict how various stresses affect reestablishing of equilibrium. These stresses are: 1. adding/removing a component, 2. changing the volume, 3. changing the temperature.
- ❑ I can sketch graphs of time vs concentration that include Le Châtelier stresses and how the concentrations of the components adjust to reestablish equilibrium.
- ❑ I understand the relationship between kinetics and equilibrium and specifically that $K_c = k_{fwd}/k_{rev}$ (as per the shoebox water demo.)
- ❑ I understand what a catalyst does and doesn't do to the kinetics and equilibrium regions.

Chapter 16. Acids & Bases

- ❑ I know how to identify a Brønsted-Lowry acid and base. I can identify conjugate acids and bases in a chemical equilibrium and I can write them.
- ❑
- ❑ I know what the hydronium ion is.
- ❑ I can write chemical equilibrium expressions for (a) a strong acid in water, (b) a weak acid in water, (c) a strong base in water and (d) a weak base in water. These expressions include appropriate arrows ($\xrightarrow{100\%}$ or $\overset{\longrightarrow}{\longleftarrow}$).
- ❑ I know the equilibrium expression for water and can write it. I know the value for its equilibrium constant, K_w.
- ❑ I know the equations for interconverting pH, $[H_3O^+]$, pOH, and $[OH^-]$.
- ❑ I can calculate the pH of a strong acid, given $[H_3O^+]$.
- ❑ I can calculate the pH of a strong base, given $[OH^-]$.
- ❑ I can calculate the $[H_3O^+]$ (and $[OH^-]$) of a strong acid, given pH.
- ❑ I can calculate the $[OH^-]$ (and $[H_3O^+]$) of a strong base, given pH (or pOH).

- ❑ I can do MICE table calculations for strong acids, weak acids, strong bases, and weak bases. For example, given the initial concentration of an acid and its K_a value, I can determine the concentration of all species as well as the pH, etc. Another example, given the initial concentration of a weak base, and the pH at equilibrium, I can determine a value for K_b for the equilibrium. Third example: I can calculate the pH of any strong acid or base given the initial concentration.
- ❑ I can create a table of weak acids and their conjugate weak bases and I can use these pairs to determine K_a or K_b given one or the other using $K_w = K_a^{wa} \times K_b^{cwb}$.
- ❑ I know how to convert K_a and pK_a^{wa} and K_b and pK_b^{wb} and that $pK_a^{wa} + pK_b^{cwb} = 14$.
- ❑ I can calculate percent dissociation once I have completed my MICE table.
- ❑ I am comfortable with writing equilibrium expressions for weak acids, strong acids and calculating the pH of any solution (given the concentration) of a weak acid or weak base. I can calculate the pH for solutions of strong acids and strong bases, given the concentration.
- ❑ I can look at the formula of a salt and determine if it is acidic, basic, or neutral. I also know when I need more information. In most cases, I can solve for pH given an initial concentration.
- ❑ I know how to recognize a Lewis acid from its Lewis dot structure. I know how to identify a Lewis base, either by its Lewis structure or because iit is a metal cation. I can sketch the product of the reaction of a Lewis acid and base.