

Checklist for Exam 2

Chapter 12. Kinetics

- I know how to inspect a reaction mechanism and determine the overall reaction. I can also identify catalysts and intermediates, if any are present.
- I know how to write a rate law for the slow step in any mechanism. I know that for mechanisms in which the second step is slow, I must substitute out any intermediates that show up in the rate law (because we can't measure their concentrations in lab, so we would have difficulty "proving" the rate law.) To do this, I know how to use an equilibrium expression from the fast step(s).
- I know what exactly it means when one, two or three (!) things appear as reactants in a mechanism's step.
- I know how to sketch a reaction profile that diagrams the mechanism. If ΔH is also provided, I can include that in my drawing. I can label the reactants, intermediates, transition states, the various E_{act} (one for each step), and the overall ΔH .
- I understand the role of temperature in the changing the rate constant (and thereby the rate) for all reactions.
- I know how to read Boltzmann distributions (population vs. energy) graphs and I know how they change as the temperature changes. I know what it means to sketch E_{act} on these graphs.

Chapter 13

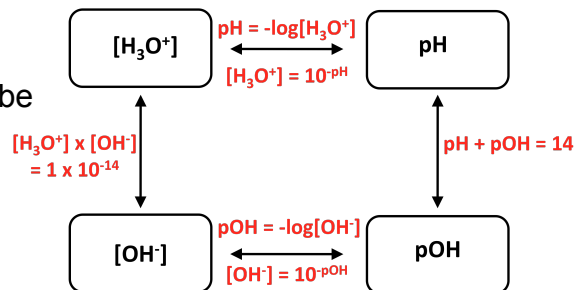
- I know how to sketch graphs that show the kinetics region becoming the equilibrium region (time vs. concentration.) I know how to include the reaction stoichiometry in these graphs (one A becoming two B, etc.)
- Given a graph such as the one described above, I can write the chemical equilibrium and 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:
 - adding/removing a component,
 - changing the volume,
 - 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 $K_C = k_{\text{fwd}}/k_{\text{rev}}$ (as per the shoebox water demo.)
- I understand what a catalyst does and doesn't do to the kinetics and equilibrium regions.

Chapter 14. (2013 version, due to the snow day)

- I know how to identify a strong acid from the list I have memorized. These six strong acids were first introduced in Section 4.5 (last semester).
- I can identify strong bases, in particular the Group I hydroxides.
- 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 \rightleftharpoons).
- I know the equations for interconverting pH, and $[\text{H}_3\text{O}^+]$. You should know how the pH scale works and which pH is most acidic, least acidic, most basic, least basic.
- I know the equations for interconverting pOH, and $[\text{OH}^-]$.
- I can do ICE table calculations for strong acids and strong bases.
- I can calculate the pH of any strong acid or base given the initial concentration.

On the exam I will tell you the relationship between $[\text{H}_3\text{O}^+]$ and $[\text{OH}^-]$, namely: $[\text{H}_3\text{O}^+] \times [\text{OH}^-] = 1 \times 10^{-14}$. This was to be covered in today's lecture. We will definitely review it Monday, and as I said, I won't expect you to know it outright – the equation will be provided on the exam. You will, however, be required to use it.



Similarly, I will also tell you the relationship between pH and pOH, namely: $\text{pH} + \text{pOH} = 14$.

The sections in Chapter 14 that we covered include: Sections 14.1, 14.2, 14.3, 14.5, and 14.7. You should be able to do problems like 14.1, 14.5(a), and 14.10(b) without additional information from me. With the equations linking pH to pOH and $[\text{H}_3\text{O}^+]$ and $[\text{OH}^-]$, you can do problems like 14.7, 14.8, 14.10(a), 14.11 and 14.12, and similar end-of-chapter problems.