7.S: Acid-base Reactions (Summary)

Before you move on to the next chapter, you should:

- Know the Bronsted-Lowry definition of acidity and basicity: a Bronsted acid is a proton donor, a Bronsted base is a proton acceptor.
- Know the Lewis definition of acidity and basicity: a Lewis acid is an electron acceptor, a Lewis base is an electron donor.
- Understand that the Lewis definition is broader: all Bronsted acids are also Lewis acids, but not all Lewis acids are also Bronsted acids.
- Be able to draw a curved arrow mechanism for both Bronsted and Lewis acid-base reactions.
- Know the expressions for K_a and pK_a.
- Commit to memory the approximate pKa values for the following functional groups:
  - H_3O^+, protonated alcohol, protonated carbonyl (~ 0)
  - carboxylic acids (~ 5)
  - imines (~ 7)
  - protonated amines, phenols, thiols (~ 10)
  - water, alcohols (~ 15)
  - α-carbon acids (~ 20)
- Be able to use pK_a values to compare acidity: a lower pK_a corresponds to a stronger acid.
- Know that:
  - For a given pair of acids, the stronger acid will have the weaker conjugate base.
  - For a given pair of basic compounds, the stronger base will have the weaker conjugate acid.
- Be able to identify the most acidic/basic groups on a polyfunctional molecule.
- Be able to calculate the equilibrium constant of an acid base equation from the pK_a values of the acids on either side of the equation.
- Be able to use the Henderson-Hasselbalch equation to determine the protonation state/charge of an organic compound in an aqueous buffer of a given pH.
- Understand the idea that the best way to compare the strength of two acids is to compare the stability of their conjugate bases: the more stable (weaker) the conjugate base, the stronger the acid.
- Be able to compare the acidity or basicity of compounds based on periodic trends:
  - acidity increases left to right on the table, so alcohols are more acidic than amines
  - acidity increases top to bottom on the table, so a thiol is more acidic than an alcohol.
- Be able to compare the acidity or basicity of compounds based on protonation state: H_3O^+ is more acidic than H_2O, NH_4^+ is more acidic than NH_3.
- Understand how the inductive effect exerted by electronegative groups influences acidity.
- Understand how resonance delocalization of electron density influences acidity.
- Be able to explain/predict how orbital hybridization affects the relative acidity of terminal alkynes, alkenes, and alkanes.
- Be able to explain why phenols are more acidic than alcohols, and how electron-withdrawing or donating groups influence the acidity of phenols.
- Be able to identify the relative basicity of a nitrogen-containg group in a compound, based on whether it is an amine, amide, imine, aniline, or 'pyrrole-like'.
- Be able to identify □-carbon(s) on a carbonyl compound, and explain why □□protons are weakly acidic. You should be able to draw the enolate conjugate base of a carbonyl compound.
- Be able to identify tautomeric relationships, specifically keto-enol and imine-enamine tautomers.
- Understand what a polyprotic acid is, what is meant by multiple pKa values, and why these values get progressively higher.