After going through the readings & problems and attending the lectures & discussion groups, you should be able to:

- Explain the difference between solutions of strong and weak acids and bases.
- Explain how the pH of a solution is related to its hydronium ion and hydroxide ion concentrations.
- Calculate the pH and pOH of a solution of a strong acid or base.
- Calculate the pH and pOH of a solution of a weak acid or base.
- Calculate the pH and pOH for polyprotic acids and bases.
- Write expressions for acidity ($K_A$) and basicity ($K_B$) constants.
- Understand the conjugate seesaw ($K_A K_B = K_W$) and related equations ($pK_A + pK_B = pK_W$) and how to use them problem solving and in calculations.
- Show how the acidity constant of an acid is related to the basicity constant of its conjugate base.
- Describe water autoprotolysis and derive $pK_W = pH + pOH$.
- Use $K_A$ or $pK_A$ values to predict the relative strengths of acids.
- Use $K_B$ or $pK_B$ values to predict the relative strengths of bases.
- Use $pK_A$ values to determine the predominant species of a weak acid or a weak base in solution.
- Calculate the percentage ionization (dissociation) of a weak acid or a weak base.
- Calculate the pH of salt solutions. E.g. Salt formed at the stoichiometric point in a titration.
- Calculate the pH of a weak acid and its salt (this is how acidic buffers are made).
- Calculate the pH of a weak base and its salt (this is how basic buffers are made).
- Calculate the pH in these industrial, environmental, and biological examples: Carbon dioxide reacts with water to form carbonic acid, which makes carbonated drinks acidic, acidic rain, rivers, and lakes in the environment, and respiratory acidosis and death in biological systems.

* Except for sulfuric acid (and a few other rare cases), to calculate the pH of a polyprotic acid, use $K_{A1}$ and take only the first deprotonation into account; that is, treat the acid as a monoprotic weak acid. Subsequent deprotonations do take place, but provided $K_{A2}$ is less than about $K_{A1}/1000$, they do not affect the pH significantly and can be ignored. For sulfuric acid assume 100% deprotonation for step 1 and setup the equilibrium for step 2 (2nd deprotonation). See section 6E.1 for a very clear example.