Chemistry 480A

Study Guide for Exam 3

1. You should know from memory:
   - The expression for osmotic pressure
   - The Gibbs phase rule
   - The relationship between $K_{\text{thermodynamic}}$ and $\Delta G^\circ$
   - The equation for $\Delta G$ when reaction components are not in their standard states
   - The expression for ionic strength
   - The relationship between $\Delta G^\circ$ for the cell reaction and the emf of the cell
   - The Nernst equation
   - $E^\circ$ for the standard hydrogen electrode
   - $E^\circ = E_{R}^\circ - E_{L}^\circ$
   - The electrochemical cell conventions

2. You should know how to:
   - Derive the expression for vapor pressure depression (from Raoult’s law)
   - Calculate the osmotic pressure of ionic and nonionic solutions
   - Sketch and/or analyze (both $p$ vs $X$ and $T$ vs $X$ versions of) a two-component liquid-liquid phase diagram
   - Sketch and/or analyze a two-component, liquid-solid phase diagram
   - Identify solid solutions, compound formation, and incongruent melting points in phase diagrams
   - Calculate $K$ from $\Delta G^\circ$ and vice versa
   - Calculate $K$ for reactions at temperatures other than 25°C
   - Define a suitable $\gamma^\infty$ for an ionic compound in water solution
   - Find the expression for $a_{\text{salt}}$ for ionic solutions in terms of molality and $\gamma^\infty$
   - Use the various forms of the Debye-Hückel limiting law to calculate $\gamma^\infty$ for an ionic compound in solution
   - Incorporate electrical work into the combined first and second laws of thermodynamics
   - Write the cell reaction from the diagram of the cell and vice versa
   - Calculate $E^\circ$ and $E$ for an electrochemical cell
   - Use a table of half-cell reduction potentials
   - Calculate $\Delta G^\circ$ or $\Delta G$ from $E^\circ$ or $E$ for an electrochemical cell reaction and vice versa
   - Find the equilibrium constant for an electrochemical cell reaction from $E^\circ$
   - Find $\Delta S^\circ$ and $\Delta H^\circ$ for an electrochemical cell reaction given $E(T)$
   - Analyze a concentration cell

3. You should understand:
   - What is meant by components, phases and degrees of freedom
   - The origin of the Gibbs phase rule
   - Vapor pressure depression, melting point depression, and boiling point elevation
   - What the symbols $|$ and $\|$ mean in electrochemical cell notation
   - What a liquid junction is
   - The function of a salt bridge