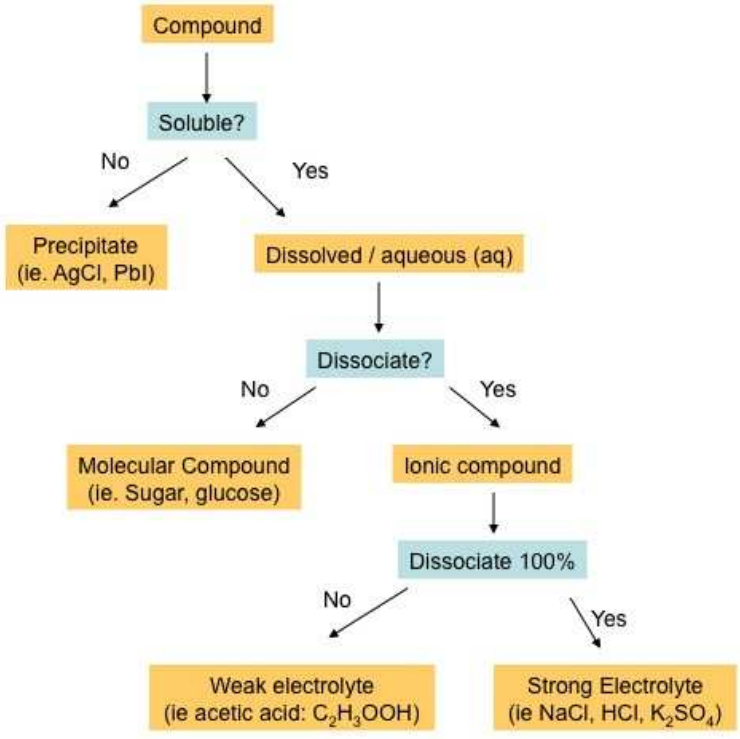
CHM 115 Exam 2 Study Guide

Chapter 3.7 Stoichiometry

- Identify limiting reagents
- Given quantities of two reactants in grams, predict how much product will be made

Chapter 4 Aqueous Reactions

- Understand the table below and how to identify different species as strong/weak electrolytes, as a molecular compound, or as precipitates.



A word of caution about the chart above: it is useful for organizing compounds we have encountered thus far in CHM 115. It will not be useful to describe organic compounds such as oil, which isn't soluble in water, but isn't a precipitate….just a warning.

- conductivity in solution is proportional to the number of ions present

- weak electrolytes are in dynamic or chemical equilibrium between the ionized and non-ionized states. They are generally about 99% non-ionized and only around 1% are in ionic or dissociated form.
- Know how to read the solubility guideline table
- Know that NO_3^- and NH_4^+ are always soluble
- Metals that are commonly insoluble include Ag^+, Hg_2^{+2}, and Pb^{+2}
- Be able to write net ionic equations and identify spectator ions (ions that do not participate in the reaction)
- acids increase the concentration on H+ when dissolved in water
- bases increase the concentration of OH- when dissolved in water
- strong acids and strong bases dissociate 100%
- weak acid and weak bases dissociate ~1%
- Acid + base → salt + water
- Some neutralization reactions produce gases such as CO_2
- Oxidation reduction reactions involve exchange of electrons
- An atom is oxidized if it loses electrons. An atom is oxidize if its oxidation number increases. (both definitions are equivalent)
- An atom is reduced if it gains electrons. An atom is reduced if its oxidation number goes down. (both definitions are equivalent)
- Know the rules for figuring out oxidation numbers
- To identify oxidation-reductions reactions identify which species got oxidized and which got reduced.
- Be able to interpret the activity series (Table 4.5) to predict whether or not a redox reaction will occur, but you do not need to memorize any of it.
- Know how to calculate the molar concentration of a solution.
- Know how to make dilution calculations (Ci Vi = Cf Vf)

Chapter 5 Thermochemistry

- Be familiar with terms like, energy, heat, work, kinetic energy, potential energy, system, surroundings, exothermic, and endothermic.
- Know the 1^{st} law of thermodynamics

- Know change in internal energy (ΔE) is defined as $E = q + w$
- Know what a state function is, and that ΔE and ΔH are state functions
- know the sign convention for q and w, when they are positive and when they are negative, regarding heat and work into/out of a system.
- know that work = $-P\Delta V$
- Enthalpy is defined as $\Delta H = \Delta E + P\Delta V$, and is analogous to internal energy
- Three points about enthalpy of a reaction: 1) it is extensive (depends on quantity), 2) the reaction can be reversed and the sign of the enthalpy should be changed, 3) don't forget the state of the reactants/products ($H_2O_{(g)}$ does have the same enthalpy as $H_2O_{(l)}$)
- Specific heat (s) is the amount of energy to raise 1 g of a substance by 1 degree C (or 1 K…same thing). Specific heat has units of J / g K.
- A calorimeter is a device to measure the heat exchange associated with a reaction.
- Hess's Law states that enthalpies of individual reactions can be added together to calculate enthalpies of net reactions.
- Enthalpies of formation are the enthalpy associated with the formation of a compound from its elements in their standard state.
- The standard state of an element is the state in which it is most stable at room temperature and atmospheric pressure. i.e. oxygen exists as $O_{2(g)}$ in its standard state (not $O_{2(l)}$ or $O_{3(g)}$).
- Enthalpies of formation can be assembled to calculate the ΔH for more complex reactions.

Chapter 6 Electronic Structure of Atoms

- Visible light is a small portion of the electromagnetic spectrum.
- Electromagnetic (EM) radiation is both wave-like and particle-like.
- Waves have a wavelength, and frequency. All EM radiation travel at the speed of light c, ($c = 3 \times 10^8$ m/s)
- The frequency of EM radiation, $\nu = c / \lambda$. Where c is the speed of light, and λ is the wavelength.
- Particles of light are called photons and have energy $E = h\nu$. h is Planck's constant (6.626×10^{-34} J s – don't memorize)