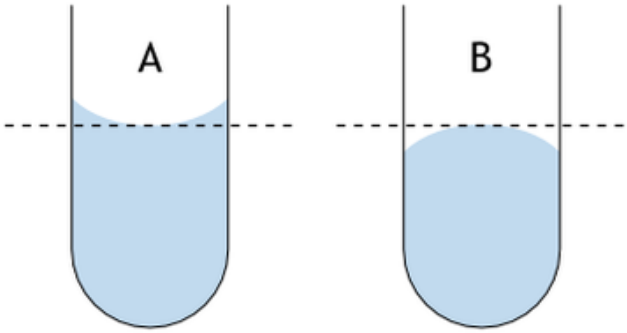
CHEM 1212 Lab Practical Tips:

Note: This is just a suggested list of topics to review for the lab practical. This is to help you find direction in what to study.

1) Be able to read a burette and/or graduated cylinder:



The meniscus is the curve seen at the top of a liquid in response to its container. The meniscus can be either concave or convex. Measure so that the line you are reading is even with the center of the meniscus. For water and most liquids, this is the bottom of the meniscus.

2) Understanding significant figures is incredibly important in the lab practical for reading glassware! Understand that for a graduated cylinder and a burette, you need to record your answer to two places behind the decimal. For example, if you read 9.5 mL on the graduated cylinder you need to record the answer as 9.50 mL

3) Don't forget to include units in your answers! For example, if you are measuring something with a ruler, report your answer in cm or inches (depending how you are doing the measurements)!

4) **Percent Yield:** In perfect conditions, the amount of product formed from a chemical reaction (**Actual Yield**) would always equal the maximum amount of product that should form based on the limiting reactant (**Theoretical Yield**). In practice this is not the case. The amount of a product formed during an *ACTUAL* chemical reaction is usually smaller than the amount predicted by Stoichiometry.

- **Theoretical yield** is always determined by the stoichiometry of a balanced chemical reaction.
- **Actual yield** is ONLY determined experimentally and may be provided to you in a problem.
- **Percent yield** describes the efficiency of a reaction, and is given by the following equation:

$$Percent\ Yield = \frac{Actual\ Yield}{Theoretical\ Yield} \times 100$$

5) For the Calorimetry experiment, please review the calorimetry section of your chapter 9 workshop. Also look over notes regarding specific heat (ie lower specific heat = easier to heat up.)

6) For the Rate of Decolorization experiment, understand the y axis represents -ln(A) and the x axis represents the time (in seconds). The slope of the graph will give you the observed rate constant.

<u>Concentration and Rates</u>:

As the concentration of reactants change at constant temperature, the rate of a chemical reaction will also change. The rate law of a reaction describes how the rate of the reaction changes based on the concentration of the reactants or products. The general rate-law for a reaction in which A, B and C are reactants is shown below:

$$rate = k[A]^x[B]^y[C]^z$$

Define the following parameters:

a. **Exponents x, y, and z**: Correspond to the order of each reactant in the rate law. Increasing the order of a reactant results in an increase in the effect that changing the concentration of that reactant has on the rate of the overall reaction. The sum of the individual orders of each reactant will provide the order of the overall reaction.

$$order\ of\ the\ overall\ reaction = x + y + z$$

b. **Rate Constant k**: The rate constant, k, is a constant that is specific to reactions at a given temperature and pressure. The units of the rate constant, k, will depend on the overall order of the reaction being observed. The rate constant, k, must be present in units which will ultimately cancel the units of the reactants (and their order) such that the final rate is given in concentration/unit time.

Units for the rate constant k:

$$units\ of\ rate\ constant\ k = \frac{M^{1-(x+y+z)}}{s}$$

7) For the Chemical Kinetics experiment, understand how to determine to order of a reaction based on a graph:

- **The Graphical Plot of a First-Order Reaction:** If given experimental data, a plot of ln[A] versus time will produce a straight line if the reaction is first order. The slope of the line will be given by the equation below where k is the first-order rate constant. slope = *-ak*
- **The Graphical Plot of a Second-Order Reaction:** If given experimental data, a plot of 1/[A] versus time will produce a straight line if the reaction is first order. The slope of the line will be given by the equation below where k is the second-order rate constant. slope = *ak*
- **The Graphical Plot of a Zero-Order Reaction:** If given experimental data, a plot of [A] versus time will produce a straight line if the reaction is first order. The slope of the line will be given by the equation below where k is the zero-order rate constant. slope = *-ak*

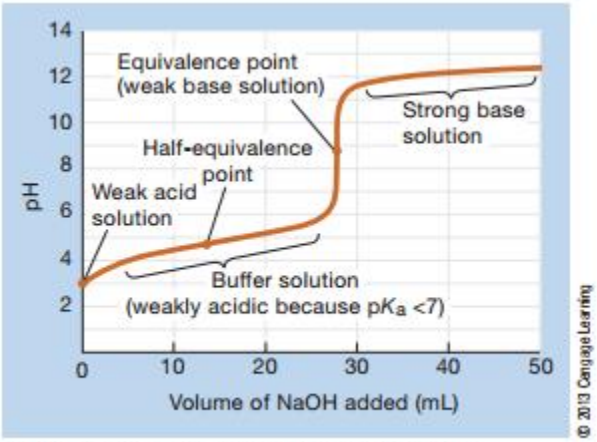
8) Understand that the The Beer-Lambert Law shows the direct relationship between concentration and absorbance:

$$A = \epsilon l c$$

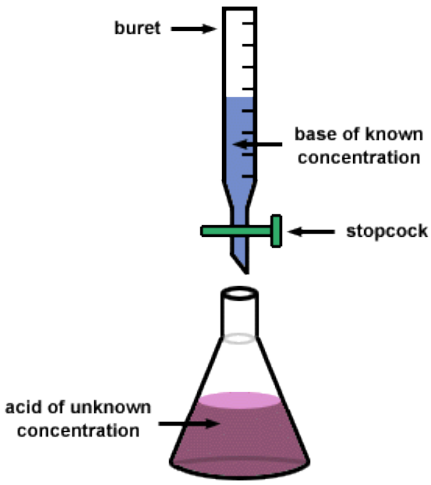
where A is absorbance, ϵ is molar absorptivity, l is path length, and c is concentration. Understand that in the graph you made, the y axis represented absorbance and the x axis represented concentration. The slope of the line of this graph gives you molar absorptivity (ϵ).

9) For the Titration experiments:

- **Titrations**: A titration is an analytical method of accurately determining the concentration of an acid, base or some other unknown component of a solution (known as *analyte*).
- In a titration, a solution of known concentration (known as a *titrant*) is slowly added to a solution of a known analyte of unknown concentration.
- The *end point* of a titration is the point at which there is no further change in pH.



pH plot for the titration of CH_3CO_2H with NaOH



- **Titration Curve**: A plot of pH versus volume of titrant added to the analyte solution can be rendered and this plot is known as a *titration curve*.
- **Equivalence Point**: The equivalence point of the titration reaction is reached when the analyte has been exactly fully consumed by the titrant. At this point, the conjugate of the analyte is present in the same number of moles as the analyte was initially.
- **Half-Equivalence Point**: this point is reached when exactly half of the analyte has been consumed by the titrant. <u>NOTE</u>: At half equivalence point pH = pKa
- For the pH vs volume of titrant added, understand the y axis is the pH and the x axis is volume of base (in mL).

10) In the Ksp experiment, understand the common ion effect. Solubility of an ionic compound is lower is a solution containing a common ion that in pure water.

11) In the Preparation of a Solar Cell experiment, understand the formula for calculating watts is: current x volts = watts. Understand the anode is where oxidation takes place (AN OX) and the cathode is where reduction takes place (RED CAT).