Additional Experimental Procedures for Day 1 – the Day of Checking In

(Please don't forget to bring your goggles on the first day)

Prepare and standardize a 0.1M NaOH solution.

Part A. Preparation of a 0.1M NaOH by dilution.

After checking in, students are instructed to prepare 250-mLs of 0.1 M NaOH solution by diluting available NaOH stock solutions. These stock solutions will be dispensed using burets already set up for that purpose. Note down the concentrations available and make a calculation of how many mLs are needed. Recall that the dilution equation is:

$M_{stock}V_{stock} = M_{diluted}V_{diluted}$ or, as it is commonly written: $M_1V_1 = M_2V_2$.

For instance, if the available stock is 2 M, and you want to prepare 250.0 mLs of 0.1M, then you can let "1" represent the stock solution and "2" represent the diluted solution where M_1 = 2 M, M_2=0.1M, V_2 =250.0 mLs and solve for V_1. In this example,

$$V_1 = \frac{M_2V_2}{M_1} = \frac{(0.1M)(250mL)}{(2M)} = 12.5 \text{ mLs}$$

Procedure: Quickly calculate the volume of NaOH needed (see above example). **DON'T FORGET TO PUT ON YOUR GOGGLES!** Collect the *approximate* volume calculated into a clean 250-mL volumetric flask. Note the mark on the flask. Very carefully add just enough water to make it up to the mark. It is usually necessary to use a wash bottle or a capillary pipet to add the last few mLs and not overshoot the mark. (Use this as a time to learn to properly fill up the volumetric flask). Mix your newly prepared NaOH solution but inverting the *capped* volumetric flask several times. Note that volume accuracy is not as critical in this part of the procedure as it is in Part B (below) when you will be doing a careful standardization.

Part A Data to be recorded:

Record the following data in your notebook or data sheet, for this part. This will be reported as part of your data in the pH and pH titration lab report.

Molar concentration of NaOH Stock Solution: M_1 = _____ M

Calculation: $V_1 = \frac{M_2V_2}{M_1} = \frac{(0.1M)(250mL)}{(\quad)}$ = _____ mLs

mLs of NaOH stock solution used (collected):

Initial buret reading _____ mLs

Final buret reading _____ mLs

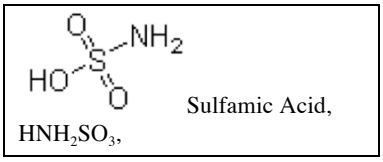
Net volume dispensed _____ mLs

Part B. Standardization of the 0.1M NaOH Solution.

After thoroughly mixing your 0.1M NaOH solution by inverting your *capped* 250-mL volumetric flask several times, you need to *standardize* your solution. (It is important for the student to realize that the concentration of the solution is still not accurately known. Why is that?). It is approximately 0.1 M, a level of accuracy which is not sufficient for its use in the second experiment (Expt #15, pH and pH Titrations). Thus, the goal of Part B is to analyze its actual concentration to at least 3 decimal places by a procedure called standardization.

Standardization of the 0.1M NaOH solution is carried out by titrating it against a *standard* solution (i.e. of *accurately known* concentration). The standard is **sulfamic acid**, HNH_2SO_3, a monoprotic weak acid which will be made available in burets so it is easily dispensed and its concentration will be labelled (around 0.1-0.12 M). The reaction is as follows:

$$HNH_2SO_3(aq) + NaOH(aq) \rightarrow NaNH_2SO_3(aq) + H_2O$$



Sulfamic Acid, HNH_2SO_3,

Procedure: Prepare three(3) clean 250-mL erlenmeyer flasks and to each of them, dispense three(3) aliquots of 25 mLs each (recorded accurately to 2 decimal places) of **sulfamic acid standard** solution. To each flask, add 2-4 drops of phenophthalein indicator. Set up your buret in your work counter, rinse it twice with a few mLs of NaOH (about 5 mLs each time) and then fill it and adjust the level to the 0.00 mL mark making sure you have displaced the air bubble at the tip. A good way to fill your buret is to use a beaker rather than a funnel to pour your 0.1M NaOH at eye level into your buret, while holding it over the drain.

Titrate each sulfamic acid standard solution to a very faint pink and record your endpoints accurately to 2 decimal places. The actual concentration of your NaOH solution can be determined as follows: At equivalence , we have:# moles NaOH = # moles sulfamic acid
And since # moles = molarity x volume(inL), we can write:

$$M_{NaOH}V_{NaOH} = M_{SulfamicA}V_{SulfamicA} \quad \text{or,} \quad M_{NaOH} = \frac{M_{SulfamicA}V_{SulfamicA}}{M_{NaOH}}$$

Part B Data to be recorded: Record the following data in your notebook or data sheet, for part B. This will be reported as part of your data in the pH and pH titration lab report.

Molar concentration of Sulfamic Acid Standard Solution: _____±_____ M
Sulfamic acid aliquots (mLs of sulfamic acid standard analyte used) uncertainty= ±_____mLs

mLs of Sulfamic Acid	Aliquot #1	Aliquot #2	Aliquot #3
Initial buret reading	mL	mL	mL
Final buret reading	mL	mL	mL
Net volume dispensed	mL	mL	mL

Endpoints of titration (volumes of NaOH titrant used) uncertainty= ±_____ mLs

mLs of NaOH	Aliquot #1	Aliquot #2	Aliquot #3
Initial buret reading	mL	mL	mL
Final buret reading	mL	mL	mL
Net volume dispensed	mL	mL	mL

Calculations to be reported in your pH and pH titration experiment (week 3):

For each of the three aliquots, calculate the molar concentration of your NaOH solution. Average the three molar concentrations and determine its standard deviation and include that in your pH and pH Titration experiment lab report.