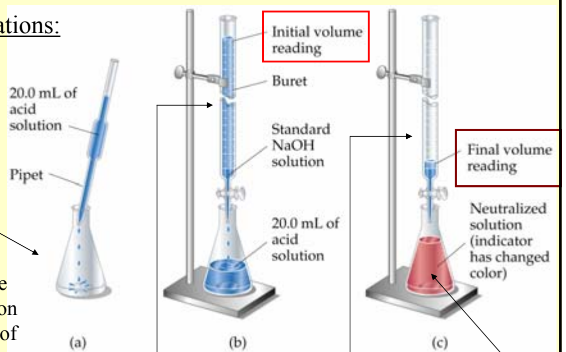
Please read section 5.10 and the following notes (not covered in class) on titration and standardization. This material pertains to experiment 5 and your HW.

Standard Solutions:

- Some solutions cannot be accurately made by weight and dilution methods if the solute is impure or unstable.
- When this is the case, one can make up a solution of approximate concentration then "***Standardize***" the solution against a "**Standard**" compound that reacts with the solute in solution.
- A standard compound is one that is very stable with a known molar mass that yields a necessary number of sig. figs. (4 or more)
- To standardize a solution, one performs a "***Titration***" where a measured volume of the solution is added to a known amount of the standard.
- An "***Indicator***" is added to signal the point where the moles of standard = moles of solute reacted (***Endpoint***), knowing moles and volume, one can compute the concentration of the solution.

Next page: acid/base titrations overview and a standardization example

Acid/Base Titrations:



A known amount of Standard is added to a flask.

The standard can be an aliquot of solution or a weighed mass of solid.

A small amount of indicator is added.

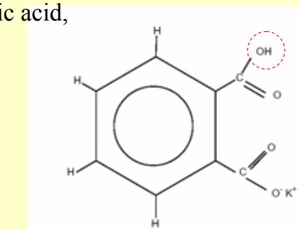
A buret is filled with the unknown solution.

The initial volume of the buret is recorded.

The solution is added until the indicator changes color.

The final volume is recorded.

A common standard used in base (OH^-) standardizations in the mono–protic acid, KHP.



KHP is an acronym for:

potassium hydrogen phthalate

(not potassium hydrogen phosphorous)

The proton in the upper right of the compound dissociates to yield $H^+(aq)$

1 mol of KHP yields 1 mol of H^+ when dissolved in solution

$$KHP(aq) \rightarrow H^+(aq) + KP^-(aq)$$

The molar mass of KHP is 204.22 g/mol ($C_8H_5O_4K$)

Jane (again not to be outdone by her brother) prepares a solution of NaOH(aq).

She performs a standardization of the solution using KHP as the standard.

Determine the $[OH^-]$ from the data collected:

mass KHP + flask:	95.3641 g	final buret reading:	30.12 mL
mass empty flask:	95.0422 g	initial buret reading:	1.56 mL
mass KHP:	0.3219 g	vol. NaOH:	28.56 mL

$$[OH^-] = \frac{\text{mols } OH^-}{\text{L of solution}} = \frac{\text{mol KHP}}{\text{L titrated}}$$

$[OH^-] = [NaOH]$ ***Strong Electrolyte!!!***

from the stoichiometry, one mole of OH^- reacts with 1 mol of KHP

$$0.3219\text{g KHP} \times \frac{1\text{mol KHP}}{204.22\text{ g}} \times \frac{1\text{ mol } OH^-}{1\text{mol KHP}} \times \frac{1}{28.56\text{ mL}} \times \frac{10^3\text{ mL}}{\text{L}}$$

$$= 0.05519\text{M } OH^-$$

$$[NaOH] = 0.05519\text{ M}$$

remember… strong electrolyte $[OH^-] = [NaOH]$