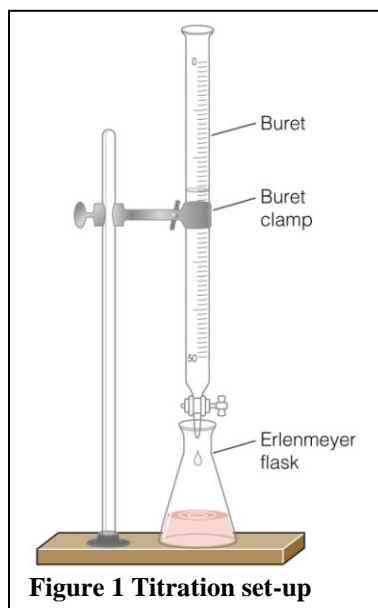PHYS 251
Titration Simulation to determine Concentration

Objective/Purpose: To experimentally determine the concentration of an acid and a base.

Background: A titration is a method of determining the concentration of a chemical by adding another chemical that reacts with it to an endpoint. The titration procedure is accomplished by adding small amounts of one reactant to a beaker or flask containing the other reactant until the reaction is completed. In an acid-base reaction, the reaction is complete when the amount of acid (number of H^+ ions) equals the amount of base (number of OH^- ions).

   This equivalence point may be detected by a pH meter, but more often is detected by a color change. A color change is a more affordable option available with a number of indicators. A drawback of these is the sensitivity of the human detection system. A slight color may appear before the human eye can detect it. Another problem with indicators is that their color changes at pH's other than the equivalence point.

   Titrations are often accomplished using a buret and a flask. Small amounts of the solution are allowed to flow out of the buret into the flask by turning the stopcock. Often localized color changes will be evident for a short period of time. Mixing the solution by swirling the flask will usually cause the color to return to the original color. As the color lasts longer, the next addition of solution needs to be smaller. Close to the endpoint (reaction completion), the additions are one drop at a time.

Figure 1 Titration set-up

Figures:

Videos: http://www.youtube.com/watch?v=8UiuE7Xx5l8&feature=related

Equations:

$$M_A V_A = M_B V_B$$

(Molarity of acid) x (Volume of acid) = (Molarity of base) x (Volume of base)

Materials Needed:

   Apparatus: Computer, calculator, pencil, paper

   Chemicals: None are needed for this experiment. All will be simulated.

   Miscellaneous:

References:
http://group.chem.iastate.edu/Greenbowe/sections/projectfolder/flashfiles/stoichiometry/acid_base.html
http://wps.prenhall.com/wps/media/objects/439/449969/Media_Portfolio/Chapter_16/FG16_13.JPG

Partner(s) First and Last names   Section _____ Date _____ Time _____
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Procedure: Open this Acid/Base Simulation program.
1. Select type of reaction (see data sheet).
2. Fill the burette with (see data sheet).
3. Select the a) acid and b) base (team preference). Record formulas on data sheet, in addition to volume and concentration given on data sheet.
4. Select the indicator (decide and record on data sheet).
5. Push slider (large volume) or press button (drop wise) to dispense from burette. When color change occurs, end point has been reached. Record volume dispensed.
6. After titration, calculate concentration of reagent in flask. Enter value in box and on data table.

Data Table:

Experiment 1			Experiment 2	
1)Type of reaction	Weak acid/Strong base		1)Type of reaction	Strong acid/Strong base
2) Fill burette with	Acid		2) Fill burette with	Acid
3a) **Select the acid**	Write formula here		3a) Select the acid	Write formula here
3b) **Select the base**	Write formula here		3b) Select the base	Write formula here
Flask concentration	M		Flask concentration	M
Flask volume	mL		Flask volume	mL
4) **Select the indicator**	Write name here		4) Select the indicator	Write name here
5) **Volume dispensed**	mL		5) Volume dispensed	mL
6) **Concentration**	M		6) Concentration	M

Experiment 3			Experiment 4	
1)Type of reaction	Strong acid/Strong base		1)Type of reaction	Weak acid/Strong base
2) Fill burette with	Base		2) Fill burette with	Base
3a) Select the acid	Write formula here		3a) Select the acid	Write formula here
3b) Select the base	Write formula here		3b) Select the base	Write formula here
Flask concentration	M		Flask concentration	M
Flask volume	mL		Flask volume	mL
4) Select the indicator	Write name here		4) Select the indicator	Write name here
5) Volume dispensed	mL		5) Volume dispensed	mL
6) Concentration	M		6) Concentration	M