Acid/Base Titration Lab

Objectives:

- observe the "end point" of a solution with a pH indicator during a titration procedure
- use the end point of the titration to calculate the molarity of an unknown acid

Equipment:

Note: *This is an incomplete list. Make sure you take note of all the equipment used in this lab in order to include a proper list in the "Materials" section for the writeup of this lab in your notebook.*

- burets (size??)
- buret clamp
- an acid (which one?)
- a base (yes...?)
- phenolphthalein indicator

Procedure:

Sometimes a diagram can be helpful in showing how a lab setup should be put together. At the beginning of your procedure section, before you list the steps, draw a labeled diagram showing the equipment used in this lab.

1. The burets on the buret stands have already been set up for you. Put a glass funnel in the top of each buret.
2. Make sure the stopcock is closed on both burets, then fill each buret with about 40 mL of the appropriate acid or base stock solution.
3. Add 25 mL of distilled water to your 125 mL flask.
4. Add 4-5 drops of phenolphthalein pH indicator to your flask.
5. Place your flask under the buret and add 2.0 mL of acid (record the start and ending readings in the table provided below). Turn the stopcock slowly at first and use this time to get familiar with how quickly the level in the buret drops. If you do overshoot 2.0 mL, that's ok – just be sure to record your exact start and ending readings below. Also, take note of how big a single drop is (watch the markings on the buret as your partner adds a single drop to the flask).
6. Swirl your flask to gently mix the contents, then place the flask on a white piece of paper under the buret containing the base. After noting the starting reading, add the base 0.5 mL at a time. Notice the solution turns pink where the base is added. Gently swirl the flask each time until the pink color disappears. As you get closer to the endpoint, you'll notice more of the solution turning pink before the color disappears. Start adding the base in smaller increments. When you add the "last drop" and the whole solution changes color and does ***not*** change back after swirling, you've reached the endpoint. Be sure to record the buret reading for the endpoint.

7. After you've finished the "trial run", you should have a pretty good idea about how much base will be required to neutralize the acid. Rinse your flask out with distilled water, and repeat the procedure for three different runs (starting with 4.0 mL, 6.0 mL, and 8.0 mL of acid). Get your end titration to the point where adding a single drop will change the entire solution's color. If you do overshoot, don't panic and don't dump your solution and start over. Simply add a few more mL of acid (this is called "back-titrating") from the acid buret (being sure to record the additional start/ending readings) and place your flask back under the base buret and titrate more slowly this time.
8. Calculate the molarity of acid from each run. Calculate the average of your three runs.

Data:

Given molarity of base (NaOH): _____

Buret Readings	**Trial Run**		**1st Run**		**2nd Run**		**3rd Run**	
	Start	**End**	**Start**	**End**	**Start**	**End**	**Start**	**End**
HCl batch ____								
NaOH batch ____								

Analysis/Results:

1. What was the average molarity of the acid?
2. You added the initial acid to 40 mL of water. How do you think the results would have been affected if you'd used only 10 mL of water? or 70 mL of water? Explain your reasoning.
3. How precise is titration: Figure out the pH of your acid given the [HCl] you calculated. Recalculate the molarity of the acid if the titration had taken 0.1 mL more. Recalculate the pH for this new concentration. How much of a pH change does 0.1 mL measure? How does this compare with a single drop? How does this compare to pH meters? (Electronic pH meters often measure pH to the nearest 0.1. Expensive pH meters may measure to the nearest 0.01)

Conclusion:

Draw your own!