**Principles of Chemistry I**

**General Laboratory Techniques**

**6. Titration**

The purpose of titration is to determine the precise volume of a solution needed for a reaction. This is done by using a buret to add small amounts of the solution to the reaction flask until some indicator changes color. The amount of solution added is determined by noting the initial and final buret readings.

The solution in the buret is called **titrant**. The point in the experiment where the indicator permanently changes color is the **endpoint**.

**Titration Technique**

* Secure the buret to a stand. Fill it with titrant to a point above the zero volume mark.
* Place a refuse beaker under the buret and turn on the stopcock full forte allowing the titrant to drain a bit below the zero mark .
* This full forte drainage is meant to eliminate any air gaps in the stopcock and tip. Check the tip and barrel for air gaps and bubbles. If there are any, consult with your instructor.
* Record the volume reading on the buret (Your initial volume reading need not be at zero.) Remove any drops on the tip by touching the tip to the side of the refuse beaker.
* Remove the refuse beaker and place the solution flask to be titrated under the buret. Be sure the indicator has been added to the flask.
* By carefully turning the stopcock, add small amounts of titrant to the flask; swirl the flask after each addition to completely mix the two solutions.
* Continue additions until one drop of titrant causes a permanent (30 sec) color change in the flask to which the titrant is being added. This is the endpoint of the titration. Record the volume reading of the buret and calculate the total volume of titrant solution that has been added.

**Tips on Titrating**

The following suggestions can improve the accuracy of your titration:

1. Make your buret reading as precisely as possible. Determine the reading to a hundredth of milliliter by estimatimg the distance between volume markings. Wait 15 seconds before making a reading. This allows the solution on the sides of the buret barrel to finish draining. If you find it difficult to see the exact bottom of the meniscus, place a darkened piece of paper behind the buret and about 1 cm below the meniscus. The meniscus will "reflect" this darkening and become more distinct.

2. The endpoint should be located to within one drop (̴ 1/20 mL). Adding one drop at a time through the entire titration takes a great deal of time and is boring. There is a way around the problem. Begin by adding about 1/2 to 1 mL at a time and watch the coloring where the titrant hits the solution. If the color change dispels by itself, the endpoint is not close. If you must swirl the flask to dispel the color change, you are getting closer and must dose down the size of the addition. When two or more swirls are needed to dispel the color change, you are very close and should make single drop additions. Alternatively if you have a reasonable idea of where the endpoint should be, add 80% of the needed titrant in one shot and then begin your drop by drop additions.

3. Place a white sheet of paper under the flask. This will allow you to see the color changes more clearly.

4. Near the end of the titration, rinse down the insides of the flask with a little distilled water to return all chemicals to the body of the solution.

5. Do not trust the results of a single titration. Repeat the titration of a particular solution at least two more times to check on the reproducibility of your result.