

# Titration Tips

The following information has been compiled by a student experienced in titration experiments. It is not exhaustive and is in no particular order.

- 1) It is very important that your buret be clean. An easy way to clean a buret is to rinse it once or twice with deionized water and then once or twice with the solution to be used. To do this, add about 3-5 mL of solution to the buret. Hold it almost horizontally so that the solution runs down the side, but not out the top. Rotate the buret so that all the surface of glass is rinsed. Run some of the solution out the tip and pour the rest out the top! (This rinsing technique also works well for pipets!)
- 2) How to tell if your glassware is clean -
  - A. it should look clean
  - B. water/solutions should run through it smoothly leaving no droplets clinging to the sides.
- 3) Don't clean a buret or pipet with soap unless it is absolutely necessary. Suds are a lot easier to get in than they are to get out! If you rinse the glassware carefully with deionized water after each use, you may never need to wash it with soap.
- 4) Glassware from the storeroom is not always clean. (Sad, but true!)
- 5) You can titrate into any container large enough to hold the volume to be added and the unknown. However, it is usually best to titrate into an Erlenmeyer flask because you can swirl the flask easily without danger of sloshing out the contents.
- 6) Always check your buret before you fill it with solution to make sure that it does not leak.
- 7) Always place a container such as a small beaker below the buret when you are filling it. Be sure the stopcock is closed!
- 8) Bubbles in the buret tip can usually be removed by tapping the side of the buret while the stopcock is open. This is best done over a sink!
- 9) Always use a sliding double buret clamp to fasten your buret to a ring stand. It makes it easier to get under the buret and to raise or lower it to eye level for an accurate reading.
- 10) Burets must always be read to  $\pm 0.01$  mL. Read the volume at the bottom of the meniscus. You have to get your eye at the same level as the meniscus! Depending on the color of the calibrations it is often helpful to put either a piece of white paper or dark paper behind the scale when making a reading. Some people like to use a white card with a heavy dark line to "lineup" the meniscus with the scale.

- 11) When filling the buret, be careful not to get solution on the outside as this can run down and eventually fall into the solution - after picking up who knows what when passing around the clamp. Some people like to use funnels when filling the buret. If you do, be sure the funnel is very clean. It is easy to run a buret over when filling with a funnel, so be careful!
- 12) If your hands suddenly feel soapy during an acid-base titration, you have probably spilled some of the base solution on them. Wash your hands and any slippery feeling glassware with lots of water right away. If your hands begin to itch or burn for no apparent reason, you have probably spilled some acid on them. Wash with lots of water. Be sure to tell your instructor if you spill any acid or base solutions on your skin.
- 13) Always place a piece of white paper under the flask to be titrated. This will help you see the color change at the end point more clearly.
- 14) Don't forget to add the indicator! If you cannot remember adding indicator after starting to titrate, go ahead and add 1 or 2 drops. A little extra indicator won't hurt anything but none at all will cause your titration to fail.
- 15) It is much easier to titrate a solution than a solid!
- 16) Hints on getting solids to dissolve:
  - a) grind them up into pieces with a mortar and pestle
  - b) swirl or stir
  - c) organic solids may dissolve better in organic solvents than in water
  - d) sometimes heating gently will help a solid to dissolve
- 17) There are lots of acid-base indicators you could use for your titration. Phenolphthalein is a good all around choice because it turns from colorless to colored (it is much easier for the human eye to distinguish than changes from one color to another) and because of the pH range over which it changes. Consult your text or other chemistry reference book if you are interested in using another indicator.
- 18) The color of a solution can interfere with that of the indicator. If your solution is colored, run a few trials to see what the solution and indicator look like at various pH values before you start to titrate. Sometimes diluting a colored solution with deionized water will make the indicator more visible.
- 19) It is easier for the eye to distinguish a change from colorless to colored than from colored to colorless, so if phenolphthalein is your indicator it is best to titrate the acid solution with the base (although in theory you could titrate either way).
- 20) While titrating, it is a good idea to wash down the walls of the flask with deionized water so that all of the titrant gets into the reaction mixture. Addition of small to moderate amounts of deionized water will not change the results of your titration.

- 21) Be consistent when reading your buret. The same eye that makes the initial reading should also make the final reading. Any absolute errors will then subtract out. This does not mean, however, that one lab partner must do all the titrations - it just means finish the ones you start!
- 22) The desired end point in a phenolphthalein titration is "A pale pink tint that persists for 30 seconds". If you are not sure if you have reached this point, record the volume of the buret, then add one more drop of base. If the solution turns dark pink or red, you were right. If not, keep titrating. As a rule of thumb, endpoints that look like pink lemonade or paler are probably satisfactory - endpoints that look like cherry kool-aid or darker will probably have to be repeated.
- 23) Some people like to do a quick "throw away" titration. They add the titrant very rapidly up to and a little beyond the endpoint to get a general idea of how much titrant will be required. Then they can perform titrations more quickly by adding titrant rapidly until the endpoint is near and then switch to adding dropwise.
- 24) If your titration seems to be taking a lot of titrant (more than 1 or 2 burets full) you may have one of the following problems:
  - a) forgot to add indicator
  - b) titrating with wrong solution
  - c) solution being titrated is too concentrated
- 25) In general, 3 consistent titrations are required to determine the concentration of an unknown.
- 26) Titration is a skill that takes a lot of practice to perfect. Be patient and don't give up if you want to develop a skill that will serve you well in many chemistry labs to come.
- 27) It almost always takes less time to do an experiment once, slowly and carefully, than to do it as fast as you can over and over until you get it right.
- 28) Do not waste your time trying to line up some initial volume such as 0.10 or 1.00 in the buret. Read it to  $\pm 0.01$  mL wherever it happens to fall. Never start with a volume of 0.00 mL - this is the least accurate measurement on the scale because there is nothing above it to use as a reference. If your titration requires more than 1 buret full of titrant, be sure to record a final volume before the solution level passes the end of the scale and then refill the buret and start titrating again.
- 29) If, for some reason, a direct titration procedure does not work well, there is a technique called "back titration" that may solve the problem. If you are interested in performing a back titration, you can look up procedures in the library. Most text books on Analytical Chemistry give a good description of the process.