Gravity Filtration:

In chemistry, even filtration is more sophisticated than it might seem. Take gravity filtration; all you do is stick a piece of filter paper in a funnel and let it go, right? Wrong. The reason it is called "gravity filtration" is because we employ gravity to help us out, if we are careful enough.

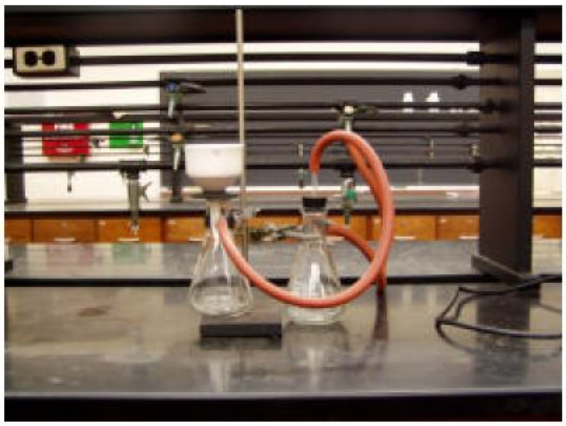
Begin with a clean long-stem funnel. Place it in an iron ring. Take an appropriate piece of filter paper (on the back of Whatmann boxes, you will find a table of types of filter paper; the slower the paper, the finer the porosity, so the longer it will take, and the smaller the particles it will catch). Fold the filter paper in half, and fold it in half again, but not perfectly; there should be a little angle, about 5°, made from the corner of the second fold when you compare the back of the folded paper with the front. Tear a small corner off of the front fold; this will help the filter paper to lie more smoothly next to the glass of the funnel so there are no bubbles between the funnel and the paper.

Moisten the filter paper completely with a bit of distilled water and carefully press the filter paper against the funnel. Be very careful to avoid tearing the paper, but you want to be sure there are no bubbles between the filter paper and the funnel. Place a clean receiving vessel underneath the funnel. Add your solution, and allow the solution to filter through the funnel naturally.

If you have set the filtration up correctly, you should see a "plug" of liquid forming in the stem of the funnel. If there are no bubbles between the funnel and the filter paper, this will create a little vacuum that will help the filtration proceed more rapidly.

Vacuum Filtration:

Choose a clean, dry side-armed flask, and secure it to a ring stand so it will not tip over. Attach a piece of vacuum hosing from the side arm, using water for lubrication if necessary, to a water trap. Attach a second piece of vacuum tubing from the water trap to an aspirator or vacuum line. The water trap prevents both liquid drawn from the faucet in an aspirator into the filtrate, and keeps filtrate from accidentally being pulled into a vacuum line. This is an important step even if you do not plan on using the filtrate because, if you need to re-filter, your filtrate will not be contaminated.



Place a collar on the top of the side-armed flask, and a Buchner funnel onto the collar. This collar is not intended to fit snuggly; it will be quite loose, but the vacuum, once applied, will draw it in tightly. Be sure that the vacuum works by turning it on and testing to see that a vacuum is created. Turn off the vacuum, and place a piece of filter paper into the Buchner funnel; the paper must not be larger than the funnel, but it must be large enough to cover all of the holes in the bottom of the Buchner funnel. Moisten the filter paper completely with a little distilled water.

Add your solution to be filtered, and turn on the vacuum. If your crystals are to be washed, first, turn off and break the vacuum by lifting the Buchner funnel slightly. Add the wash liquid to the original container, and pour it onto the crystals in the Buchner funnel. Using a rubber policeman, VERY carefully stir the crystals to break them up and wash them thoroughly, but do NOT tear the filter paper. Re-apply the vacuum. This step is usually repeated three times.

Decanting:

There are times that you would like to separate a mixture, but it is not necessary to do so with extreme care. Decanting is a method in which one can separate liquids from solids in a mixture rapidly, but relatively sloppily. Typically, one begins by centrifuging the mixture; this forces all of the solid to the bottom of the test tube (although if you are decanting from a larger container, say, a beaker, this step is obviously impossible with standard laboratory equipment). Place a stirring rod across the top of the container, not to stop the solid from flowing out, but

rather to help the liquid flow out more easily because it breaks the surface tension which can form without it. Slowly and carefully pour the liquid from the mixture into another container; stop when the solid is about ready to pour out as well.

It must be kept in mind that this is not a good separation technique; it is designed to be fast and crude when this is all that is required. The solid will still have a considerable amount of liquid left on it, and the liquid will have some of the solid in it as well. Of course, do not use this as an excuse to be sloppy. It is really the analysts call as to when the separation is complete; if you try to get too precise with it, you lose the speed (which is the only real advantage), but if you are not precise enough, you may as well not be decanting at all. The only real hint I can give you is to pour slowly and try to avoid agitating the solution.

Centrifuging:

Centrifugation is a process which uses centrifugal force to separate mixtures by density; the more dense material will be on the bottom (typically solids) while the less dense will be on top (typically liquid, although a similar technique is used to separate proteins by biochemists). The most important thing about centrifuging is to balance the centrifuge; put a test tube of the same size and design opposite the test tube to be centrifuged. The test tube can be filled with tap water if necessary (do NOT dilute another solution with tap water; instead, place it in its own slot and balance the centrifuge). If the centrifuge is not properly balanced, it is very easy to severely damage the centrifuge. If you understand the concept of vectors, you can balance the centrifuge with three test tubes as well; ask your instructor for more information.

Once the centrifuge is balanced, turn it on. Allow it to run for one or two minutes. If the centrifuge begins making a lot of noise, turn it off and check the balance. You must stay with the centrifuge the entire time it is running, since minor vibrations can cause a centrifuge to "walk" off of the bench. When you turn it off, allow it to come to a stop itself; NEVER put your hand (or anything else) above the centrifuge.