

Demonstrations of Nine Practical Lab Techniques

Technique #1 – Use of a Burette

Technique #2 – Use of a Pipette

Technique #3 – Use of a Volumetric Flask

Technique #4 – Weighing

Technique #5 – Use of a Bottle-Top Dispenser

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Technique #7 – Preparation of a Standard Solution

Technique #8 – Titration

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#1 - Techniques on the Use of a Burette

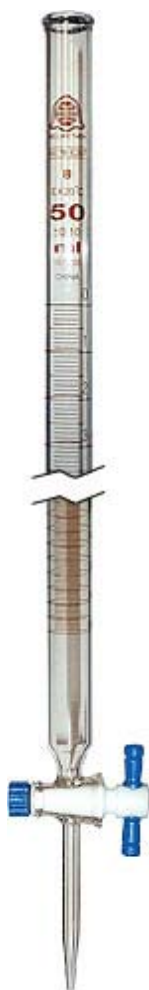


Figure 1:
A 50 mL
burette

A burette is used to deliver variable volumes of solution precisely and accurately (Figure 1). It is used for titrations, where the solution in the burette is called the *titrant*. When the stopcock valve is aligned with the burette, as shown in Figure 1, the valve is in the open position and the titrant flows from the burette into the collecting vessel. Rotate the stopcock valve 90 degrees to close the valve. A commonly used burette in our lab delivers a total volume of 50 mL and is calibrated in 0.1 mL increments. This means that the finest division on the burette is 0.1 mL (Figure 2).

When reading the burette, the last digit is the digit where you estimate to within the finest division. Therefore, a burette reading of the 50 mL burette is recorded to two decimal places.

Steps to prepare and use a burette:

1. A burette is usually stored with distilled water and capped.
2. Empty the burette of distilled water from the top and check that the stopcock is liquid-tight. If the stopcock feels loose when it is turned, hold onto the stopcock handle and rotate the screw clockwise to tighten. The stopcock should rotate smoothly. If it doesn't, you should disassemble the stopcock to clean the stopcock and where it touches the glass surface of the burette. Reassemble the stopcock with all its parts as laid out in Figure 3.

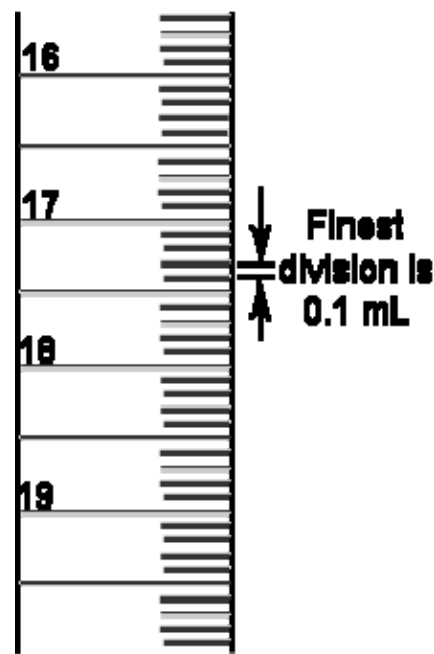


Figure 2: Division
markings on a
50 mL burette

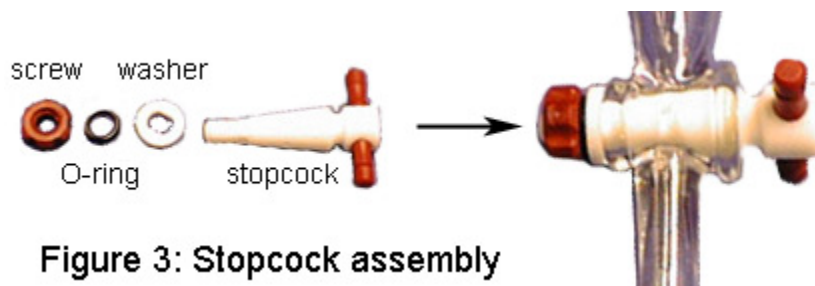


Figure 3: Stopcock assembly

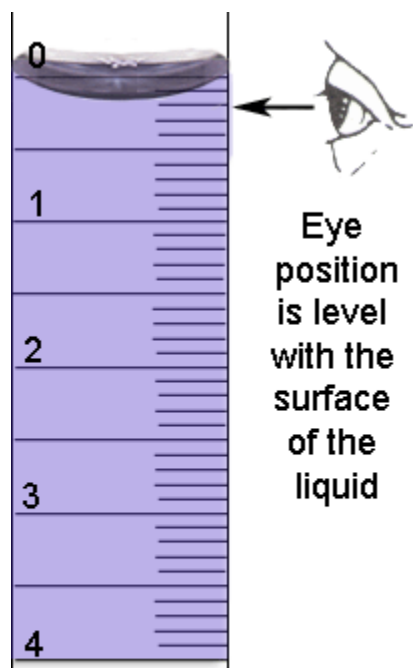
3. Close the stopcock and using a small beaker, add approximate 10 mL of the titrant from the top. Hold the burette horizontally, rotate the burette to ensure the titrant touches the interior surface of the burette. Open the stopcock to allow the titrant to drain through the tip. Drain the rest of the titrant from the top of the burette. This step known as *acclimatization* is done at least twice.
4. Fill the burette well above the zero mark. Rotate the stopcock to let some solution flow through the tip.
5. Look for any trapped air bubble below the stopcock (Figure 4). To dislodge the air bubble, take your burette over to the sink, rapidly rotate the stopcock and allow small quantities of titrant to pass. Close the stopcock and check if the bubble is gone. If the bubble remains, open the stopcock and tap the burette near the stopcock, or give the burette with a quick up-and-down jerk. A combination of the above procedures should dislodge the trapped bubble (Figure 5).



Figure 4:
Trapped
air bubble



Figure 5:
Air bubble
removed



**Figure 6: Initial reading
of the burette.**
(eg - $V_i = 0.20$ mL)

6. Finally, refill the burette to above the zero mark. Lower the level of the titrant below the zero mark. The eye should be level with the meniscus for a proper reading. The correct reading is where the bottom of the meniscus touches the scale. Record the initial volume (V_i) to 2 decimal places (Figure 6).
7. Place a receiving flask (usually an Erlenmeyer flask) under the tip of the burette. Adjust the burette height so that the tip of the burette is inside the neck of the Erlenmeyer flask (Figure 25).
8. Dispense the titrant through the burette until a desired volume is reached or until a chemical analysis is complete. **Do not let the solution drain past the last mark on the burette.**

9. Record the final volume (V_f). The volume of solution dispensed is found by subtracting V_i from V_f .

Final Burette Reading, V_f (mL)	23.45
Initial Burette Reading, V_i (mL)	0.20
Volume delivered (mL)	23.25

10. To clean up, drain the solution from the top of the burette into a proper waste container. Rinse the burette 2-3 times with distilled water. Each time, open the stopcock to drain some of the rinse water through the tip and then empty the rest through the top of the burette.
11. Store the burette with distilled water.

#2 - Techniques on the Use of a Pipette

Pipettes are for the transfer of known volumes of liquid from one container to another. Pipettes that deliver a fixed volume are called volumetric or transfer pipettes (Figure 7a).

Other pipettes are known as measuring pipettes. They are calibrated with graduated markings along the side so that any volume up to the maximum capacity can be delivered (Figure 7b).

Liquids are drawn into the pipette through a slight vacuum by using a pipette bulb (Figure 8). ***Never use your mouth to pipette.***

The volume of a volumetric pipette is recorded to two decimal places (i.e. – 10.00 mL). To read the volume of a measuring pipette, estimate the last digit to within the finest division on the pipette.

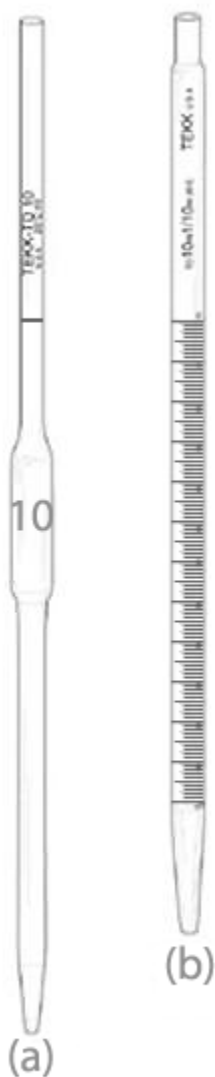


Figure 7:
Pipettes



Figure 8: Different types of
pipette bulbs

Steps to prepare and use a volumetric pipette:

1. Inspect the pipette to make sure that the tip is not chipped and the top end of the pipette is smooth and flat. If the top end of the pipette is chipped, or not smooth, it is very difficult to pipette.
2. To fill a pipette, a rubber bulb (Figure 8) is used to provide suction to pull up the solution. Keep the tip of the pipette below the surface of the liquid. It is easier to draw up solution from a smaller, narrower container (i.e. 50 mL beaker) to avoid sucking up air. ***Avoid sucking liquid into the pipette bulb.***
(Note: Never dip a pipette into the reagent bottle. Obtain the solution with a small clean and dry beaker. Pipette the solution out of the beaker.)

3. Acclimatize the pipette with the solution to be used in the analysis by drawing up a small amount of the solution. Remove the bulb and tilt the pipette horizontally to rinse the inner walls of the pipette. Drain completely. Repeat this step three times.
4. Fill the pipette with solution past the calibration mark. Remove the bulb and quickly place the index finger of the hand holding the pipette over the exposed end of the pipette.

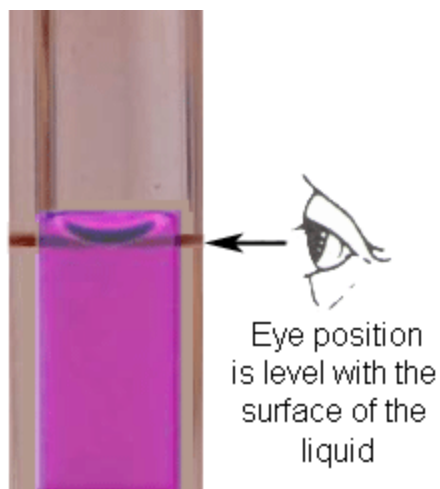
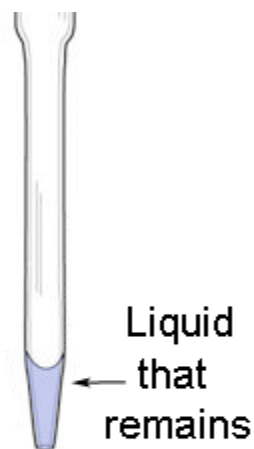


Figure 9: The bottom of the meniscus sits at the calibration mark

5. Tilt the pipette slightly and wipe away any liquid on the outside surface. Slowly release pressure on the index finger so that the bottom of meniscus approaches the calibration mark at eye level. At the mark, apply pressure on the index finger to stop the level of the liquid.
6. Touch the tip of the pipette on the wall of the container. This will drain any drop that remains on the pipette tip.

7. Transfer the pipette to the receiving container and release the pressure on the index finger. Drain the solution into the receiving container with the pipette tip touching the wall of the container. After draining, wait 10 seconds before removing the pipette. At this point, the calibrated amount of liquid has been transferred. Look closely at the tip of the pipette. A small portion of solution remains in the tip (Figure 10). ***Do not blow out the pipette.***
8. After use, clean the pipette by rinsing with distilled water.



**Figure 10:
A small portion
of the liquid
remains.**

#3 - Techniques on the Use of a Volumetric Flask



Figure 11: A 100.0 mL Volumetric flask

A volumetric flask is calibrated to contain one specified volume. It is used to prepare standard solutions and for the dilution of solutions. Volumetric flasks are cleaned and thoroughly rinsed but rarely do they need to be dried. When the meniscus touches the mark that is etched on the neck of the flask, the calibrated volume is contained in the volumetric flask.

When preparing a solution with a solid solute, the solid should not be emptied directly into the volumetric flask. First, dissolve the solid in a beaker using about half to two-thirds of the volume of the final solution. Second, quantitatively transfer the solution to the volumetric flask. Details of preparing a standard solution and quantitative transfer are covered in *Technique #7*.

The volume measured in a volumetric flask is recorded to four significant figures (i.e. – 100.0 mL).

Steps to make a Dilution using a Volumetric Flask

1. Pipet the solution to be diluted into the volumetric flask directly.
2. Add distilled water to fill the flask about half to two-thirds full.
3. Swirl the flask to mix the solution.
4. Bring the level close to the mark and allow time for drainage. Then use a Pasteur pipette to make the final addition (Figure 12). The eye should be level with the meniscus and the mark to make a correct reading for the volume (Figure 13).



Figure 12: Pasteur pipette

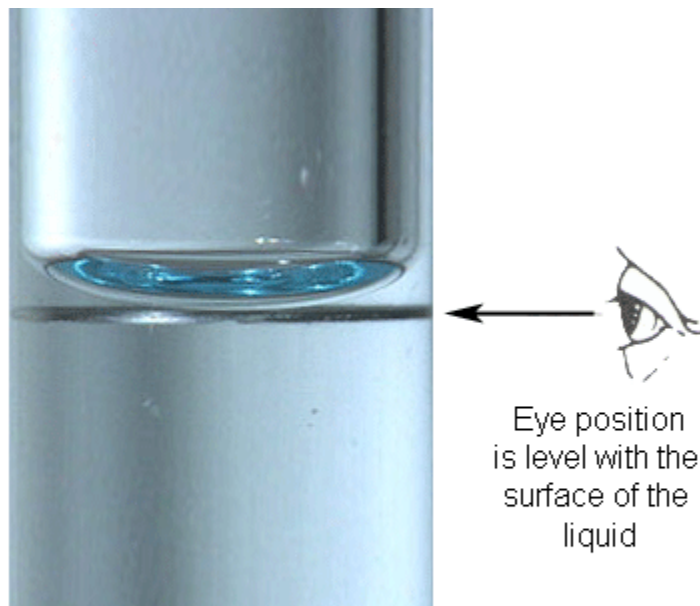


Figure 13: Fill the volumetric flask such that the bottom of the meniscus touches the mark on the neck of the flask

5. Firmly stopper the flask and invert repeatedly (at least 15 times) to assure uniform mixing.

#4 – Techniques on Weighing



Figure 14: An electronic analytical balance

There are many different types of balances or scales available to measure the mass of a sample. The selection of the balance depends on the mass of the object or sample and the precision needed for the measurement. A top-loading balance is used to determine the approximate mass of the sample needed. In this course, we will be mostly using electronic analytical balances (Figure 14). These balances are easy to operate and are capable of measuring to 0.0001 g. Models of these balances vary in the labs. Consult your instructor and operating manual specific to the model of the balance.

There are two methods of weighing:

1. Weighing by difference – This is a technique which is used when it is important to know the precise amount of the sample that has been transferred to a reaction mixture.
2. Weighing by taring – This technique is used when the mass of the empty container is not important. The empty container is ‘zeroed’ or *tared* on the balance.

These two methods will be described in detail below.

The Balance Room

Balances are sensitive to drafts, changes in temperature, or the vibrations caused by moving people. The balances are stored in a separate room to minimize these variables and are placed on concrete tables.

Balances are very expensive and are sensitive to attack by corrosive chemicals. ***Do not take liquid into the balance room.*** When possible, chemicals should be added to the weighing container outside of the balance chamber. During the weighing process, the



Figure 15: The balance room

weighing container should be placed on a clean surface, such as a kimwipe, so that the bottom of the container does not pick up any dust. It is important that you clean up all chemical spills. If in doubt consult your instructor.

Weigh boats (Figure 16) are disposable containers used for weighing. They are made of polypropylene plastic and are inexpensive. A used weigh boat should be discarded in the waste container. All chemicals and spatulas that are used should be returned to their proper places. Depending on the experiment, other types of weighing container could be a porcelain crucible (Figure 17), an aluminum plate (Figure 18) or a small beaker.



Figure 16: Weigh boat



**Figure 17:
Crucible with lid**



**Figure 18:
Aluminum containers**

The balance room must be kept tidy. Materials taken into the balance room include datasheets, pen and the sample to be weighed. Enter mass measurements directly on the datasheet with your pen. Before you leave your balance, make sure:

1. The balance and the area around it is clean. Spills inside the balance should be brushed off using the brush on top of the balance. Spills on the concrete table should be cleaned using Kimwipes.
2. Close all the doors of the balance.
3. Turn off the balance.

Weighing by difference

1. Pre-weigh an approximate quantity of the sample into a weigh boat using a top-loading balance.
2. Record all the masses for each step directly on the datasheet in pen.
3. Turn on the balance by pressing on the control bar. After a few seconds, the display will read 0.0000.
4. Open the sliding glass door (on the side) and place the sample/weigh boat on the balance pan. Close the sliding glass door and wait until the reading is stable. Record the value.
5. Transfer the sample into a beaker.
6. Weigh the emptied weigh boat on the analytical balance. Do not brush off any sample particles from the emptied weigh boat. Record the mass of the emptied weigh boat.

7. The difference between the two weighings is the mass of the sample transferred into the beaker.

Datasheet for Weighing by difference

1. Mass of weigh boat and sample _____ g
2. Mass of emptied weigh boat _____ g
3. Mass of sample transferred _____ g

Weighing by taring

1. Place a weigh boat on the balance pan. Close the doors and wait for the reading to stabilize. Press briefly on the control bar or the tare button and the display changes to 0.0000 g. The weight of the weighing boat is now tared.
2. Remove the weigh boat from the balance and set it on a piece of kimwipe. With a spatula, carefully add the sample to the weigh boat. Place the weigh boat back on the balance pan. Close the doors and wait for the reading to stabilize. Record the mass of the sample.

Datasheet for Weighing by taring

1. Mass of weigh boat and sample _____ g
2. Mass of empty weigh boat 0.0000 g
3. Mass of sample _____ g

#5 – Techniques on the Use of a Bottle-Top Dispenser



**Figure 19:
A Bottle-Top Dispenser**

A bottle-top dispenser is a hand operated pump that screw on to a reagent bottle. These dispensers are surrounded by a clear plastic sleeve, which protects the glass cylinder from breaking, and eliminates the risk of hazardous spills. The volume is accurate to about 1-2%. The volume to be dispensed is set by adjusting the volume knob on the plunger.

Steps to Use a Bottle-Top Dispenser

1. Prior to use, check the dispenser to see whether the dispenser volume is set correctly.
2. Make sure that the reagent bottle has enough solution before mounting the bottle-top dispenser on the reagent bottle.
3. Place a graduated cylinder at the outlet.
4. Pull the top of the dispenser up to as far as it will go. Let go of the dispenser and let the plunger fall by gravity. The liquid should be collected in a graduated cylinder.
5. While the liquid is dispensing into the graduated cylinder, observe that there is no air bubble in the liquid. If air bubbles are present, it could be that the container is near empty or the dispenser is malfunctioning. Consult your instructor to refill the solution and check the mounting of the dispenser.
6. Read the graduated cylinder and make sure that the volume collected is within 2% of the preset volume.
7. Place a clean, empty container at the outlet.
8. Repeat steps 3 and 4 to dispense the solution into the container.

#6 – Techniques on Gravity Filtration

There are two general methods of filtration: gravity and vacuum. In gravity filtration, the filtrate passes through the filter medium under the force of gravity and the capillary action between the liquid and the funnel stem.

There are several varieties of filter paper. Good filtration depends on the retention of the filter paper and the speed of the filter paper. Usually, fast papers will retain coarse particles. Slow papers will retain fine particles. The optimum choice is a paper, which is as fast as possible, yet retains all visible particles, and thus giving a clear filtrate.

Low-ash or ashless quantitative-grade papers can be ignited without leaving an ash. The residue left by an 11-cm circle of a low-ash paper may be as low as 0.06 mg. An ashless-grade paper typically leaves 0.05 mg or less from an 11-cm circle. This small mass is considered negligible in most analytical procedures.

Decantation is a process used to separate the liquid from the mixture to be filtered. To decant a liquid from a solid, in one hand hold the beaker that has the mixture in it. Hold a glass-stirring rod in the other hand. Touch the lip of the beaker to the glass rod and pour the mixture to be filtered using the glass rod as a guide to pour slowly to ensure that the solid is not carried along. This also prevents the liquid from running back along the outside of the beaker.

Washing of the solid to remove soluble impurities follows the decantation of the supernatant liquid. Use a small amount of wash liquid and mix it thoroughly with the solid. Allow the solid to settle and decant the wash liquid through the filter. Repeat this procedure several times. Several washings with small volumes of liquid are more effective in removing soluble contaminants.

Transfer the washed solid in the filter funnel is the final step. The bulk of the solid is transferred to the funnel by squirting a stream of wash liquid from a wash bottle. The last traces of the solid are removed from the walls of the beaker by scrubbing with a rubber policeman. Rinse the beaker and rubber policeman and transfer the rinse liquid to the funnel. Repeat this at least two times.

Step to prepare a gravity filtration

1. It is important to use the correct size filter paper. Properly sized filter paper should stop just below the rim of the glass funnel. As a guide, use filter paper whose diameter is about 1 cm less than twice the diameter of the funnel, for example a six-centimeter diameter funnel uses a filter paper of eleven-centimeter diameter. The filter paper should sit a few millimeters from the rim of the funnel (Figure 20).

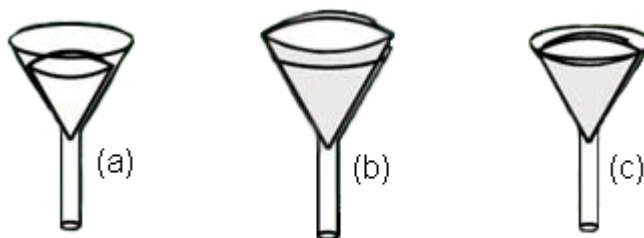


Figure 20 - Correct size of filter paper is (c)

2. Fold the filter paper by referring to Figure 21.

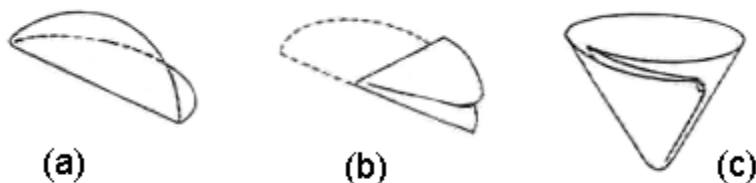


Figure 21 - Folding a filter paper

- (a) Fold the filter paper in half.
 - (b) Fold the filter again to within about 10° of a 90° fold. The second fold is not exactly at a right angle. Tear off the corner of top fold.
 - (c) Open the filter paper so that the torn corner is on the outside of the cone. The tear enables the paper to stick better to the funnel.
3. Place the folded filter paper snugly into the funnel by moistening the filter paper with the solvent of the mixture to be filtered. This should resemble Figure 20 (c).

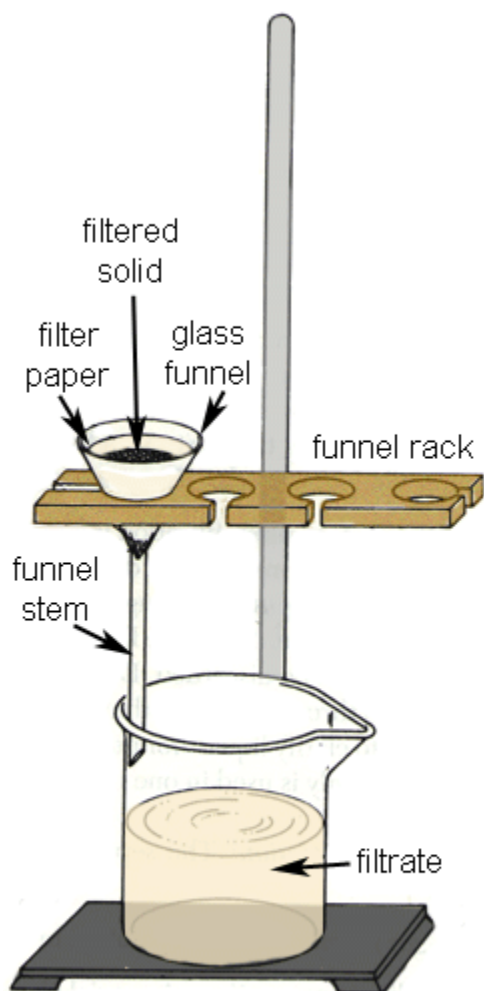


Figure 22 - A gravity filtration setup

4. Press the filter paper against the top wall of the funnel to form a seal. Support the funnel with a funnel rack.
5. Set up the gravity filtration apparatus as per Figure 22. Ensure that the funnel rack is positioned so that the funnel stem is inside the beaker. Position the beaker so that the funnel stem is touching the side of the beaker to avoid splashing.
6. Allow the mixture to settle and then *decant* the liquid from the solid. *Wash* the solid which remains in the beaker several times. Finally, *transfer the washed solid* to the funnel.

Techniques on Vacuum Filtration

This type of filtration is used with water or high-boiling organic solvents and is much faster than gravity filtration. For the set-up (Figure 22a), a filter flask must be clamped in position before attaching the rubber tubing, rubber stopper (adapter) and Büchner funnel (or crucible). This prevents the top-heavy apparatus from toppling over and spilling material. A medium- or slow-speed filter paper is used that is wetted with the solvent before the vacuum is applied with the water aspirator. Use a large beaker under the aspirator to minimize splashing. Check that there is a good seal between the apparatus when vacuum is applied before filtering the sample.

During the filtration, the mixture should be poured at a rate that the bottom of the funnel is covered with some solution. The collected crystals/precipitate can be washed with some chilled solvent. Do not discard the mother liquor (in the filter flask) as more compound can be recovered.



Figure 22a - A vacuum filtration setup

Caution: Running water can be sucked back into the filtration apparatus if the water pressure decreases. Be sure to break the vacuum by disconnecting the tubing at the aspirator before turning off the running water.

#7 - Techniques on Preparation of a Standard Solution

A **primary standard** is a substance that has a known high degree of purity, a relatively high molar mass, is non-hygroscopic and reacts in a predictable way. A **standard solution** is a solution having a very well known concentration of a solute. A measured volume of the standard solution then reacts with the substance being analyzed.

Potassium Hydrogen Phthalate ($\text{KHC}_8\text{H}_4\text{O}_4$) is a good primary standard because of the following properties:

1. High purity
2. Low toxicity
3. High molar mass (204.23 g/mole)
4. Soluble in water
5. Stable in air
6. A monoprotic acid and reacts rapidly with a base

When a standard solution of Potassium Hydrogen Phthalate is properly prepared, it can be used to determine the concentration of a sodium hydroxide (NaOH) solution. This process is referred to as the standardization of a solution.

Quantitative Transfer

Quantitative transfer is a technique, which ensures that in the transferring of the sample from one container to another, the **entire** sample is transferred. For example, a solid sample, which has been weighed in a weigh boat (container 1), is to be transferred to a beaker (container 2). In the transfer process:

1. Pour the sample from container 1 into the container 2. Depending on the type of container being used, sometimes tapping the container lightly, such as a weigh boat, will help knock the particles into the beaker.
2. Using a water bottle filled with distilled water, rinse container 1 thoroughly with distilled water.
3. Pour the rinse water into container 2.
4. Repeat steps 2 and 3 three times.

Steps to prepare a standard solution of Potassium Hydrogen Phthalate

1. Dry the Potassium Hydrogen Phthalate at 110°C for several hours. Remove the $\text{KHC}_8\text{H}_4\text{O}_4$ and let cool in a dessicator.
2. Calculate the mass of $\text{KHC}_8\text{H}_4\text{O}_4$ that is required and determine the final volume of the solution, V_f , being prepared. Ensure that you have a volumetric flask of volume V_f available.
3. Obtain the glassware needed:
 - a. A beaker which will hold approximately two-thirds the volume of the final solution.
 - b. A volumetric flask which will hold the final volume, V_f , of the solution.
4. Using a weigh boat, weigh the $\text{KHC}_8\text{H}_4\text{O}_4$ to 4 decimal places on an analytical balance (See *Technique #4 for Techniques on Weighing*). In the steps to follow,

make sure that the level of accuracy is maintained when transferring reagents from one container to another.

5. Follow the steps on *quantitative transfer*, and transfer the entire sample of $\text{KHC}_8\text{H}_4\text{O}_4$ from the weigh boat to the beaker.
6. Add distilled water to the beaker to dissolve the $\text{KHC}_8\text{H}_4\text{O}_4$ sample. The amount of distilled water should be about half to two-thirds of the final solution volume, V_f .
7. Using a stir rod, stir until the $\text{KHC}_8\text{H}_4\text{O}_4$ crystals are dissolved. Inspect the beaker closely.
8. Pour the solution from the beaker into the volumetric flask.
(**Note:** A small funnel may be used if you are uncomfortable with pouring from the beaker.)
9. Follow the steps on *quantitative transfer*, and transfer the solution from the beaker to the volumetric flask. (Note: If a funnel is used in this step, the funnel must be rinsed 3 times. All the rinse water must be poured into the volumetric flask.)
10. Follow *Technique #3 – Techniques on the Use of a Volumetric Flask* starting at Step 2 to finishing preparing the standard solution to a final volume of V_f .

#8 – Techniques on Titration

Titration is a method of analysis that allows you to determine the endpoint of a reaction. To perform a titration accurately, a precise quantity of the **titrant** needs to be dispensed into the reaction flask.



Figure 23 - An Erlenmeyer flask

In a titration, the reaction flask is usually an Erlenmeyer flask (Figure 23). It is used because it is conical in shape. This shape makes it easy to swirl the flask without spilling. For example, in an acid-base reaction, you may choose to pipette the acid into the Erlenmeyer flask. The base is introduced to the acid with the use of a burette. The solution in the burette, in this case, the base, is known as the titrant. A **colour indicator** such as **phenolphthalein** is introduced into the Erlenmeyer flask to detect the **endpoint** of the reaction. In acidic solution, phenolphthalein is clear in colour. In basic solution, phenolphthalein turns pink. The endpoint of the reaction is reached when the solution turns pink and the pink colour does not disappear after 30 seconds.

Steps in performing a titration

1. Follow the steps in *Technique #1 – Techniques on the Use of a Burette* and fill the burette with the titrant, the base.
2. Take an initial volume burette reading and enter it on the datasheet.
3. Follow the steps in *Technique #2 – Techniques on the Use of a Pipette* and pipette the acid into the Erlenmeyer flask (Figure 24).
4. Set up the burette and Erlenmeyer flask such that the tip of the burette is inside the neck of the Erlenmeyer flask (Figure 25). This ensures that all the base will be dispensed into the Erlenmeyer flask.



Figure 24 - Pipette the acid into the Erlenmeyer flask



Figure 25 - A titration setup

5. Add a few drops of colour indicator, such as phenolphthalein, to the acid solution. At the start of the titration, the acid solution in the Erlenmeyer flask should be clear. Add the titrant to the titration flask slowly and swirl the flask frequently. When the titrant touches the acid solution, the solution briefly turns pink in colour (Figure 25). Upon swirling, the pink colour will go away. Slow down the addition of the titrant when the trail of pink colour is taking longer to go away. Reduce the volume of the additions as the titration progresses. When you are near the **endpoint**, the titrant should be added a drop at a time.
6. When it is judged that only a few more drops are needed, rinse down the walls of the Erlenmeyer flask. Quickly spin the closed stopcock 180° . This allows a small shot of titrant to shoot out.
7. When the volume of titrant to be added is judged to be less than one drop, open the stopcock so that only part of a drop appears. Close the stopcock and touch the drop on the side of the Erlenmeyer. Use the wash bottle to rinse the partial drop into the Erlenmeyer flask with swirling.
8. The endpoint is reached when the colour change does not disappear after 30 seconds. The phenolphthalein colour change is from clear to pale pink (Figure 26).

1.



Figure 26 - The colour change observed at the endpoint of an acid-base titration. Flask#1 is the desirable colour change. Too much base has been added to flask #2.

9. Read the final burette volume. The difference between the initial and final readings on the burette is the volume of base used in the titration.
10. Repeat a titration at least twice. The burette volumes should be within ± 0.10 mL or less.

Datasheet for a Titration

Trial 1:

1. Final burette reading _____ mL

2. Initial burette reading _____ mL

3. Volume of titrant used in titration _____ mL

Trial 2:

1. Final burette reading _____ mL

2. Initial burette reading _____ mL

3. Volume of titrant used in titration _____ mL

Trial 3:

1. Final burette reading _____ mL

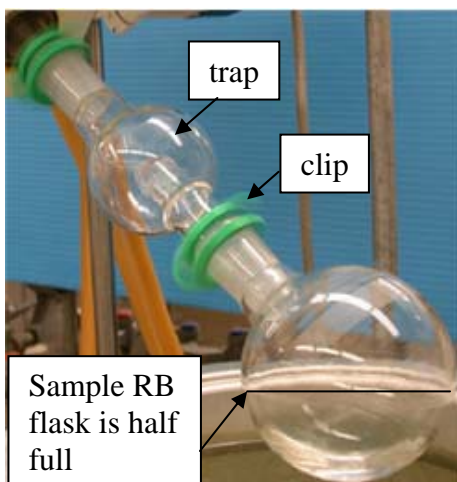
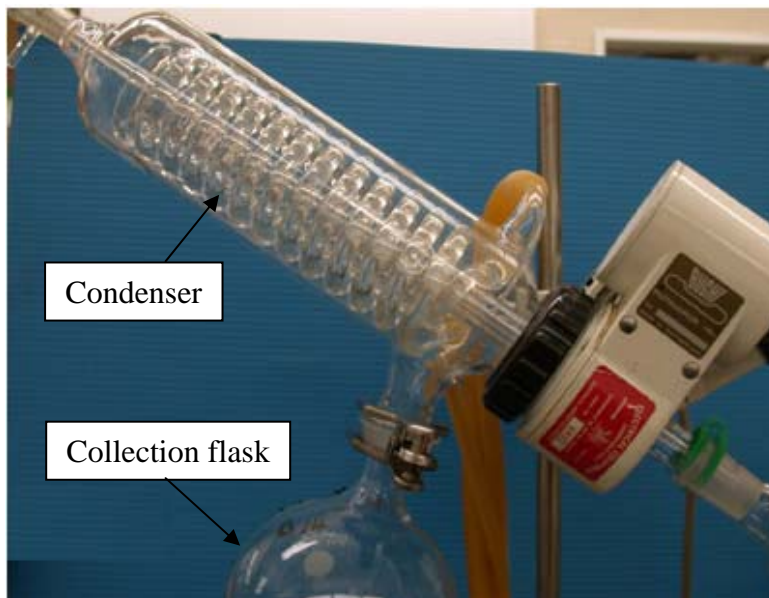
2. Initial burette reading _____ mL

3. Volume of titrant used in titration _____ mL

#9 – Rotary Evaporator

The rotary evaporator is a piece of equipment that is designed to allow you to distill a liquid under conditions of reduced pressure. Since the pressure within the system is reduced, it means that the liquid can be distilled at a lower temperature than it would at atmospheric pressure.

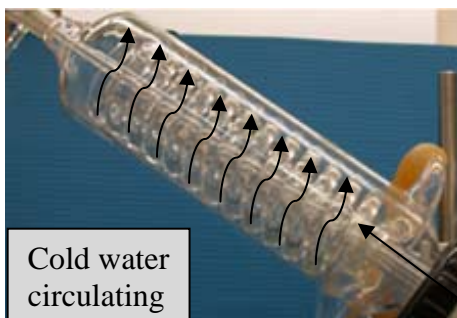
This is a very safe and fast method of distilling flammable solvents like dichloromethane. Dichloromethane normally boils at 40°C at atmospheric pressure.



The sample to be “rotovapped” is added into the round bottom (RB) flask. The sample RB flask should never be more than half-full with liquid when it is attached to the rotary evaporator. The sample RB flask is connected to the trap and is secured using a circular clip. The clip has two sides. It is always oriented with the smaller circle on top.

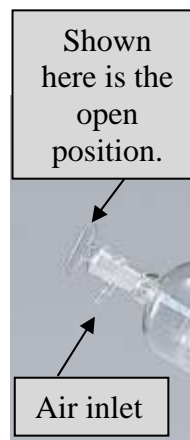


The stopcock that is fitted at the top of the condenser needs to be in the closed position. To close, turn the stopcock such that it is cross-wise (90 degrees) to the air inlet. Turn on the water aspirator to evacuate the system.

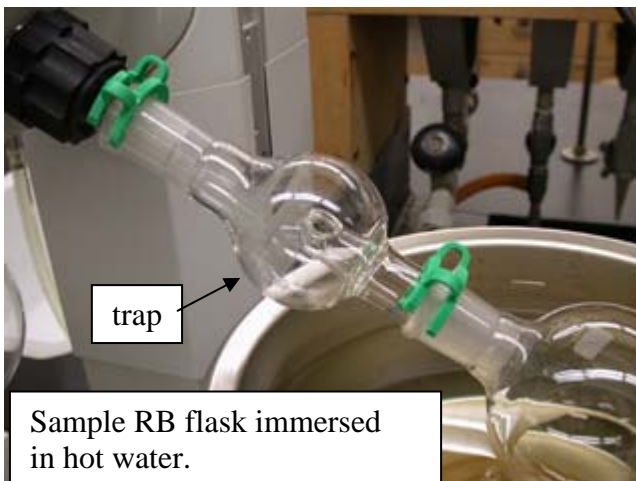


Ensure that the condenser has cold water running through the glass coil.

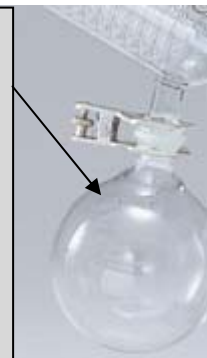
Vapour enters the distillation tube.



When the vapour enters the distillation tube inside the condenser, it will be in a cooled environment for the vapour to condense and drip into the large round collection flask to which it is attached.



Watch for the dripping of the condensed solvent into the collection flask.



There is a splash trap at the end of the distillation tube to prevent unwanted sample from splashing up into the condenser.

To speed up the rate of evaporation, the liquid sample can be warmed with hot water. Lower the flask by sliding the “Push” knob below the water bath. The temperature can be set using the dial on the side of the water bath.



To ensure even heating of the sample RB flask, turn the rotary dial to spin the sample RB flask that is immersed in the hot water bath.



Observe the condensation of vapour near the condenser. As the solvent condenses, you will see dripping of the condensed vapour collecting in the collection flask. Once the dripping stops, wait another minute and stop the rotary evaporator.

To remove the sample RB flask, disassemble by reversing the steps. Raise the sample RB flask from the hot water bath. Turn the rotary dial to stop the sample RB flask from spinning.

Turn the stopcock that is fitted at the top of the condenser so that it is in-line with the air inlet. This will let air back into the system, and you should hear the sound of air rushing into the system. Turn off the water to the aspirator and the condenser. Remove the clip that is used to secure the sample RB flask. Gently give the neck of the sample RB flask a twist and remove the flask from the rotary evaporator.

Steps in operating the rotary evaporator

1. Turn power switch on. Turn water bath on. Adjust water bath to desired temperature.
2. Turn on water to condenser (slow to moderate flow).
3. Turn on aspirator full counterclockwise.
4. Attach the splash trap to the vapour tube and secure with clip.
5. Attach the sample RB flask to the splash trap and secure with clip.
6. Adjust rotational speed of the flask.
7. Turn the air inlet valve to the closed position to obtain a vacuum.
8. Slide the "Push" knob down to unlock the lift mechanism to lower the sample RB flask into the bath.
9. Watch for the dripping of the condensed solvent into the collection flask at the condenser. After the dripping stops, wait another minute to ensure that the evaporation has finished.
10. To disassemble, slide the "Push" knob to raise the flask.
11. Turn the rotational speed knob to the off position.
12. Turn the air inlet valve to the open position to re-establish atmospheric pressure.
13. Remove the clip and the sample RB flask.
14. Remove the clip and the splash trap.
15. Turn off aspirator, water to the condenser, water bath and the power switch.