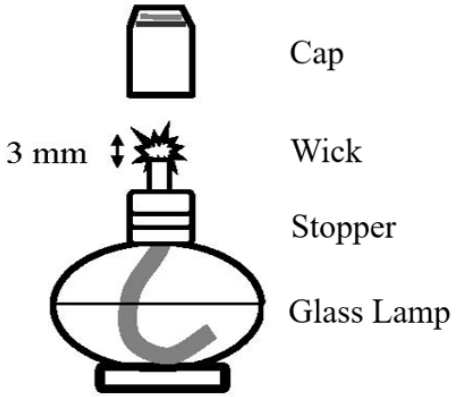
T1 - Alcohol Lamp

2024/11/05

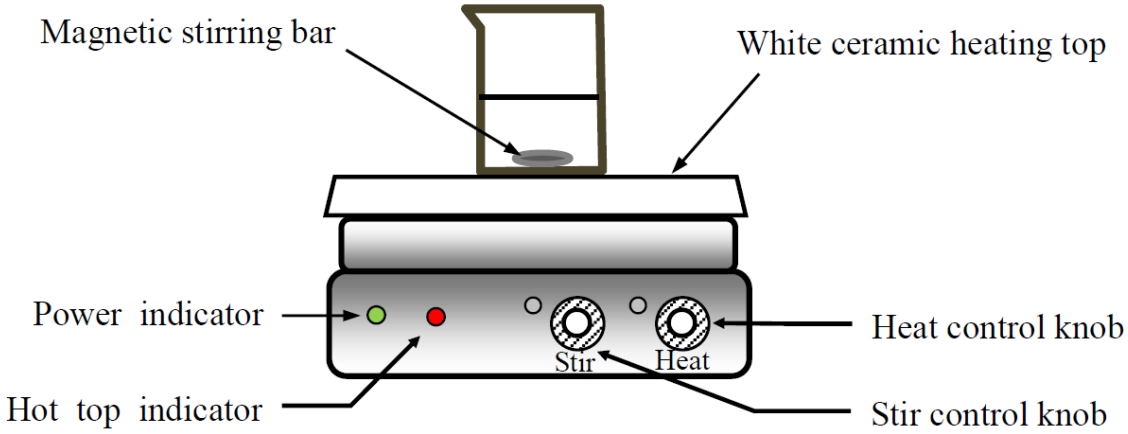
- Inspect the lamp before each use to make sure there are no cracks, chips or defects in the glass body.
- Adjust the wick height to about 3 mm from the top of the metal cap.
- Fill the lamp with denatured or 95% ethanol through a funnel to about 1/2 to 2/3 volume.
- Light the alcohol lamp using a match.
- Use the lamp only in an upright position.
- Keep all combustible materials (clothing, paper, books, chemicals, etc.) away from the lamp when in use.
- Never use book or other items to raise the alcohol lamp.



T1 Video on YouTube (Click)

- Use windshield to block wind and do not use books. Do not tilt lamp to avoid alcohol leakage while heating.
- Adjust device upon heating to an appropriate height.
- After use, cap should be put on to insulate air and extinguish the flame instead of blow it out. If lamp will not be used for a long time, alcohol inside should be returned to storage bottle.
- If lamp is overturned and cause small fire, cover the fire quickly with a wet rag and do not remove the rag immediately while extinguished, or flame may ignite again. Use fire extinguisher instead if a big fire happens. Inform teacher as soon as possible in such emergency and after fire is extinguished, immediately open doors, windows and exhausts to expel alcohol vapor in lab.

T2.1 - Stirrer/Hot Plate



T2 Video on YouTube (Click)

Controls and Indicators of CORNING-420 Stirrer/Hot Plate:

- Power Indicator: Green light on when Stirrer/Hot plate is properly connected to input power.
- Stir Control Knob: Turn it all the way counterclockwise to turn off stirring function. Turn it clockwise to set desired stirring speed.
- Heat Control Knob: Turn it all the way counterclockwise to turn off heating function. Turn it clockwise to set desired heating temp.
- Hot Top Indicator: Illuminates when the temp. of the top is too hot to touch (greater than 60^{o}C). When heating top is more than 550^{o}C, Stirrer/Hot Plate will automatically power off and indicator starts to flash until the temperature is less than 60^{o}C.
- White ceramic heating top with loading capacity 34 kg.

T2.2 - Stirrer/Hot Plate

- Connect Stirrer/Hot Plate to a grounded power outlet with correct voltage. Never leave a gap between plug and outlet, replace damaged power cord immediately.
- Keep power cord away from white heating top to avoid burns and damaged.
- Always wear safety goggle and other protective equipment to avoid spillage while operating Stirrer/Hot Plate.
- Place vessel in the center of white top with appropriate stirring speed. If stirring bar jumps irregularly, turn off Stirrer/Hot Plate to adjust vessel's positon, then restart.
- Clean white top before and after use or when liquid spills. Use non-corrosive cleaning agents and do not immerse Stirrer/Hot Plate in water for cleaning.
- Replace Stirrer/Hot Plate once white heating top is broken or scratched.
- Never heat large amount of volatile, flammable materials (such as ether, acetone, *n*-hexane, etc.) directly by a Stirrer/Hot Plate.
- Insulating objects such as aluminum foil, thick-walled glassware cannot be heat by a Stirrer/Hot plate.
- Take out stirring bar in solution by a Teflon-coated magnetic rod, do not grab it by hand to avoid corrosive chemicals and burns.

T3.1 - Mercury Barometer

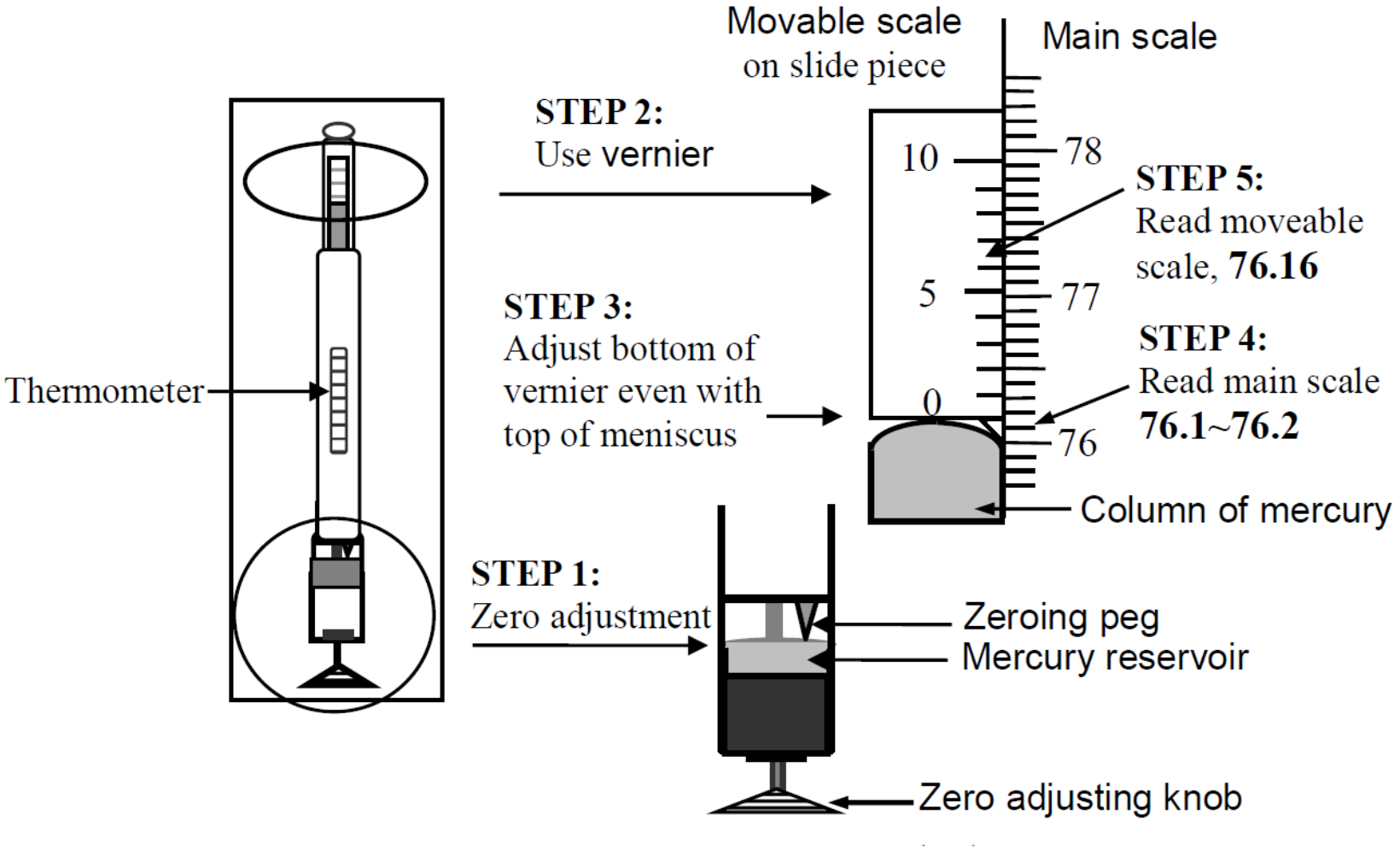


Figure T3-1 Illustration of mercury barometer

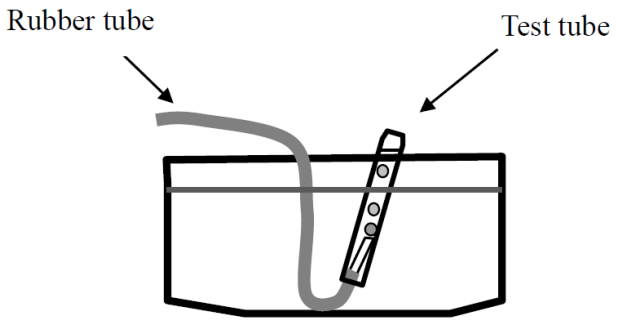
T3 Video on YouTube (Click)

T3.2 - Mercury Barometer

- Step 1: Zero adjust
  Rotate the **Zero Adjusting Knob** to adjust the top of the mercury reservoir just touching the tip of the **Zeroing Peg**.
- Step 2: Read the height of mercury column by the **vernier**
  - Adjust the height of the **Movable Scale** so that the bottom of the slide piece is just even with the top of the meniscus.
  - Read the main scale on the right of vernier. As in Fig. T3-1, the bottom of slide piece indicates the height of mercury is between 76.1 cm and 76.2 cm.
  - Read the movable scale on the left of vernier where the lines match up with the main scale, i.e. 6 (the percentile of measurement). Therefore, the atmospheric pressure reads 76.16 cm-Hg.
- For more precisely measurement, one should refer to manual of barometer to make correction of temperature.

T4 - Collecting Gases over Water

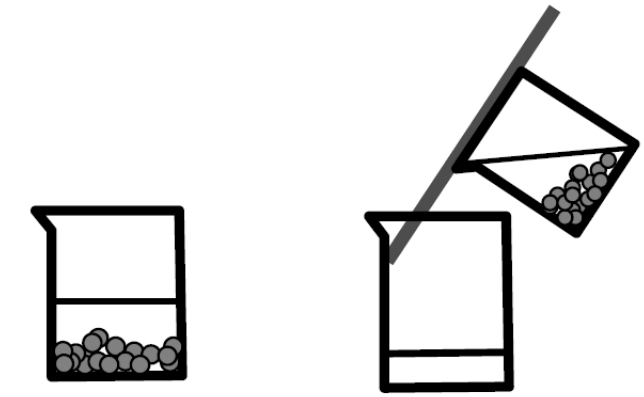
- Collection of gases over water is used to collect slightly water-soluble or water-insoluble gases from chemical reaction.
- Water-insoluble gas is introduced into water of gas collection device and for its density of the gas is lower than that of the water, gas will rise to displace the water out. Oxygen (O_2), nitrogen (N_2) and hydrogen (H_2) can be collected by this method.



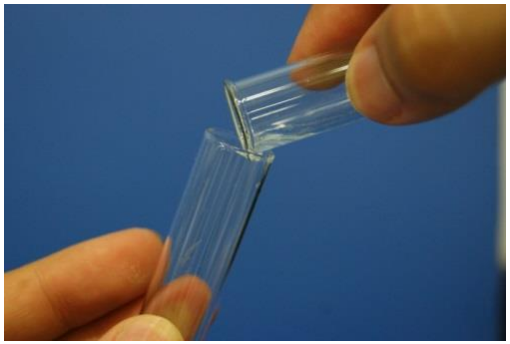
T4 Video on YouTube (Click)

- For gases that are soluble in water, such as ammonia (NH_3), hydrogen chloride (HCl) …etc., they are not suitable to be collected by this method.
- Operation:
  - Invert the test tube that filled with water into the tub of water.
  - Place the rubber tube into the opening of test tube that displace the water out.
  - When the gas bubbles start to emerge from the opening of test tube, take rubber tube out of the test tube.
  - Stand the test tube upside down on table (opening pointed downward) or stop it with a rubber stopper.

T5 - Decantation



Sedimentation Decantation



T5 Video on YouTube (Click)

Decantation is a simple method to separate solids and liquid. When specific gravity of the solid precipitate is greater than liquid, it settles to the bottom. While there is little solid remain suspended, it may be separated easily from the liquid by carefully pouring off the liquid.

- Stand the suspended solution by allowing the solid to settle to the bottom of the mixture.
- Use a glass rod to guide the liquid flow when pour off the liquid from the beaker slowly enough that the solid is not carried along.

T6 - Gravity Filtration

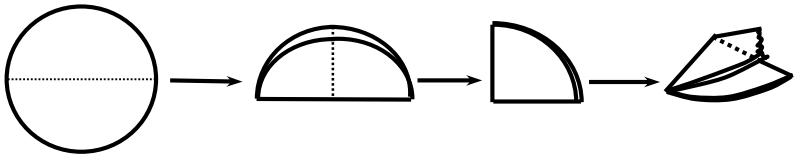


Figure T6-1 Folding a filter cone

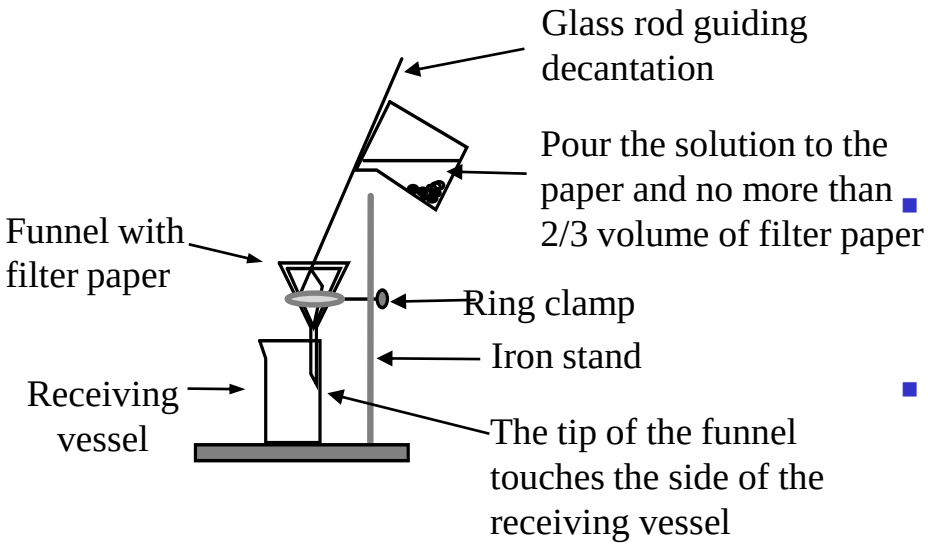
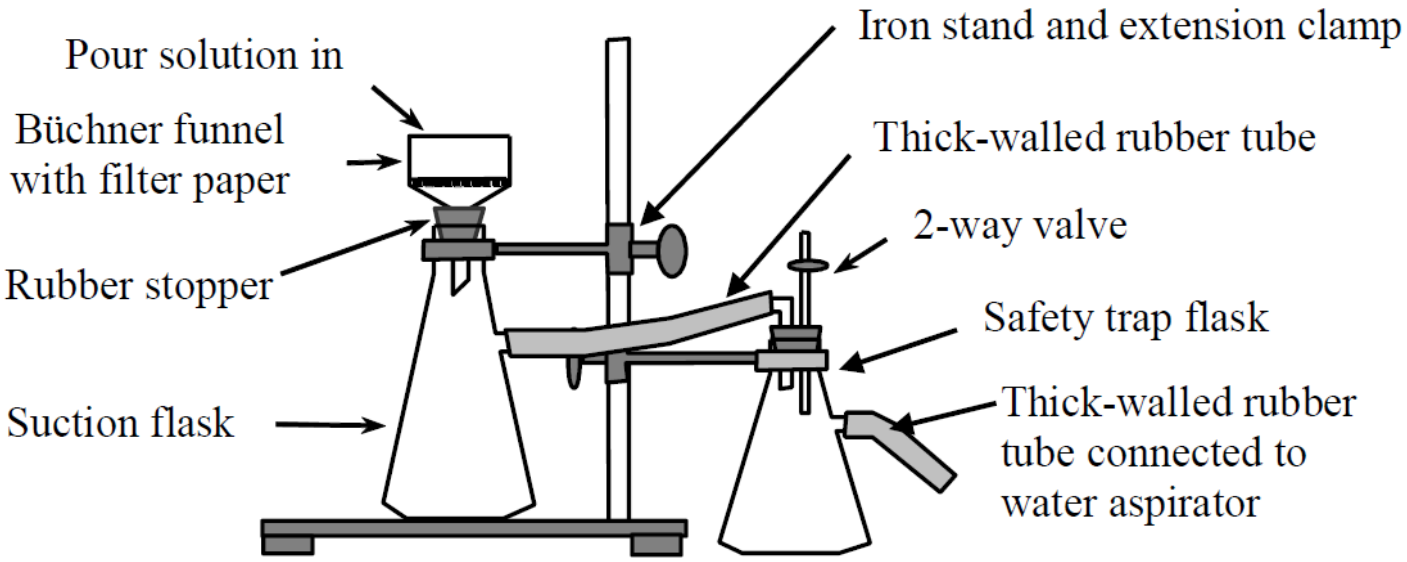


Figure T6-2 Setup of gravity filtration

- Fold the filter paper to cone shape. Tear off a small piece at corner to stick better to the funnel. Properly position the paper in the funnel, and the filter paper should not over the edge of funnel.
- Use a ring clamp to support the glass funnel. The tip of the funnel should touch the side of the vessel which receives the filtrate.
- Use a glass rod to guide liquid, and pour the liquid onto the paper not on the glass.
- Pour the solution into the filter until the paper cone is no more than two-thirds filled. Never fill the cone completely.
- After filtration, use tweezers to clip the filter paper; do not use your hand.

T7.1 - Vacuum Filtration

T7 Video on YouTube (Click)

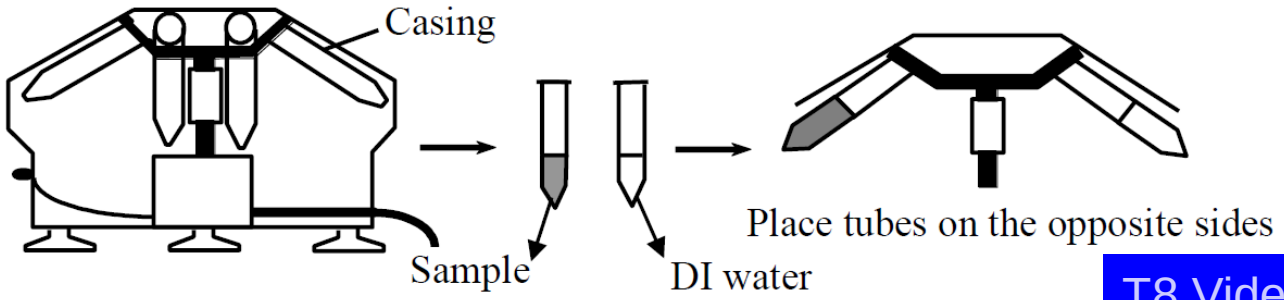


- Fill up the water tank of circulating water aspirator with water (water flows in from bottom and out from top), and keep circulating flow.
- Fix safety trap flask and suction flask with extension clamp.

T7.2 - Vacuum Filtration

- A Büchner or Hirsch funnel is sealed to the filter flask by the rubber stopper or a rubber gasket cone.
- Select a suitable unfolded piece of circular filter paper to cover the perforations of Büchner funnel or Hirsch funnel.
- Moisten the paper with small amount of solvent, and tightly sealed against the bottom by turning on the water aspirator and closing the 2-way valve (stopcock parallel to bench) to apply suction.
- Test the suction works, then pour the solution down to a glass rod aimed at the center of the filter paper.
- In order to collect the precipitate (crystal), it can be washed by adding small amounts of wash liquid over the surface of the precipitate. Precipitate can be air-dried by allowing them to stand in the funnel and drawing a current of air from the room through the precipitate with the vacuum pump.
- After filtration, open 2-way valve first (stopcock perpendicular to bench) and confirm no one is using vacuum filtration, then turn off the power of water aspirator to avoid the water backflow to the safety trap bottle from water tank.
- Turn off the circulating flow; drain the water in the water tank.

T8 - Centrifugation



T8 Video on YouTube (Click)

- Check the casing inside the machine is intact. If corrosion causes holes in casing or there is unknown substance inside, clean or replace the casing.
- Use centrifuge tubes in centrifugation; **do not use ordinary test tubes**.
- Use an equal number of tubes or fill one with a counterbalancing solution. Place centrifuge tubes on **opposite sides to keep balancing**.
- Always close the centrifuge cover before you start the motor, and open it only after the assembly has stopped.
- Start the centrifuge from low speed to check if there is any malfunction, then speed it up.
- If there are unusual sounds or vibration, turn off the centrifuge immediately in order to check and fix up.
- There must be at least one person look after the centrifuge when in use.
- When centrifugation is completed, turn off the switch and allow the rotating centrifuge assembly to come to rest. Do not attempt to stop the rotation manually when the centrifuge is still rotating at high speed.

T9 - Electronic Balance

T9 Video on YouTube (Click)

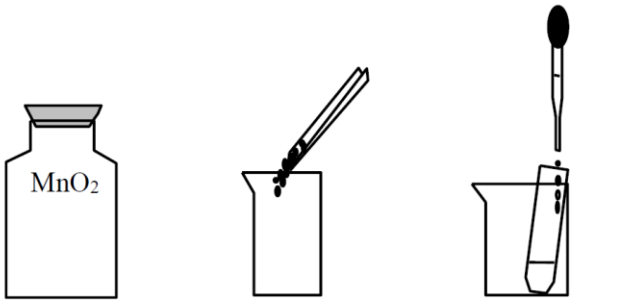
- To maintain calibration, never move the balance.
- Do not overload the balance. Maximum load of an electronic balance in lab is usually 610 g.
- Check to see that the balance is level and clean before use.
- Warm up the balance for 30 min before use.

Electronic Balance
(s.f. only contains two decimal places)

Analytical Balance
(s.f. contains four decimal places)

- Put weighed object in the center of weighing pan. Read digital readout for mass.
- Use folded weighing paper, beaker or bottle as container while weighing. Do not put chemicals on the pan directly.
- Always allow an object that has been heated to return to room temperature before weighing it. The buoyancy of convective airflow around the pan will affect object's apparent mass.
- Keep the balance and its case scrupulously clean. The balance area has a soft brush for this purpose.
- Do not invert balance upside down to avoid damage to the parts inside.
- Analytical balance is an instrument with high precision with maximum load of 210 g. Close its windshields while zeroing and weighing, otherwise the reading is fluctuated and inaccurate.

T10 - Weighing Chemicals

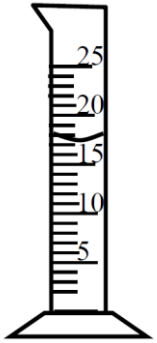


Read label first | Weigh solid chemicals | Weigh liquid chemicals

T10 Video on YouTube (Click)

- Read the label on the bottle of the chemicals carefully to avoid taking the wrong one.
- Use folded weighing paper, beaker, or weighing bottle to hold solid chemicals.
- Use a clean and dry spatula to take solid chemical.
- Use a clean and rinsed dropper to take liquid chemicals.
- Keep the electronic balance clean and control the amount of chemicals taking to avoid excess weighing, dripping, and scattering around.
- Unless specifically directed to the contrary, never return any excess reagent to the original bottle to avoid contamination. Put it in specified waste can.
- Keep well closed after taking chemicals.
- Keep the reagent shelf and the laboratory balance clean and neat at all times. Clean up any spillages immediately.

T11 - Graduated Cylinder



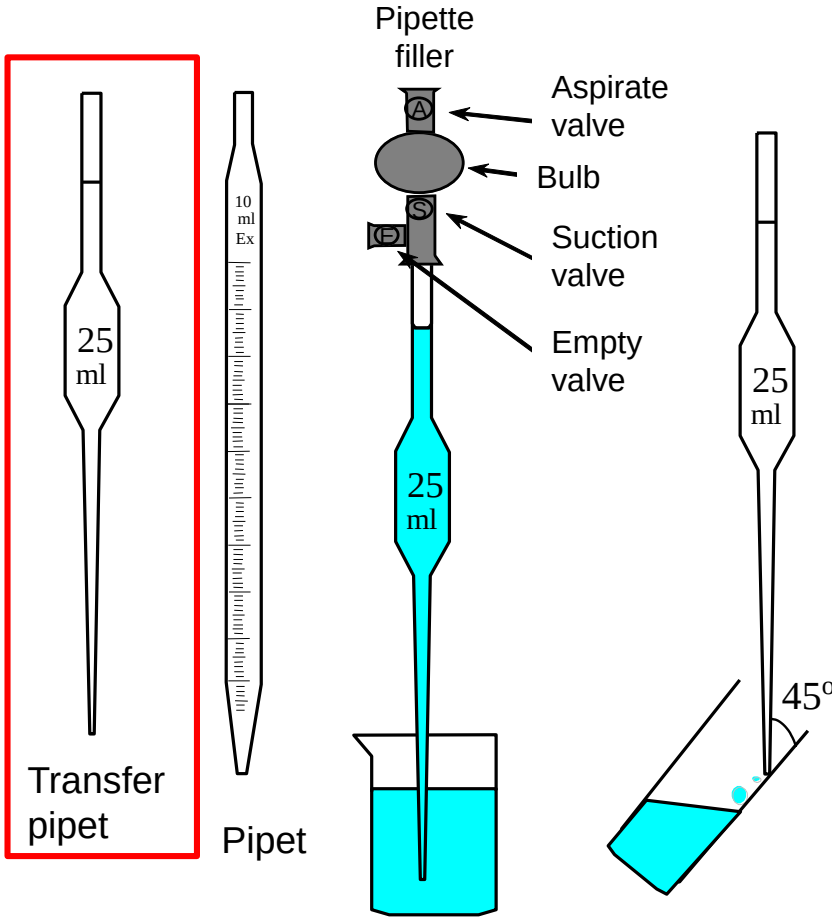
T11 Video on YouTube (Click)

- Clean the graduated cylinder and rinse twice with small amount of the liquid to be taken.
- Carefully place the liquid to be measured into the graduated cylinder with a steady stream against a wall near the calibration line, being careful not to splash.
- When the level is just below the calibration line, stop for a few minutes to let the liquid drain from the walls of the container.
- Use a dropper to add the liquid to the calibration line, or to draw out excess fluid.
- Slowly incline the cylinder to provide a steady stream of liquid from the spout to transfer the liquid to another container. Be careful not to splash.
- Continue inclining the cylinder until it is vertical and hold for about several seconds.
- Touch the drop at the tip of the spout to the wall of the receiving container.
- Wash and brush the graduated cylinder after use.

T12.1 - Transfer Pipet

- Wash a 25 mL-transfer pipet thoroughly.
- Rinse twice with small portion of sample solution.
- Press valve **A** of pipet filler and squeeze bulb to expel the air inside and create a vacuum.
- Insert the top of pipet into pipet filler, press valve **S** to draw liquid to pass the graduation mark.
- Remove pipet filler and quickly close the top of pipet tube with forefinger and adjust liquid level to the mark.
- Hold pipet vertically and transfer liquid into container. (One hand hold pipet and the other hand hold container.)
- Remove forefinger and free fall the drop on tip by touching it to the wall of container.
- Stay for 15 s to drain the solution.
- Do not blow out remaining liquid. Pipet is calibrated for this to remain.
- Wash thoroughly after use.

T12 Video on YouTube (Click)

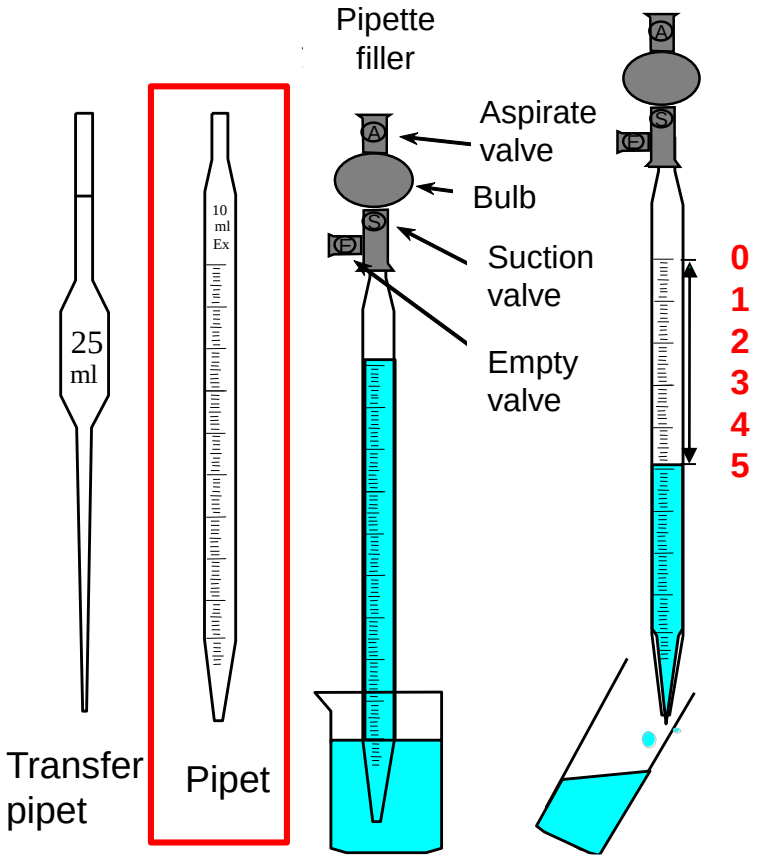


T12.2 - Graduated Pipet

E.g. Deliver 5.00 mL solution:

Partially deliver

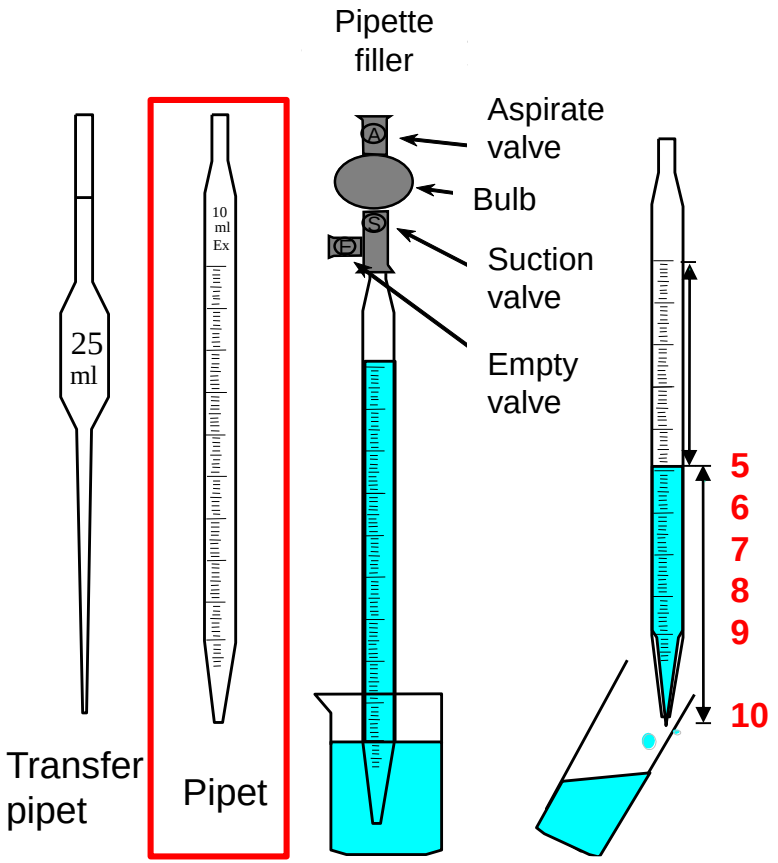
- Wash a 10 mL pipet thoroughly.
- Rinse twice with small portion of sample solution.
- Press valve **A** of pipet filler and squeeze bulb to expel the air inside and create a vacuum.
- Insert the top of pipet into pipet filler, press valve **S** to draw liquid to equal to the mark of 0.00 mL.
- Hold pipet vertically and transfer liquid into container. (One hand hold pipet and the other hand hold container to operate.)
- Press valve **E** to drain liquid to the mark of 5.00 mL.
- Wash thoroughly after use.



T12.3 - Graduated Pipet

E.g. Deliver 5.00 mL solution:

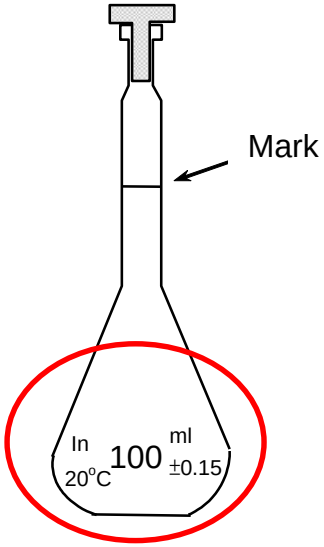
- Wash a 10 mL pipet thoroughly.
- Rinse twice with small portion of sample solution.
- Press valve **A** of pipet filler and squeeze bulb to expel the air inside and create a vacuum
- Insert the top of pipet into pipet filler, press valve **S** to draw liquid to pass the graduation mark.
- Remove pipet filler and quickly cover the top of pipet with index finger and adjust liquid level to the mark of 5.00 mL.
- Hold pipet vertically and transfer liquid into container. (One hand hold pipet and the other hand hold container to operate.)
- Remove index finger and free fall the drop on tip by touching it to the wall of the flask.
- Stay for 10-15 s to drain the solution.
- Do not blow out remaining liquid, pipet is calibrated for this to remain.
- Wash thoroughly after use.



T13 - Volumetric Flask

T13 Video on YouTube (Click)

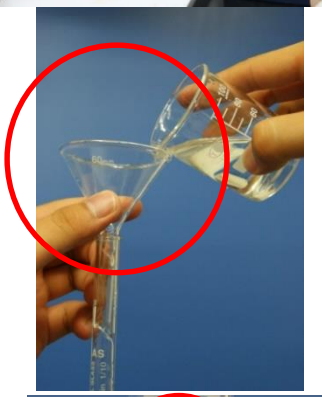
- Wash volumetric flask thoroughly and rinse with DI water.
- Transfer the solution to flask with the help of a funnel.
- Fill the flask about half full and swirl the contents to achieve solution.
- Bring the liquid level almost to the mark.
- Use a dropper to add solvent to the mark.
- Stopper the flask and invert the flask repeatedly to assure homogeneous.
- Pour the solution in a beaker for later use; do not store the solution in the flask.
- Wash immediately after use.

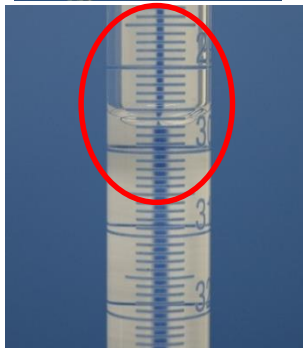


T14 - Titration

- Rinse a buret with D.I. water thoroughly.
- Rinse twice with ca. 5 mL titrant.
- Transfer the titrant to buret via funnel.
- Drain slowly until the tip is free of air bubbles and completely filled with liquid.
- Read and record initial (V_i) and final volume (V_f) of buret to 0.01 mL.
- Place buret tip well inside the receiving flask during titration.
- Swirl the flask with right hand and control the stopcock with left hand (process done by one person).
- Rinse the buret with tap water, inverted clamped, and left to dry after the experiment.

T14 Video on YouTube (Click)





T15 - Litmus Paper

Figure T15-1 Using litmus paper to test acid base property

T15 Video on YouTube (Click)

- Blue litmus paper will turn red under acidic condition.
- Red litmus paper will turn blue under basic condition.
- With the color change of the litmus paper, the acidity and alkalinity of sample can be known but the precise pH value cannot be determined.
- There is another widely used universal indicator paper which is a combination of a variety of indicators to obtain various color changes. Compare the colors with pH paper indicator chart, the pH value of sample can be known roughly.
- When test with solution, use a clean glass rod dip the solution and then touch it on a litmus paper or a universal indicator paper. Do not throw litmus paper directly into solution to avoid contamination.
- When test with gas, first wet the litmus paper and then place it on the opening of vessel. After the gas diffuse out and absorbed by litmus paper, the acidity and alkalinity can be judged by color change.

T16.1 - pH Meter

Preparation and Calibration:

- Push the **"POWER"** button, warm up for 10 minutes
- Remove the electrode cap by **rotating** it
- Use washing bottle to **rinse the electrodes**
- Blot dry with a **tissue**
- Press "**HOLD**" when cleaning the electrodes and the screen will freeze
- Collect **pH 7.0** and **4.0** standard buffer solution
- Switch **Mode** to **"Temp"** function to check if the temp is close to r.t.
- Switch to **"pH"** function
- Immerse **thermoprobe** and **electrodes** into pH 7.00 buffer solution
- Adjust **Calib.** knob until meter shows **'7.00'**
- Rinse thermoprobe and electrodes
- Immerse in pH 4.00 buffer solution
- Adjust **Slope** knob until meter shows '**4.00**'

T16.2 - pH Meter

Measurement:

- **Use** beaker for testing
- Place the electrode on the holder
- When testing, **both thermoprobe and the electrode** should be placed in soln
- The **salt bridge** of electrode should be fully immersed in the test solution
- Position the electrode properly so that the stirring bar will not strike the electrode
- Turn the magnetic stir on
- Rinse the electrode with D.I. water and blot dry with tissues when changing the test soln
- Immerse the electrode in **clean D.I. water** when not in use
- Immerse the electrode in **3 M KCl** soln when not in use for long period of time

T17 - Spectrophotometer

Calibration and Measurement:

(1) Turn on power to warm up for 20 min

(2) Empty the cuvette holder

(3) Press Mode button and set to A (Absorbance)

(4) Set the analytical wavelength (i.e. 620 nm)

(5) Press [BLANK] button to zero set

(6) Place blank soln to cuvette holder

(7) Press [BLANK] to calibrate

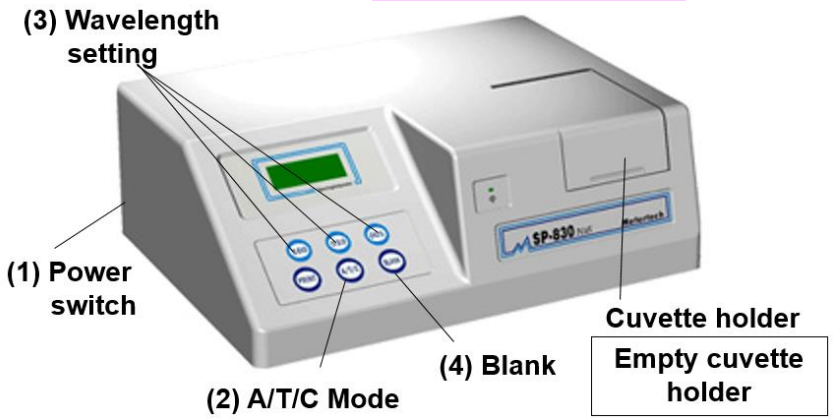
(8) Place sample soln into cuvette holder

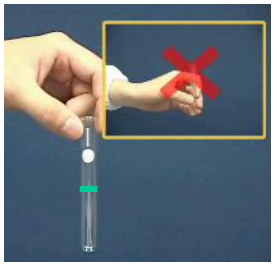
(9) Align cuvette in same direction to control the path of the light

(10) Close lid and read the Absorbance

Note: YouTube T17 Video shows old Spectronic 20, new SP-830 plus is used in lab now

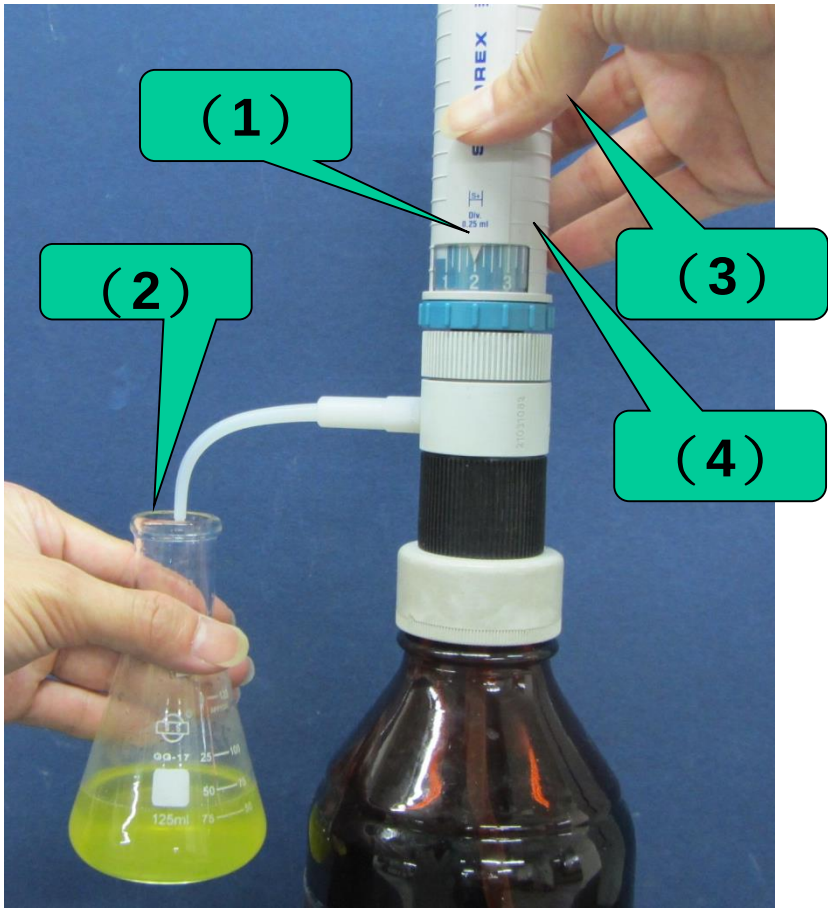
SP-830 plus





Laboratory Dispenser

1. Check the pre-set volume and do not change the volume setting afterwards.
2. Position the flask under the tip of dispenser.
3. Lightly pull the piston pump up and down several times to get rid of the bubbles.
4. Lightly pull piston pump up to the top, then slowly push down to obtain the measured solution.



Vortex Mixer

Notes:

1. **Before use:**
   Switch to “TOUCH” mode and set speed knob at low
2. **During use:**
   Bring tube bottom to touch the tube holder on mixer. Adjust to moderate speed during oscillation because high speed may let the mixed solution splash out

Use moderate speed during oscillation

Tube holder

“ON”

“TOUCH”

Mode switch

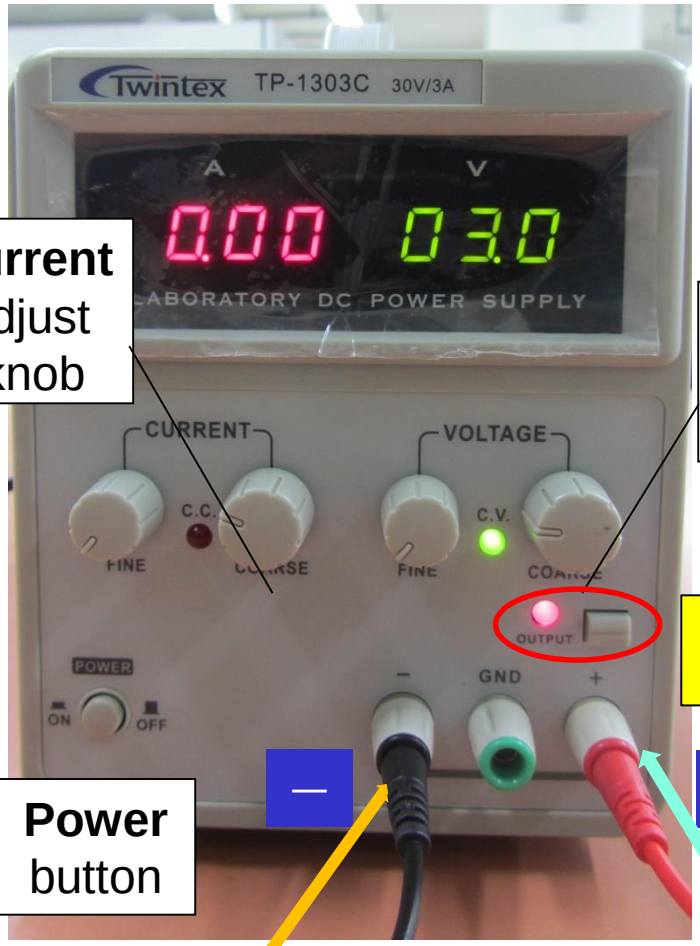
Speed knob

Table Top Centrifuge

1. **Before centrifugation:**
   Place centrifuge tubes in equilibrium position.
   Latch the top cover, set speed knob at low scale **(1~2)**
2. **Start centrifugation:**
   Set timer at a short interval (1~2 min) to start centrifugation. If there are unusual sounds or vibration, stop the centrifuge immediately.
3. **Speed up:**
   Without any malfunction, then speed it up. **(scale 5)**
4. **Stop centrifugation:**
   Unplug the power cord or wait until time is up, never turn the timer counterclockwise to stop and cause malfunction

ARON DSC 200A-1

DC Power Supply (Use in E11)



Current adjust knob

Voltage adjust knob

OUTPUT button

Power button

Connect to Cu wire

Connect to ITO glass

(1) Disconnect to Cu wire and ITO glass, set all knob/button at zero

(2) Power on, press OUTPUT button (light on)

(3) Adjust Voltage/Current knobs to 3 V

(4) Press OUTPUT button again (light off)

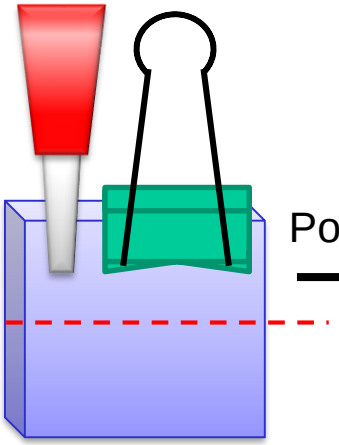
(5) Connect Cu wire/ITO glass correctly

(6) Press OUTPUT button (light on), electrolysis for 5 min

(7) Observe the color change during reaction

(8) After use, disconnect Cu wire and ITO glass, set all knob/button at zero

(9) Power off and place it underneath lab bench



Polymerize