

APPENDIX F: BASIC LABORATORY TECHNIQUES

1. Lighting a Bunsen Burner

Become familiar with the style of Bunsen burner you have, noting how the air ports can be adjusted.

Steps to follow are:

- a. Attach the rubber intake hose of the Bunsen burner to the nearest gas valve.
- b. Check that all gas valves at the laboratory benches are shut off, and then open the main gas valve.
- c. Close off air intake ports at the base of the barrel so as to produce a cool red flame upon lighting. This is done either by rotating the barrel clockwise until it stops or rotating a sleeve at the base of the barrel to cover intake ports.
- d. If there is a gas valve at the base of the barrel, check that it is open about one-half to one revolution.
- e. Fully open the valve attached to the intake hose. If there is no valve at the base of the barrel, then partially open the valve at the intake hose. Using a flint striker or a match, light the gas at the top of the barrel. If there is too much gas/air mixture coming through the barrel, it will create a strong current of gas that is difficult to light and that may blow out the match. If this happens, check the air intake ports to ensure they are closed. Once lit, you should have a cool red flame.
- f. The air ports can then be opened by turning the barrel counter-clockwise or rotating the sleeve to get the desired intensity of flame (blue flame is hottest).
- g. The gas valve can be opened further to get a bigger flame.

2. Pouring Solutions into a Funnel Filter

Pour the liquid along a glass stirring rod, the end of which is in line with the centre of the filter in the funnel. This will avoid splashing the solution or liquid.

[See [Videos](#) listed at the end of this appendix.]

3. Diluting Concentrated Acids and Bases

Working with concentrated acids or bases safely requires careful handling and an understanding of the hazards involved.

Never add the water to the concentrated acid or base, as this causes an excessive build-up of heat and spattering may result. The acid or base should always be added to the water.

The following steps help to reduce the inherent hazards associated with these concentrates:

- a. Put on a long-sleeved laboratory coat, rubber gloves, and full face protection.
 - b. Determine the volume ratio of water and acid/base required for the concentration intended and the total volume of dilute acid/base needed.
Example: Let us assume 1 L of 10% sulfuric acid is required and 50% sulfuric acid is on the shelf. To get a 10% concentration requires a ratio of 2 mL of 50% acid to 8 mL of distilled water. Therefore, to make 1 L of 10% acid, add 200 mL of the acid to 800 mL of water.
 - c. Measure the required amount of the concentrated acid or base in a graduated cylinder. This can be done in a fume hood to avoid inhaling fumes, particularly acid fumes that are very corrosive. Now add it slowly to the proportionate amount of water in another container. Using a glass stirring rod, stir the water as the acid or base is added to dissipate the heat.
 - d. Avoid inhaling concentrated acid vapours.
4. Cutting Glass Tubing

Follow the procedure as outlined.

- a. Etch the glass with a triangular file.
- b. With the etch facing away from you, hold the tubing with both hands so that the thumbs are pressing on each side of the etch. Apply gentle pressure on the thumbs to snap the tubing.
- c. Glazing or fire polishing the cut end of the tubing in a hot Bunsen burner flame will remove the rough edges.

5. Inserting Glass Tubing into a Stopper

Safe insertion of tubing or a thermometer into a rubber stopper can be done as follows:

- a. Ensure there are no rough edges on the end being inserted. If necessary, glaze the end in a hot flame and let cool.
- b. Lubricate the glass with glycerin, Vaseline, or stopcock grease.
- c. Wrap a cloth around the tubing or thermometer, or put on thick gloves before starting the insertion.
- d. Grasp the tubing close to the end to be inserted with the fingers of one hand and the stopper in the fingers of the other. Avoid grasping either with the palm of your hand.
- e. Insert with a rotating motion while applying gentle pressure. Avoid excessive force that can snap the tubing. If excessive force is required, check to ensure the hole is large enough to accommodate the tubing.

Notes

If glass tubing or thermometers remain in stoppers for prolonged periods of time, the stoppers will harden and the glass will bind to the stopper surface. Do not attempt to push or pull glass tubing or thermometers from rubber or cork stoppers that have hardened. It is best to cut away the stopper from the glass with a sharp knife or scalpel.

6. Boiling Liquids

Liquids often boil in an uneven fashion called “bumping,” because bubbles of steam cannot form regularly on the smooth container walls. This leads to irregular flashes of superheating that result in large bubbles of steam erupting violently to the surface, causing splashing and spitting or, at worst, expulsion of contents from full containers.

Bumping can be prevented by adding a few boiling chips to the liquid before you start heating. These chips provide a rough surface upon which bubbles can form. Avoid adding the chips to liquids near boiling temperature because this can cause immediate boiling over of the liquid. “Porous” boiling chips cannot be reused since the pores become filled with liquid on cooling. “Sharp” chips like silicon carbide or coal are reusable until they become coated with residues and become ineffective.

7. Heating Flammable Liquids

Heating flammable liquids should be done in a water bath heated by a hot plate. Test tubes of flammable liquid can be placed in a beaker of water large enough to immerse the test tube contents but small enough to keep the tubes upright. If the use of an open flame cannot be avoided in heating the water bath container, place the container on a wire gauze or alternative surface to ensure that the flame does not reach the flammable vapours. Alternatively, a larger metal tray of water placed on a stand plus a beaker of water set into the tray to hold test tubes of flammable liquid would be the safest arrangement when an open flame is used. If it is the beaker itself that holds the flammable liquid, then it may have to be weighed down to offset buoyancy while in the water bath.

8. Avoiding a Van de Graaff Discharge

Operating a Van de Graaff generator in a draft-free room with low humidity may result in a build-up of electric charge on your body if your shoes are non-conducting and prevent flow of current to the floor. Once electrified, you will get an electric discharge if you touch any grounded object, such as the metal switch to turn the machine off. To avoid this unpleasant “zap,” hold a small metal object in your hand while using the generator, and then touch it against ground before turning off the generator switch with your other hand.

9. Removing Stuck Glass Stoppers

Follow the procedure outlined below:

- a. Stand the bottle in a large sink.
- b. Cover the stopper and the neck of the bottle with a cloth.
- c. Gently tap the stopper. If the jammed stopper is glass, use another glass stopper to tap against it, since glass stoppers will set up a resonance that will often successfully loosen the stopper stuck in the bottle.
- d. If possible, run the neck of the bottle under a stream of hot water to allow for expansion of the neck, and then repeat the tapping.
- e. If these measures fail, it will be necessary to break the neck of the bottle to remove its contents. Score around the neck with a glass file, then apply a point of hot glass to the score mark. The neck should break cleanly along the score mark.

10. Weighing Chemicals

When handling chemicals, keep the following points in mind:

- a. Wear a protective apron and gloves when necessary.
- b. Always place the powdered chemical on paper (filter paper, hand towel, paper cup) or in a container when weighing necessary amounts. Avoid chemical contact with metal pan or balance.
- c. Use a fume hood when handling powders of more toxic or corrosive chemicals to avoid inhalation.
- d. Replace the cover or stopper on the chemical container as soon as possible, particularly for more volatile substances.
[See [Videos](#) listed at the end of this appendix.]

11. Odourous Chemicals

If required to smell the chemical or solution, hold the container slightly in front of and beneath your nose and waft the fumes towards your nostrils with your hand.

Never smell a chemical or solution directly.

12. Use of Scalpels

Remember the following points when using scalpels:

- a. Always cut away from fingers near the area being dissected.
- b. Never try to catch a scalpel that has been dropped.
- c. After completing a series of dissections, immerse in 5% sodium hypochlorite solution for at least 30 minutes to prevent carry-over of contaminants. Follow with a thorough cleaning of scalpels.

13. Use of an Autoclave

Autoclaves are high-pressure steam or dry heat devices used to sterilize infected or potentially infected material, or to prepare for sterilized solutions or equipment. To operate an autoclave safely, remember the following points:

- a. Ensure the door is completely closed before starting the sterilization process.
- b. Use containment procedures when sterilizing known infected material. Wear full protection including a long-sleeved laboratory coat or gown, protective gloves, and a face mask as a minimum protection against infection.
- c. Always use a “hot hand” or glove to remove any article from the autoclave. It must never be presumed that the autoclave has cooled down.
- d. Carry out regular sterilization effectiveness testing using spore strips or an equivalent.
- e. Regularly check mechanical parts of the autoclave for normal functioning. Poorly maintained autoclaves can be lethal.

14. Pressure Cooker-Type Autoclave

- a. Ensure safety valve is clear and operative.
- b. Tighten wing nuts evenly by tightening two opposite nuts simultaneously.
- c. Do not allow the operational pressure (gauge reading) to exceed that specified in the operation manual. Generally, this will be between 101.3 kPa to 138 kPa (15–20 psi) pressure.
- d. Allow to cool before opening the stopcock to equalize pressure.
- e. Remove the cover only when the pressure has been equalized.

15. Shaking a Test Tube

The proper and safe technique of shaking the contents of a test tube is as follows:

- a. Place a stopper into the tube.
- b. Shake the tube by flicking it with your finger or by holding the stopper with your thumb and turning the tube over several times.

Videos

Using a Balance. MIT Digital Lab Techniques Manual.

www.youtube.com/watch?v=cG6QrqS4ruQ&list=PL07AC74BBD3085056

Filtration. MIT Digital Lab Techniques Manual.

www.youtube.com/watch?v=P-UBuAFxjiA&list=PL07AC74BBD3085056