
Lab Safety

INTRODUCTION

Performing experiments can be great fun. Observing nature up close and personal is interesting, informative, and rewarding. As beginning students, your task in the laboratory is to become familiar with the proper use of chemical equipment, techniques, and reagents. The results of an experiment are not as important as the manner in which you perform the experiment. You are in training. When you learn a technique, you will usually find that later experiments will require you to repeat that technique. Remember what you have done previously, and refer to past experiments if you need a reminder of the details of the technique.

Just as there are dangers involved with cooking, so there are dangers involved in a chemical laboratory. Burns and cuts are common injuries for cooks. They typically occur while the cook is distracted or in a hurry. In a college chemistry course, many students are working side-by-side, and so safety becomes a collective responsibility that requires the full cooperation of everybody in the laboratory. The ultimate responsibility for safety lies with each one of the students carrying out some type of procedure. Accidents often result from an indifferent attitude, failure to use common sense, or failure to follow instructions. Each student should be aware of what the other students are doing because all can be victims of one individual's mistake. Do not hesitate to point out to other students that they are engaging in unsafe practices or operations. Help one another. If necessary, report it to the instructor. In the final assessment, students have the greatest responsibility to ensure their own personal safety.

This guide contains a list of do's and don'ts to minimize safety and health problems associated with experimental laboratory work. Here are a few general guidelines:

1. Follow all safety instructions carefully.
2. Be familiar with the location of safety facilities such as safety showers and eyewash stations.
3. Become familiar with the hazards of any chemicals you will use, and know what precautions to take and emergency procedures to use before undertaking any work.
4. Become familiar with the chemical operations and the hazards involved before beginning an operation.

PERSONAL PROTECTION

Eye Protection

During a laboratory session, all people in the laboratory must wear eye protection at all times, even when not performing a chemical operation. Remember, others in the laboratory may still be working, even if you have finished. The State requires full cover eye goggles with indirect ventilation. The bookstore carries the approved style. If you have a pair of goggles, check with the instructor to see if they are the approved type.

Body Protection

Lab aprons or coats must be worn during experiments. Inexpensive aprons are sold in the bookstore. If you plan to take a full schedule of science lab classes, you should invest in a lab coat. These are usually made of cotton or polyester. The storeroom has a few for sale, and also has information on where to purchase them.

Clothing worn in the laboratory should offer protection from splashes and spills. High-heeled or open-toed shoes, sandals, or shoes made of woven materials should not be worn in the laboratory. Shorts, cutoffs, and miniskirts are also inappropriate. Long hair and loose clothing should be constrained.

Internal Protection

Everyone working in a chemistry laboratory should be aware of the dangers of ingesting chemicals. These common sense precautions will minimize the possibility of such exposure:

1. Do not prepare, store, or consume food or beverages in the laboratory.
2. Do not apply cosmetics in the laboratory.
3. Wash hands before leaving the laboratory.

The information in this guide is taken primarily from [Safety In Academic Chemistry Laboratories](#), by the American Chemical Society, 1990

LABORATORY PROTOCOL

Behavior

The chemistry laboratory is a place for serious learning and working. Horseplay cannot be tolerated. Variations in procedures including changes in quantities, reagents, apparatus, or setups may be dangerous. Such alterations may only be made with the knowledge and approval of the instructor.

Housekeeping

In the laboratory and elsewhere, keeping things clean and neat generally leads to a safer environment. Put all excess clothing and books in designated areas. Do not pile them on any of the work areas in the laboratory, including the balance areas. Keep drawers and cabinets closed when working. Keep aisles as clear as possible by positioning lab stools close to the benches. Do not kneel down during experiments.

Inform the instructor immediately if anything breaks or spills. Use the required procedure for the proper disposal of broken items, chemical wastes and solvents. These procedures will be listed in the laboratory directions or will be directly given by the instructor in case of accidents.

After an experiment, return all equipment to its proper place. Some items will go into your personal drawer, some will go into the shared drawers, and some will be returned to carts or to the storeroom. Be aware of what should be in your personal drawer so that you do not mistakenly place items there which belong elsewhere. There are only a few metal objects that belong in your drawer: crucible tongs, forceps, scoopula, micro spatula, and test tube holder. Any other metal equipment belongs in the common drawer or is special issue.

Cleaning Glassware

Examine glassware for chips before handling. Chipped glassware can inflict nasty cuts.

Clean glassware with soap and a brush, if necessary. Brushes are found inside the cabinet doors under the sinks. Use tap water for washing and rinsing. Use deionized water for a final rinse. If the glassware will have water added to it as part of a procedure, it does not have to be dried. If you are cleaning glassware after a lab, it also does not have to be dried. It will air dry in the drawer overnight. Use paper towels to dry glassware when necessary, such as when a dry substance, a prepared solution, or a nonaqueous solvent will be used. For test tubes and graduated cylinders, prepare the paper towel by folding it again and again and again, until it is a long tube with the diameter of the tubular glassware. Then put a lengthwise crease in it, and insert it into the glassware, and move it partially out and back in the glassware a number of times with rotation.

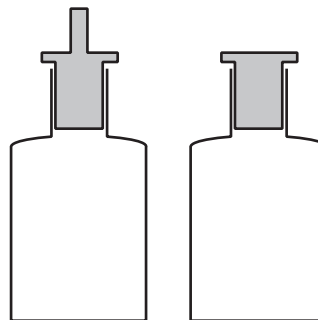
Do not use compressed air to dry glassware.

Transporting Chemicals

Chemicals for experiments will be placed in various locations depending on the type and quantity of chemical required.

Solid chemicals that will be weighed will be found alongside the balances. You will weigh the chemical onto weighing paper or into a container, depending on the experiment, and then take the chemical back to your work area. If you spill any solid as you are weighing, tell the instructor, who will show you the cleanup procedure. Failure to do so may result in a grade penalty.

Liquid chemicals will be in duplicate sets in the fume hoods when small volumes are required. When large volumes are required, the liquids will be in carboys on the side counters or on carts. Each experiment tells you how much of a liquid chemical to get. Liquids will be in a variety of containers. Some have dropper tops. Others will be in plastic containers with screw tops. A common container is a glass reagent bottle with one or another of the two stoppers shown here:



To remove the stopper on the left, with the back of your hand facing down, grasp the fin of the stopper between your index finger and second finger, pull it off of the bottle. Grasp the bottle with the stopper still between your fingers pointing away from the bottle to pour, or use a transfer pipet attached to the bottle to withdraw, the volume required. Back hand the stopper in place when finished. Finned stoppers are designed to be held, not to set down on the table top.

The stopper shown on the right is designed to be set down on the table top, upper flat side down. When you replace it in the bottle after pouring, take care that your fingers do not touch the part of the stopper that extends into the bottle.

Keep the bottles in their original order in the fume hood. **Do not** take bottles out of the fume hood. If there is a spill, tell the instructor.

After you have obtained the liquid, take it back to your work place, unless the experiment tells you otherwise. Be careful. Try to anticipate any abrupt moves by other students as you pass by them. If the liquid is in a test tube, you will place it either in the test tube rack or in a beaker or flask, depending on the instructions in the experiment.

Disposal

The handling of reaction by-products, surplus and waste chemicals, and contaminated materials is an important part of laboratory procedures. Each laboratory worker is responsible for ensuring that wastes are handled in a manner that minimizes personal hazard and recognizes the potential for environmental contamination. Each experiment will give specific instructions for disposing of chemicals. We follow State and Federal guidelines for disposal procedures.

Only if the directions in the experiment tell you to do so should you pour liquids into the sink. Otherwise, follow the directions for the proper place to pour liquid waste. Solid waste should also be placed according to directions. Paper towels may be discarded in the waste containers, unless they were used to clean up a spill. In that case, ask the instructor where to dispose of the paper.

Broken glass belongs in its own waste container. Broken thermometers are kept separate. Always report broken glassware immediately.

Unattended Experiments

The general rule is that as long as there is a flame or a heating device on, you must be at your lab station. Many experiments involve waiting periods for reactions to develop. In some cases, it is safe to leave the procedure on its own, while in other cases, it is not safe. If you need to leave the laboratory, and you have doubts about the safety of a procedure that is developing, ask the instructor. If an experiment has a number of parts, and you wish to leave the laboratory between parts, then simply inform the instructor that you are doing so.

EMERGENCIES

Injuries

Report all injuries to the instructor. Typical injuries are cuts and burns. If a caustic chemical spills or splashes onto your clothing or body, it can cause injury if not properly rinsed and/or neutralized. Spills onto the hands are the most common. Immediately rinse with tap water. Rinse longer than you might expect you should. Take special care that you rinse under the fingernails.

If a caustic substance gets on the clothing, tell the instructor. Remedies usually involve rinsing and application of a baking soda paste. When a spill onto clothing could cause a modesty problem, treatment will occur in the storeroom. In severe cases, use the safety shower. Remove contaminated clothing while under the shower. Seconds count, and no time should be wasted because of modesty.

Splashes into the eyes are prevented by safety goggles, but in the event that a chemical does get splashed into the eyes, the eye wash station delivers a soft flow of water into the eyes. If such an accident takes place, nearby students must

immediately help and inform the instructor as well as lead the injured student to the eye wash station.

If an injury requires professional treatment, the Student Health Center (xt 6258) has the following hours:

Monday through Friday: 9:00 AM until 2:00 PM

Monday through Thursday: 4:00 PM until 6:00 PM

Otherwise, call 6111 to get Campus Security to help, and find out the insurance carrier for the injured student.

Earthquake

If an earthquake strikes, turn off the gas, pull electrical plugs, set containers in the sink, and get into the center aisles between the lab tables or in the area near the greenboard at the instructor's station. Stay away from the chemical and equipment storage areas. Get on the floor with your head under a stool seat. When the shaking stops, wait for further instructions. It might be safer inside than outside. Emergency crews will advise the next steps to take if there are any.

Fire

If a person's clothing is on fire, that person should use the safety shower. Douse the fire with water immediately when noticed. Fire blankets must be used with caution because wrapping the body can force flames towards the face and neck. Quickly remove any clothing contaminated with chemicals. Use caution when removing pullover shirts or sweaters to prevent contamination of the eyes. Douse with water to remove heat and place clean, wet, cold cloths on burned areas. Get medical attention immediately.

A fire contained in a small vessel can usually be suffocated by covering the vessel with a watch glass or a properly sized beaker. Do not pick up the vessel. Do not cover with dry towels or cloths. Remove nearby flammable materials to avoid spread of the fire.

If the fire is burning over an area too large to be suffocated quickly and simply, all persons should evacuate the area. The instructor will use the fire extinguisher on the fire if that seems feasible.

If the fire is out of control, activate the fire alarm. One alarm is up the hallway out of the lab, a few feet from the doors, opposite room 2324. Another alarm is down the lower hallway, a few feet from the doors, opposite room 2304.

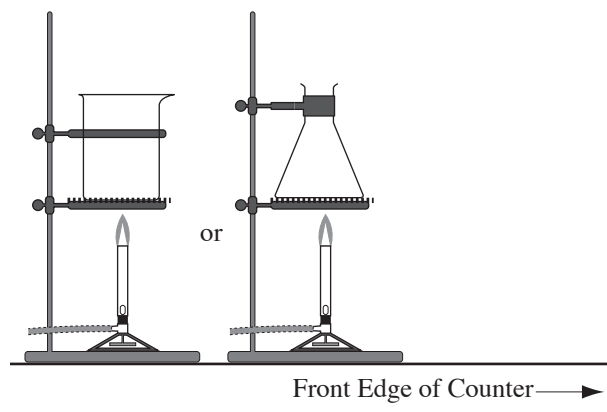
Bomb Threats and Fire Drills

While these are not emergencies, they do require that everyone evacuate the building. Turn off gas spigots and electrical devices. Walk to the Quad outside of the chemistry area. For a fire drill, wait for the sound announcing the conclusion of the drill. For a bomb threat, wait for further instructions.

COMMON LABORATORY PROCEDURES

Heating

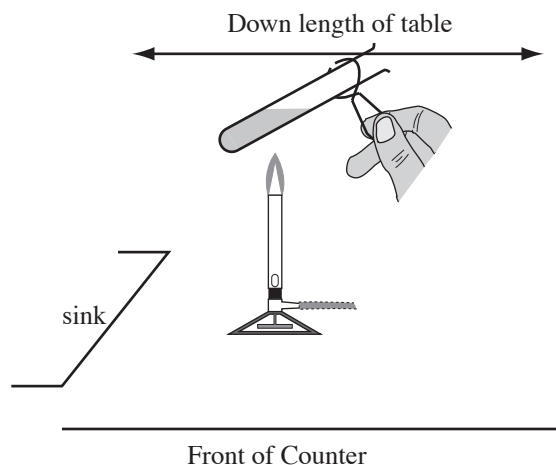
When heating containers with a bunsen burner, the container is usually situated on a wire gauze sitting on a ring support clamped to a support stand. There must always be a protective device to keep the container from falling off of the ring. This can be a second ring support or a clamp. The ring must come out from the rod so that its center of gravity is over the base of the support stand. The support stand should be set on the counter so that it faces the edge of the counter:



With this arrangement, if the support stand assembly tips over, it lands on the counter, not on you. Place the hose from the burner to the gas spigot in a path that keeps the hose lying flat and out of the way.

If a hotplate furnishes the heat, secondary support is not required.

Test tubes are best heated in a water or sand bath. If a test tube is heated using a direct flame, then the mouth of the test tube must point down the length of the counter, not toward any person.



There are sections in the lab book on how to perform other common procedures, such as weighing, measuring using graduated cylinders, using bunsen burners, using thermometers, and so forth. As experiments call for these procedures, you will be referred to the appropriate section of the book. If you have any difficulty in understanding a procedure, ask the instructor for help. Some procedures require practice, such as lighting a bunsen burner and maintaining a proper flame on the burner. Do not hesitate to ask for help so that you will be competent and feel confidence in using the equipment and performing procedures.

Obtaining Chemicals

When you go to get chemicals during laboratories, you will be told the name of the chemical, and if it is in solution, the strength of the solution. The names and strengths on the chemical containers must match exactly with the names and strengths listed in the experiment. Occasionally and unintentionally, alternate common names for chemicals will be used on labels. This would not cause any problem to a professional chemist, but it is an error in a student lab. If you have any doubts about the names on labels, ask the instructor. If an alternate name was used, it will be changed immediately.

CONCLUSION

Please do not be alarmed by this list of problems and remedies. The experiments are written to minimize possible harm to students and to the environment. Your knowledge of the causes of harm further minimizes danger. Of the thousands of students who have worked in these laboratories over the past decades, only a very few have had moderately serious injuries that required a doctor's care. Minor cuts and burns are relatively common, but these are easy to fix with a bandaid and ointment. There are many more injuries on the PE fields than in the chemistry laboratories. This is due to the care taken by the staff and by students during experiments, as well as to the nature of the experiments performed.

Explore and learn during the semester. Be aware of what you are doing, and take care doing it.

Keep this safety guide in the lab book, and refer to it as requested or needed.

Do the following two tasks today, and obtain the instructor's initials before leaving the lab:

1. Show the instructor that you open reagent bottles properly, and correctly hold or place the stopper while you pour or transfer liquids.

Instructor's OK _____

2. On the diagram below, indicate where the following are located by writing the name at the location(s):

- | | |
|----------------------------------|--|
| a) Fire extinguishers | g) Excess clothing and book storage |
| b) Eye wash stations and showers | h) Fume hoods |
| c) First aid kits | i) Instructor's station |
| d) Fire blanket | j) Makeup lab supplies/chemicals |
| e) Room light switch | k) North, south, east, west indicator |
| f) Store Room | l) Mark an X at your position in the lab today |
| | m) MultiMedia console |

