

University of Massachusetts, Amherst
Department of Chemistry
Undergraduate Organic and Inorganic Laboratories

Laboratory Safety and Waste Disposal

**Read this handout carefully, save it, and refer to it throughout the semester.
Not following these instructions is an effective way to lose points.**

The organic chemistry laboratory is a potentially hazardous work environment, much more so than the general chemistry lab. The chemicals used in the organic lab are generally more toxic and flammable than those you've encountered previously. Extreme caution, attention and common sense must be exercised at all times. THINK BEFORE YOU ACT. If you are uncertain about anything, ask a Teaching Assistant or faculty supervisor. Be cognizant of what others are doing around you. Pay close attention to what you are doing. Carefully read the following comments on safety and waste disposal. **FAILURE TO FOLLOW THE SAFETY RULES ENDANGERS ALL PERSONS PRESENT AND WILL RESULT IN THE LOSS OF CREDIT OR EXPULSION FROM THE COURSE.**

GOOD PREPARATION is a key to safe experimentation. To ensure that you are well prepared, before you may begin work, you must present an acceptable prelab outline to your TA at the beginning of your lab period. This will constitute 20% of your lab report grade. Note that you will not be allowed to work until you present an acceptable prelab outline to your TA (see "Notebook and Grading Policies" handout for details.)

EYE PROTECTION: Eyes are extremely vulnerable. The possibility of fire, explosion, and the spattering of corrosive chemicals makes the wearing of **APPROVED EYE PROTECTION MANDATORY**. From the moment that you enter the lab to the time that you leave, you will wear approved eye protection AT ALL TIMES. Whether you are washing glassware, taking a melting point (MP) or spectrum, or weighing material, you will wear eye protection AT ALL TIMES while in the lab. You may be doing something seemingly nonhazardous, but your neighbor may have an accident that could affect you. For this reason, everyone must wear eye protection constantly while in the lab. Failure to do so will result in the loss of credit. Normal prescription glasses are not sufficient. Shatterproof goggles or safety glasses which cover the sides and tops of the eyes must be worn. Safety glasses must conform to ANSI Standard Z87. So called "visitor" glasses are not acceptable. Contact lenses, even with additional safety glasses, should never be worn in the lab. Chemicals splashed into the eye can become trapped between the eye and the contact lens, making washing of the contaminated spot difficult, and possibly causing the lens to become fused to the eye. If a chemical enters the eye, immediately flush the eye with water for 15 minutes, using an eyewash fountain. Have someone help you to get to the fountain and to keep the eye open while flushing. Report the accident immediately to your instructor. You must be accompanied to the infirmary as soon as possible after flushing the eye. Know the location of the nearest eyewash fountain.

TOXICITY: Treat all laboratory chemicals as if they are toxic - most of them are. Do not inhale them (dust or vapors), ingest them, or allow them to come into contact with your skin. Many organic chemicals can pass rapidly through the skin, and even gloves, to cause systemic poisoning. Wash spills off of the skin immediately with copious amounts of water and soap, then consult your instructor. Note that gloves are not used in this lab. Gloves make working on the small scale used in the lab very difficult. Also, the type of glove must be matched to the specific chemical being used. Otherwise a chemical can pass right through the glove, onto the skin, and enter the bloodstream. All work with laboratory chemicals must be done in your fume hood. Dispose of wastes properly (see WASTE DISPOSAL below). For obvious reasons, food and drink, even if in a closed container, are not allowed in the lab. PERIOD. Wash your hands thoroughly with soap and water before leaving the lab, whether for a moment or for the day. It is good lab practice to wash your hands frequently while working in a lab, just in case accidental exposure occurs.

FIRES: Many organic solvents are extremely flammable - more so even than gasoline. For this reason, open flames will not be used in the lab. Heating will be done with electrically heated devices or steam

baths. Note though that the commonly used solvent, diethyl ether, has an autoignition point of 175°C - even a hot sand bath or melting point device can ignite it. Note too that any electrical device can arc upon being switched on or off, and can therefore ignite a flammable solvent. Be sure that you know the location and proper use of the nearest fire extinguisher and safety shower.

ACCIDENTS AND EMERGENCIES: Accidents happen quickly and without warning. They are over and damage is done before you know it. Prevention is the only completely effective measure to counteract accidents. Careful preparation and constant attention to what you and your neighbors are doing will help to prevent accidents. Take careful note of the location and direction for use of all emergency equipment - fire extinguishers, safety showers, eyewash fountains and first aid cabinets. Minor cuts and thermal and chemical burns are the most common injuries that occur in this lab. The pain and tissue damage from minor thermal burns is greatly reduced by cooling the burned tissue IMMEDIATELY with very cold water - the sooner, the better. Use cold tap water immediately, then place the burned tissue in an ice/water bath until the pain subsides, being careful to not freeze the tissue. Washing immediately with water, then soap and water, is also the first step to take in case of skin contact with a laboratory chemical. A minor scratch can be rinsed out with water then washed with soap and water and covered with a bandage. Forcing thermometers or any glass tubing through an aperture will almost always result in a cut, possibly serious. Twist and push the tubing gently through the aperture, holding the tubing as close to the aperture as possible, and pushing away from yourself. If excessive force is required, stop what you are doing and lubricate the tubing with water or glycerol or get assistance. All injuries must be reported to the instructor. If a serious injury occurs, an instructor must accompany the injured student to the infirmary. If the injured person cannot be moved, 911 must be called and the location, nature and severity of the injury described.

CHEMICAL SPILLS: Clean up spills immediately. Never leave them unattended. If the spill is left, another person may accidentally become contaminated and poisoned. Large spills must be reported to your instructor. (Mercury (Hg), which when spilled, is capable of producing toxic concentrations in the air is no longer used in the lab. To improve safety and to lessen the environmental footprint of the organic lab, Hg thermometers have been replaced with those containing a nontoxic liquid.)

BROKEN GLASS: Broken glass can be very dangerous. Carefully dispose of broken glass items in the glass waste container (NOT in the trash). Never try to force a thermometer or any other glass tubing through an aperture. Lubricate if necessary. Never place a hot thermometer onto a cold surface (benchtop) or try to cool it with water - it will crack.

NEATNESS: Keep your work area uncluttered. This will help to prevent accidents. You should have only your notebook and equipment being used in your work area. Common work areas, such as the balance, MP, and spectrometer areas, as well as your own lab bench and fume hood space, must be cleaned up after use. The lab will be clean and neat when you enter it. To be sure that it is left this way, your TA will assign students from your section, on a rotating basis, to clean up common areas at the end of the day. Everyone should be sure that her or his own area is left clean.

USE OF COMPUTERS, AUDIO OR VIDEO EQUIPMENT, OR CELLPHONES IS NOT ALLOWED IN THE LAB. These devices are distracting and may interfere with emergency responses.

SOME GENERAL SAFETY ITEMS AND RULES: (1) Work is not allowed in the lab unless an instructor is present. (2) Never heat a closed system. When heating a reaction vessel, be sure that an opening to the atmosphere exists and that it is unclogged. (3) When heating a test tube or flask, never point the opening at yourself or at anyone else. (4) Never perform unauthorized experiments. Certain combinations of chemicals can result in toxic or explosive mixtures. (5) Long hair must be tied back and sandals may never be worn in the lab. (6) Long pants are strongly recommended. (7) Bicycles may not be brought into the lab. (8) Chemical waste and broken glass must never be placed into the regular trash - injury to the custodian could result. Incorrectly placed chemical waste can result in severe fines.

ALLERGIES AND MEDICAL CONDITIONS. If you have any known allergies to specific materials, such as latex, inform the course instructor. The same for any medical conditions that may affect your work in the lab.

A NOTE ON ACCIDENTALLY SPREADING CHEMICAL CONTAMINATION. You should keep in mind that all surfaces in a lab may be contaminated with chemicals and that placing anything onto a lab bench makes possible the contamination of that item. Such contamination may then be carried out of the lab and spread elsewhere and onto your person. This is exactly why food and drink containers, even if unopened, should never be brought into a chemical lab. A container is placed onto a bench top, the container picks up a small amount of chemical without your knowledge, you leave the lab then open the container, some of the chemical enters the container or gets onto your hands, and soon you've accidentally introduced that chemical into your mouth. For the same reason, anything, such as a computer or backpack, when placed onto a lab bench may become contaminated. Be aware at all times. Wash frequently. Store personal items in the cubbyhole below your work space. You will find that the lab is in a very clean condition when you enter. Also, we try to use chemicals that are not extremely toxic. Nevertheless, you should exercise care when in any chemical lab and assume that small, unseen amounts of a chemical may be on a work surface. Act accordingly.

WASTE DISPOSAL: Chemical pollution is a problem that all of us should be well aware of and concerned about. Decades of negligence and illegal dumping of toxic substances have created extremely polluted areas of air, land and water. Reversing this situation and cleaning up our environment requires the efforts of everyone at every level of society. Dumping toxic chemicals down the drain or into the trash is illegal and irresponsible and is also not in your own self interest. Illegally dumped chemicals will return to us in our food, air, and water. The UMass Organic Lab in conjunction with the UMass Department of Environmental Health and Safety (EH&S) has an excellent system for the collection and proper disposal of chemical wastes. Please make every effort to use the system properly. Containers for the disposal of various types of waste are located in a specially designated fume hood in the lab and are clearly labeled. Instructions for correct placement of waste are given in the weekly handouts. Include in your prelab outlines, procedures for handling chemical waste. Proper handling of chemical waste is an easy way for you to make a real contribution to our environment and it is not difficult to do the right thing.

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