

University of Massachusetts at 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.

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 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 will 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 acceptable. 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, 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. Evaporate hazardous solvents and carry out reactions which emit toxic vapors in a fume hood only. 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.

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. Note though that the commonly used solvent, diethyl ether, has an autoignition point of 175°C - even a hot sand bath or MP apparatus 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 counteractive measure against accidents. Careful preparation and constant attention to what you 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 the 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 chemical. A minor scratch can be rinsed out with water and covered with a bandage. Forcing thermometers and 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. Any injury 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) spills, which occur most commonly from broken thermometers, pose a special hazard. Hg has a vapor pressure which is high enough to form toxic concentrations in the air. Even the small amount of liquid Hg from a thermometer, upon falling to the floor, breaks up into hundreds of tiny droplets which disperse over a large area. It is nearly impossible to clean all of it up. Note that 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. Bring only your lab text and your notebook to your workbench. Have on your benchtop only the equipment being used. Common work areas, such as the balance, MP, and spectrometer areas, as well as your own lab bench, 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 two 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 AUDIO OR VIDEO EQUIPMENT OR CELLPHONES IS NOT ALLOWED IN THE LAB.

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 not 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.

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 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 the fume hoods at each end of 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.