Safety in the Organic Chemistry Laboratory

Organic chemistry can be a rewarding and enjoyable experience, but it can also be dangerous. Many of the chemicals that we will be working with are flammable and may be hazardous to your health if they get into your body. However, if you use common sense and your knowledge of chemical principles, you should be able to avoid injury or illness. One of the purposes of this course is to help you learn how to handle chemicals safely.

Most accidents occur when students get in a hurry and knowingly take a chance. Always think about what you are doing and what is going on around you (what your neighbor is doing may also be a danger to you). Don't become paranoid, but treat chemicals with respect. The following guidelines will help you stay safe in the laboratory.

Exits and safety equipment

Always know the location of the nearest exit and the safety equipment such as safety shower, eye wash, and fire blanket. Don't hesitate to use this equipment if you need to. To use the safety shower, pull down on the triangle. To use the eye wash, push or pull on the paddle at the side and blink your eyes in the stream of water (don't try to force the eyelid open). Basic first aid supplies are also available. Please report all injuries to the instructor, even if you just need a bandaid. In case of an emergency, call 911 or campus security using the telephone in the stockroom.

Follow directions

Stick to the procedures outlined in the experiment. The scientific spirit of experimentation and exploration has made many wonderful discoveries, but it has also gotten a lot of people hurt or killed throughout past centuries in order to discover what is safe and what isn't. Don't go mixing things just to see what will happen!

Limit your chemical exposure

All chemicals are toxic to one degree or another, but they can't hurt you unless they get into your body. There are four ways in which chemicals can enter your body – ingestion, inhalation, absorption, and injection. Each of these routes should be safeguarded to prevent chemicals from entering.

To avoid ingesting chemicals, you should not put food or anything else into your mouth while in the lab. Make sure that you wash your hands with soap and water before leaving or on your way out.

Many organic chemicals evaporate easily. To avoid inhaling chemical vapors, do as much of your work as possible in your fume hood, not on the lab benches. If I have forgotten to turn on the hoods or if they don't seem to be working, please let me know! When testing for an odor, waft the vapors carefully toward your nose rather than inhaling them directly. Keep chemical containers and waste containers closed at all times unless you are adding or removing chemicals.

Many organic chemicals are also easily absorbed through the skin. Always wear goggles, long pants, and closed-toed shoes. Gloves and aprons are also available to protect your hands and clothing. Also, avoid touching your face and especially your eyes with gloved or dirty hands. If you get a

chemical on your skin, wash with soap and lots of water (don't use acetone or any other organic solvent as this will only help it to be absorbed). Don't wait to see if it burns, turns red, stings, or shows any other kind of reaction. Soap and water are the best solution for all chemicals that we will handle.

Injection can occur when working with needles or when glassware is broken. Always cap needles if you need to walk with a syringe, and always be cautious when handling glassware. Walk carefully when carrying anything containing chemicals, and be aware of others who are doing so.

Fire safety

Many organic chemicals are also flammable, making fire a particular hazard in the organic laboratory. No open flames will be used. Solvent vapors are often heavier than air, and will flow along the ground – if a spark ignites the solvent in one area, it can "flashback" to the solvent bottle and start the contents on fire. If a small fire begins in a beaker, the best procedure is to smother it with something nonflammable like a watch glass. Don't ever pour the contents of a beaker onto a fire, because if it contains a flammable solvent you have just made the situation much worse, and if a solvent is burning, you will just spread the fire. If a fire is in a contained area such as a hood it may be feasible to fight it with a fire extinguisher. Always fight a fire with your back to the exit, and never try to use an extinguisher if you don't know how.

Fire extinguishers are coded according to the kind of fire they are meant to be used on: class A – paper and wood, class B – flammable liquids, class C – electrical fires, class D – metal fires (such as sodium or metal hydrides). Our extinguisher is a class ABC, which means it should be effective in fighting any type of fire that could occur.

If a fire alarm should sound while you are working in the lab, turn off all stirrer hot plates and running water and exit the building by going down the stairs and out of the southeast door.

Hot plates

Instead of Bunsen burners, we will be using stirrer/hot plates to heat reactions. Be careful when working around hot plates that you do not touch them when they are hot. Also be careful with hot glassware – remember, hot glass looks exactly the same as cold glass! Hot glassware can also crack if placed on a cold surface, so always let heated glassware cool slowly.

Good housekeeping

Good housekeeping is essential to safe laboratory practices. Chemists seem particularly prone to making and living with messes, but this is not an acceptable practice in this lab. Store backpacks, purses, coats, and other tripping hazards by the door just inside the lab or on a clean bench away from our work area. Keep the benches and hood areas as free from clutter as possible even while you are working – this will help you keep track of what you are doing, as well as making spills less likely. Clean up each step as you go, using waiting time while chemical processes are occurring for clean-up where possible. If you spill something, clean it up immediately, whether it is on a bench, balance, or stirrer-hot plate.

Chemicals that you will need are stored in the west hood. For solids that must be weighed out, take the bottle to the balance, then put the lid back on and return it unless you are handing it directly to another student. If you spill a solid on the balance, brush it off with the paint brush provided. For all

other chemicals, bring your glassware to the supply hood rather than carrying the container to your work space. Always use a clean spatula or pipet when removing chemicals from the container to avoid contaminating the whole bottle. Do NOT pour chemicals into weighing boats or beakers and measure from there - the chemicals we use are too expensive to waste.

MSDS's

Every chemical used in our laboratory has an accompanying MSDS – a Material Safety Data Sheet. This document has information such as the health hazards, how to clean up spills, fire danger, and what to do if you are exposed to the chemical. Our MSDS collection is on a computer in the stockroom.

Chemicals at home

The safety practices that you learn in the laboratory also apply to chemicals found in your home. Pesticides, fertilizers, weed killers, gasoline, mercury thermometers, cleaning products, bleach, drain cleaners, paints, varnish, batteries, motor oil, antifreeze, medications, even cosmetics and perfumes should be stored out of the reach of children and used only for their intended purpose. Avoid breathing vapors or extended skin contact with these products. Know where to find the number for poison control center in case of accidental ingestion.

Disposal of chemicals

Although this is not strictly a safety issue, proper disposal of waste is important to protect the environment (and to keep us from getting in BIG trouble with the relevant government agencies). The only thing that should go down the drain in the sinks is soapy water from washing your glassware and your hands, aqueous solutions of household chemicals, and tap water used for ice baths or steam baths which has had no contact with other chemicals. All other chemicals should go into one of the designated waste containers in the east hood as described below. Items such as paper towels, empty syringes, and used cotton may be put into the garbage. Please refer to this list throughout the semester, and ask questions if you can't figure out where something should go.

Type of waste container	What should go there	Examples
Liquid Inorganic waste (large plastic container)	all aqueous solutions	2M HCl, saturated sodium bicarbonate solutions, NaOH solutions
Solid Inorganic waste (small plastic container)	inorganic solids	sodium sulfate, silica gel, calcium chloride, alumina
Organic waste (large plastic container)	organic solvents and compounds	acetone used for rinsing glassware, ether, ethanol, hexanes, products
Glass waste (metal container)	disposable or broken glass	used test tubes, melting point tubes, capillary tubes, broken beakers
Needle waste (beaker)	used needles	needles only!