Prevent Common Laboratory Accidents

Understanding the causes for common accidents and the precautions that can be taken will reduce the number of accidents and also greatly reduce the severity of accidents.

CUTS

The most common laboratory accident is a cut from broken glassware, sharp instruments, or attempting to force a cork or rubber stopper onto a piece of glass tubing.

- Teach students the proper method for using glassware and sharp instruments.
- Always inspect glassware before using it and do not use chipped, cracked, or severely scratched glassware.
- Never handle broken or chipped glass without using proper hand protection.
- Dispose of all broken glass in a container that is assigned for broken glass and never in the general garbage container.

When inserting glass tubing or a thermometer into a rubber stopper, be sure to make a proper-sized hole, lubricate the cork or stopper (lubrication is essential with a rubber stopper), and use gentle pressure with rotation on the glass part. Serious injury including severed nerves and tendons are common injuries caused by improper manipulation of glass tubes and stoppers.

BURNS

Burns from hot glassware or metal are the second most common laboratory accident. Remind students that hot glass or metal looks the same as room temperature objects. Do not touch, hold or pick up any hot object with bare hands. Use crucible tongs, heat-resistant gloves, or silicone gripping devices when handling hot crucibles, glassware, or metal equipment. Burners, wire gauzes, and tripods also remain hot for a long time after use. Handle these with care, especially during clean-up.

Teach students the proper way to light Bunsen burners. Use piezoelectric or flint lighters. Do not use matches. Always turn off burners when not in use or if walking away from them. Never reach over a lit burner. Follow strict proper attire rules when using burners, tie back long hair and avoid all loose-fitting or baggy clothing.

Hot plates are another potential source of burns. Always assume that hot plates are HOT. Prepare small “HOT” signs and place them next to hot plates that are on or recently turned off.

FIRES

Though not very common, fires are particularly hazardous in a laboratory setting. Most are fairly small and can easily be put out with a little water or small fire extinguisher. If the fire is larger than a backpack, pull the alarm and evacuate the room.

Do Not use flammable chemicals unless they are necessary for the lab activity. Only put out and dispense the minimum amount of flammable material. If flammable materials are in use in a laboratory, extreme care must be taken to avoid all sparks, flames, and heat sources. Never heat a flammable liquid with a flame. Extremely harmful fires happen when additional flammable solvent is added to a hot vessel over a flame during a flame test demonstration. Never, ever add additional solvent to a hot mixture.

Organic solvents such as alcohol, ether, acetone, or hexanes should not be stored in an open vessel such as a beaker, test tube or Erlenmeyer flask. The vapors can and will creep along a bench, ignite, and flash back to the source. Keep volatile organic solvents in a bottle or flask with a stopper or cap to reduce the vapors.

Some finely divided metals, such as zinc and iron may ignite when moist. Fires have been started in garbage cans from wet paper towels and zinc dust. Make it a practice to collect all flammable metal dusts in a beaker and dispose of them properly.

The best protection against a fire is to never have an open flame in the laboratory. Since that is not always practical, understanding how to put out a fire with a fire extinguisher should be part of your safety training. Contact your local fire department or district safety officer for fire safety training. If clothing or hair catches on fire, use the stop, drop, and roll procedure. Using a fire blanket or coat to smother the fire will quickly extinguish the fire.

If Bunsen or other types of burners are used in the laboratory, teach students the proper method for lighting the burner. Instruct them to turn off the burner when they are done using it or if they are walking away from their work area. Know where the master switch is to turn off all the gas to the room.
EXPLOSIONS

Never heat a closed system or conduct a reaction in a closed system (unless specifically directed to perform the latter process and then only with frequent venting). Before starting a distillation or a chemical reaction, make sure that the system is vented. Be particularly careful of any reaction that generates gas or excessive heat (e.g. decomposition of hydrogen peroxide or reaction of sodium carbonate and acid). If a chemical demonstration generates excess heat or gas, use a chemical splash or explosion shield and have all students wear safety goggles. The results of an explosion are flying glass and spattered chemicals; both are usually hot or corrosive.

CHEMICAL EXPOSURE, SKIN AND EYE IRRITATION, AND CHEMICAL BURNS

Avoid all contact with lab chemicals and solutions. The best protection against chemical exposure is to always wear chemical safety goggles, chemical resistant gloves, and a lab coat or apron. Even chemicals that are not normally corrosive may cause a serious allergic reaction upon exposure. Instruct students not to touch their face or eyes while in the laboratory. Immediately rinse any area exposed to a chemical reagent with clean water for 15 minutes. Remind students not to eat or drink in the laboratory.

Use safer alternatives to replace hazardous or corrosive materials whenever possible. When using hazardous materials, using the minimum amount and lowest concentration of a chemical solution greatly reduces the hazard.

Inorganic acids and bases are very corrosive to the skin and eyes. Concentrated acids will cause almost instantaneous burns. Even dilute solutions (<0.1M) are strong skin irritants and may cause a redness on the skin. Use extreme care and personal protection equipment when handling these materials. Many other inorganic salt solutions, especially oxidizers, are body tissue irritants and should be handled with care. Many organic solvents will absorb into the skin and/or dry out the skin causing dermatitis.

Two common causes of chemical exposure is dropping a bottle during transportation or spilling during dispensing. Establish standard safety procedures for transferring and dispensing hazardous chemicals to reduce spills.

Instruct students to promptly clean up all small spills and to notify the instructor if there is a large spill. Keeping a clean lab bench reduces accidental contact with corrosive or irritating chemicals. Keep a plentiful supply of paper towels, sponges, or spill absorbent materials on hand. Remind students to wash their hands before leaving the laboratory.

INHALATION OF CHEMICALS

Many common organic solvents are toxic if inhaled. Good ventilation is essential if using volatile organic solvents in the laboratory. A room ventilation system that provides at least four air changes an hour is recommended. Review the MSDS (Material Safety Data Sheet) for inhalation hazards and either find a safer substitute or take the required precautions before using an inhalation hazard. One precaution may be to use microscale quantities of the material or perform the activity in a fume hood. Teach your students how to ‘waft’ a chemical and to never directly smell an unknown chemical. Do not evaporate excess solvents in the laboratory; always use a fume hood or a suitable distillation apparatus with a condenser for evaporation.

Chemical store rooms should not smell like chemical store rooms. If it does, upgrade the ventilation system to a continuous ventilation system and consider removing some of the organic materials that may be contributing to the odors.