

OHIO NORTHERN UNIVERSITY DEPARTMENT OF CHEMISTRY

STUDENT'S GUIDE

TO STANDARD OPERATING PROCEDURES FOR ACADEMIC COURSES

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I. PURPOSE AND SCOPE

This document (CMO5) is intended to provide instructions for laboratory students on how to safely perform all laboratory operations used in their laboratory courses.

II. OWNERSHIP

A. Students

It is your responsibility as a student to make sure that you are sufficiently well informed to be able to work safely in a laboratory. You need to consider how your work affects not only yourself, but also the others working in the laboratory.

B. Laboratory Instructors

Instructors, assisted by TAs, will train students during the initial laboratory sessions of each course or course sequence they attend. Such training will be incorporated in the described curriculum. Teaching assistants will help document the training by collecting each student's signature on a student's training acknowledgment form. The instructor or TA will demonstrate new lab techniques that are not covered during the initial training session before allowing the students to perform the new technique.

III. GENERAL SAFETY GUIDELINES

- A. All laboratory operations should be planned carefully beforehand. Review and understand the written procedure for the experiment before coming to the laboratory. Your instructor will demonstrate how to use equipment and instruments, as well as alert you to any special hazards and how to deal with them. Follow directions and pay close attention to instructions.
- B. Your laboratory instructor will show you the location of the following items and instruct you how to use them. Be sure you know their location and proper use of the following:

Eye Wash Fountain	Fire Blanket
Safety Shower	First Aid Kit & Supplies
Fire Extinguisher	Emergency Exits
First Aid Manual	Biohazards
Emergency Phone Nos.	Sinks
Nearest Phone	Chemical Hygiene Plan
Material Safety Data Sheets	Broken Glass Receptacle

- C. Consult your lab instructor if you are unsure of the hazards or proper use of any reagent or equipment. Ask questions about use, technique or disposal when you have any doubt as to proper procedure. There are NO dumb safety questions.
- D. Perform only the assigned experiments. Unauthorized experiments are strictly forbidden. Maintain a serious working atmosphere. Do not engage in horseplay.
- E. Do not store equipment, backpacks, coats, chemicals or other materials on the floor or in other places where laboratory workers can trip or knock over the item, or in places that would block fire exits.
- F. Do not work alone in laboratories except under the supervision of a faculty member. Permission from the laboratory instructor is required for after hours work.

- G. Get approval from the lab instructor if you intend to leave experiments unattended for a short time. Leave a note by the apparatus identifying the experimenter and back-up personnel.
- H. Report any accidents, injuries or close calls to the lab instructor or teaching assistant immediately. To ensure appropriate treatment, report minor injuries, no matter how trivial they seem.
- I. Do not consume or store any food or beverages in the laboratory. If the laboratory experiment involves food or beverages, clearly label them “not for human consumption” or equivalent.
- J. Keep your work area safe and clean.
- K. After completing an experiment, turn off, unplug, and properly store all electrical equipment. Turn off all gas and water valves.
- L. Wash hands, face, and arms thoroughly if contaminated and always wash your hands before leaving the building. Always wash before eating, drinking, smoking or applying make-up after working in the laboratory. Shower after working with chemicals.

IV. LAB ATTIRE AND PROTECTIVE CLOTHING

Proper attire and use of approved safety goggles are simple but effective ways of protecting oneself from laboratory hazards.

- A. Wear approved eye protection at all times when working in the laboratory. Eye protection must have “ANSI Z87” stamped on it. The use of contact lenses (especially soft contacts) in the laboratory is not recommended. Chemicals can become entrapped in, absorbed by or caught behind the lens, promoting eye irritation or causing damage to the eye. If you do wear contact lenses in the laboratory, use a good set of safety goggles over them. Eye protection is required by the second laboratory period.
- B. Use face shields or safety shields in laboratory operations that have the potential to result in fires or explosions or which utilize pressurized or high vacuum operations. Authorization of the lab supervisor is required before carrying out any of the above operations. Prior to such operations, check the safety equipment (fire extinguishers, shields, safety showers, etc.)
- A. Wear protective gloves for some procedures. The type of glove selected should protect against the chemical that you are using, or against heat, cold, or sharp objects. Wear gloves for work with strong corrosives or with acutely toxic chemicals. As noted above, special procedures may require special protective equipment on a case-by-case basis. Consult your lab instructor.
- B. Wear clothing that is comfortable, covers exposed skin, and does not restrict motion yet is not so loose (especially sleeves) as to catch on equipment. Shorts and miniskirts are not recommended. Consider the flammability of the clothing fabric. The use of lab coats is strongly recommended.
- C. Wear sturdy shoes that cover your feet. Sandals and open-toed shoes are dangerous footwear in the lab. Canvas shoes do not provide the necessary protection from laboratory accidents.
- D. If you have long hair, tie it back to keep it away from flames and chemicals.

- E. Have your personal clothing and protective equipment, such as lab coats, laundered or cleaned regularly. Immediately clean your personal clothing and protective equipment after contamination.

V. WORKING WITH EQUIPMENT AND GLASSWARE

A little forethought in the use of and assembly of equipment and glassware can prevent major accidents. Be careful with Bunsen burners, hot plates, hot plate-stirrers and other hot objects. Be especially careful around equipment with moving parts. These items can catch your clothing or open up suddenly, showering you with dangerous material.

- A. Whenever possible, use a broom and dustpan to handle broken glassware. Do not use damaged, cracked or broken glassware.
- B. Dispose of broken glassware and dangerous items such as syringe needles in special containers as directed by your laboratory instructor. Do not place in the regular trash. These items should be as free of chemical contamination as possible before disposal.
- C. When inserting thermometers or glass tubing into stoppers or corks, lubricate them with water or glycerin and twist, using short strokes and minimum pressure. Covering the thermometer or tubing with a towel protects hands and fingers from injury in case the article being inserted breaks.
- D. Treat a test tube as you would a gun. Never point a test tube at anyone, especially when it is being heated. Never look down into a test tube or flask in which an experiment is being conducted.
- E. Never take equipment or glassware out of the chemistry laboratory.
- F. Report broken thermometers to the lab supervisor. The mercury must be cleaned up thoroughly under the direction of the laboratory supervisor to avoid contamination of the lab with poisonous mercury vapor.

VI. WORKING SAFELY WITH CHEMICALS

Knowledge, caution and common sense add up to chemical safety. Assume any unfamiliar chemical is hazardous. Consider a mixture to be at least as hazardous as its most hazardous component. Know the hazards before you handle the material. Treat all chemicals with respect. Check your lab write-up for special hazards. Follow all chemical safety instructions and procedures to the letter. Minimize chemical exposure by careful use and good housekeeping.

- A. Laboratory operations that have the potential to produce hazardous levels of fumes, gases, or volatile solvent vapors in excess of recommended exposure levels require fume hoods.
- B. Do not: (a) use unlabeled chemicals, (b) taste a chemical, (c) pipet by mouth, (d) smell a chemical. Check odors only if instructed to do so. Check by gently wafting the vapor towards your nose with your hand. Avoid skin contact with chemicals.
- C. Never combine substances unless you have been explicitly instructed to do so.

- D. Clean up any spilled reagents immediately, especially near the balances or reagent shelf. Before cleanup, neutralize acid spills with solid sodium bicarbonate, NaHCO_3 ; neutralize base spills with boric acid. **You are responsible for neutralizing, if necessary, and cleaning up your own spills.**
- E. Read the chemical labels very carefully to ensure that you have the correct chemical. Read labels 3 times: when you pick it up; just before you use it; and after finishing. Match name, formula and concentration on the label to lab directions.
- F. Use particular care to avoid skin and eye contact when working with corrosive agents such as acids and bases. If you spill any corrosive chemical on yourself, rinse the affected area with water for a minimum of 15 minutes. If the outside of a reagent bottle is contaminated, handle with gloves and rinse the bottle before using the reagent. Remove contaminated clothing immediately. Notify your lab supervisor.
- G. Always add acid to water. Pour water and acid into the mixing container in the order of the spelling of "water". The "w" for water precedes the "a" for acid. Always mix acids and water slowly and carefully.
- H. Do not light bunsen burners or strike matches unless instructed to do so. Do not risk electrical sparks when flammable vapors are present.
- I. Do not insert pipets, spatulas, or medicine droppers **from your own lab kit** into the reagent bottle. Dispense solids by tapping out and take only what you need.
- J. Never return unused reagents to the reagent bottle. Do not contaminate reagents by exchanging caps or stoppers or by laying stoppers on the desk top. Contact your lab instructor for proper disposal of excess reagent.
- K. Do not place reagents directly on the balance pan. Use a tared weighing container or paper.
- L. Clean up your work area prior to leaving the laboratory.

VII. WORKING WITH ELECTRICAL EQUIPMENT

Electrical equipment always means the chance of shock or fire. Do not touch with wet hands or while standing on a wet floor.

- A. Do not use any electrically powered equipment that is not wired with a safety ground and 3-prong plug.
- B. Report any shocks, defective or worn equipment, such as frayed wires, or undue heating to your laboratory instructor. Do not attempt to repair the equipment yourself.
- C. Extension cords are not appropriate.
- D. Never use electrical wires as supports, nor pull live wires.

VIII. WORKING WITH PRESSURIZED MATERIALS

Handle cylinders of compressed gases as high-energy sources and therefore as potential explosives. Be aware that non-toxic gases can act as asphyxiates should they displace enough air.

- A. Toxic gases should be used and stored in ventilation hoods.

- B. Except when being moved, compressed gas cylinders must be securely strapped or chained to a bench-top or wall at all times. Overturned compressed gas cylinders may become “rockets” with the capability of destroying everything in their path, including cement walls.
- C. Whenever moving a gas cylinder, remove the regulator and replace with the protective cap.
- D. If a cylinder is moved more than a few feet, a properly designed wheeled cart must be used, with the cylinder strapped down and the protective cap in place.
- E. Never use cylinders whenever uncertain of the contents.
- F. Always use the appropriate regulator on each gas cylinder. The threads on the regulators are designed to avoid improper use. Do not use adapters or homemade modifications!
- G. Do not expose cylinders to temperatures higher than 50° C.
- H. Never lubricate, modify, force, or tamper with cylinder valves.
- I. Never bleed cylinders completely empty. Leave a slight pressure to keep out contaminants
- J. Never direct high pressure gases at anyone, nor use compressed gas or air to blow away dust or dirt or residual solvent; the resultant flying particles are dangerous. Be aware that rapid release of compressed gas will cause an unsecured gas hose to whip dangerously.
- K. Wrap evacuated or pressurized glass containers with tape or enclose in a box or approved shielding to protect against implosion whenever possible.
- L. When reducing pressure, use specifically designed equipment only. To avoid the danger of implosion, never evacuate a thin-walled, flat-bottomed flask.

IX. WORKING WITH CRYOGENS

Use of low temperature chemicals and operations require special procedures. Such operations require the prior approval of your lab instructor. Be aware that the primary hazards of cryogenic liquids are fire, explosion, pressure build-up, embrittlement of materials, asphyxiation, and contact with and destruction of living tissue.

- A. Use gloves and face shield for handling cryogenic liquids or chipping or handling dry ice.
- B. Use only properly-vented containers for cryogenic liquids. Avoid pouring cold liquid onto the edge of a glass dewar flask when filling to prevent implosion.
- C. Immerse objects to be cooled slowly to prevent boil-over.
- D. When finished tapping cryogenics, check to ensure that the safety valve is open.

X. WORKING WITH HIGH ENERGY RADIATION

A. Ultraviolet Radiation

Consider all radiation of wavelengths shorter than 300 nm dangerous. Protective goggles with UV-absorbing lenses should be worn when eyes might be exposed to light in this range.

XI. DEALING WITH INJURY

A. Modes of Exposure:

- Eyes: Flush with water for 15 minutes
- Ingestion: Follow the label and MSDS instructions
- Skin Contact: Stand under the emergency shower and remove contaminated clothing immediately for major spills. For minor spills, flush with water for 15 minutes and remove contaminated clothing.
- Inhalation: Get to fresh air and get prompt medical attention.

B. If you become overexposed to a hazardous substance, inform your laboratory instructor and get medical attention. For first-aid instructions, check the First Aid Manual (Meyer 266), or the MSDS information found in Meyer 262.

C. Remove any clothing on which a chemical has been spilled.

D. Treat burns immediately by placing the burned area under cold water for at least 15 minutes. Cold water markedly reduces the subsequent pain and blisters.

E. If an individual's clothing or hair is on fire, use the safety shower first. If a shower is not readily available, have the individual roll on the floor, and beat out or smother the remaining flames with a fire blanket. Once the fire has been extinguished, roll the individual up inside the safety blanket to prevent shock. Then get medical help promptly.

F. Report allergies to your lab supervisor.

XII. DEALING WITH FIRE

A. Suffocate a small fire in a vessel by covering it. Do not pick up the vessel. Remove nearby flammable objects. Inform the instructor or TA immediately.

B. If it is not practical to cover the fire, but the fire is small and does not involve metals, then use a CO₂ or dry extinguisher. Fight the fire from a position from which you can escape and only if you are confident that it can be extinguished. Remember that it is easy to underestimate a fire.

C. If the fire cannot be extinguished quickly and simply, all persons should evacuate the laboratory, close the doors, and leave the building using the stairs.

D. Activate the fire alarm located at the top of the staircases if instructed to do so.