SAFETY AND LABORATORY RULES FOR GENERAL CHEMISTRY LABORATORIES

Explanatory comments may be found below under Standard Operating Procedures

1. APPROVED SAFETY GLASSES AND A LAB COAT **(100% COTTON)** MUST BE WORN AT ALL TIMES.
2. **DO NOT** WEAR SYNTHETIC FIBERS SUCH AS NYLON OR POLYESTER INTO THE LABORATORY. These fibers can ignite, burn and melt to your skin causing severe burns. Natural fibers such as 100% cotton are recommended.
3. NO FOOD, DRINKS OR SMOKING ARE ALLOWED.
4. FULLY CLOSED SHOES ARE REQUIRED.
5. WEAR PANTS (NO CAPRIS) OR FULL LENGTH SKIRT THAT EXTEND TO THE TOP OF YOUR SHOES. NO SKIN SHOULD BE VISIBLE BETWEEN THE BOTTOM OF YOUR PANTS/SKIRT AND THE TOP OF YOUR SHOES WHEN YOU ARE STANDING. IF SKIN IS VISIBLE, YOU WILL BE ASKED TO LEAVE THE LAB UNTIL YOU ARE APPROPRIATELY DRESSED FOR WORKING IN A LABORATORY ENVIRONMENT.
6. TIE BACK LONG HAIR TO AVOID RISK OF EXPOSURE TO CHEMICALS OR FLAMES IN THE LAB.
7. WEAR GLOVES WHEN HANDLING CORROSIVE, TOXIC OR OTHERWISE DANGEROUS CHEMICALS. **REMOVE GLOVES BEFORE LEAVING THE LABORATORY. DO NOT TOUCH PHONES, DOOR HANDLES, WATER FOUNTAINS, ETC. WITH GLOVED HANDS.**
8. WORK IS PERMITTED ONLY DURING SCHEDULED LABORATORY PERIODS.
9. NO OPEN FLAMES ARE ALLOWED except as directed by the instructor.
10. KNOW THE LOCATION OF FIRE EXTINQUISHERS, SAFETY SHOWER, EYE WASH STATION, AND THE NEAREST EXIT.
11. NO UNAUTHORIZED EXPERIMENTS MAY BE PERFORMED.
12. CHEMICALS SHOULD NOT BE TAKEN HOME FROM THE LAB except as directed by the instructor.
13. DO NOT USE BROKEN OR CRACKED GLASSWARE. Check glassware before using it.
14. NEVER TASTE CHEMICALS.
15. UNDERSTAND THE SPECIFIC HAZARDS OF THE CHEMICALS YOU ARE WORKING WITH.
16. KEEP YOUR WORK AREA ORGANIZED AND FREE OF CLUTTER. LABEL CONTAINERS HOLDING CHEMICALS.
17. DISPOSE OF LIQUID WASTE AS DIRECTED BY INSTRUCTOR. READ WASTE LABELS CAREFULLY. LIDS MUST BE IMMEDIATELY REPLACED ON ALL WASTE CONTAINERS.
18. CLEAN YOUR WORK AREA AND PUT AWAY ALL EQUIPMENT AND GLASSWARE BEFORE LEAVING.
19. RE-CAP CHEMICAL BOTTLES IMMEDIATELY AFTER USE.
20. CLEAN UP SPILLS IMMEDIATLEY. If a large spill occurs ask your TA for instructions regarding clean up.
21. DIPOSE OF WASTE PROPERLY:
    1. **BROKEN GLASS CONTAINERS** ARE ONLY FOR BROKEN GLASS.
    2. NEEDLES ARE TO BE DISPOSED OF IN **SHARPS CONTAINERS** ONLY. Do NOT remove the needle from the syringe or attempt to recap the needle before disposal.
    3. ONLY SOLID CHEMICALS AND WEIGH PAPERS SOILED WITH CHEMICALS BELONG IN THE **SOLID WASTE CONTAINER.**

4. PAPER TOWELS, GLOVES, TRANSFER PIPETS (that have been rinsed) SHOULD BE DISPOSED OF IN THE **TRASH**. If your gloves or a paper towel have been heavily soiled with chemicals inform your TA.
5. SOME CHEMICALS AND MATERIALS USED WITH THOSE CHEMICALS REQUIRE SPECIAL DISPOSAL. ALWAYS FOLLOW YOUR TA'S INSTRUCTIONS FOR WASTE DISPOSAL.

22. NO CHEMICALS EXCEPT WATER SHOULD GO DOWN THE DRAIN except as directed by the instructor.
23. THE USE OF CELL PHONES, LAPTOPS, TABLETS, ETC. IN THE LAB IS NOT ALLOWED. THESE DEVICES CAN BE EASILY DAMAGED AND CONTAMINATED WITH CHEMICALS, WHICH CAN POSE SERIOUS SAFETY HAZARDS.
24. WASH YOUR HANDS BEFORE YOU LEAVE THE LAB.

STANDARD OPERATING PROCEDURES IN THE GENERAL CHEMISTRY LABORATORY

Any student working in an unsafe manner may be dismissed from the laboratory by an instructor.

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1. Attitudes and Preparation

a. Come to laboratory periods on time and mentally prepared by studying the experiment and planning your activities.

b. Be prepared physically; for example, don't try to do lab work on an empty stomach, without sleep, or when ill.

c. Write everything you do and see in a notebook so that you can trace your actions and make corrections if necessary.

d. Clothing worn in the chemistry laboratory may be damaged or discolored if a chemical is spilled onto the clothing. You should wear clothing that you would not mind discarding if necessary. Wear a 100% cotton lab coat to minimize exposure.

e. If you wear contact lenses, try to avoid wearing them in the lab. If you must wear contact lenses, your glasses must seal particularly well to your face.

f. If you have any existing physical conditions that might affect your performance, your health, or other peoples' health in the lab (such as pregnancy, epilepsy, etc.) consult with a physician before participating in this course. If, after consulting with a physician, you decide to participate, please inform your instructor of your existing physical condition(s). This information will be kept confidential; other examples might include medications, allergies, AIDS, etc. Special arrangements may be possible.

g. It is highly recommended that you carry a health insurance policy. Except in very unusual circumstances, medical claims are the responsibility of the student.

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2. Your Working Environment

a. Safety glasses meeting ANSI standard Z87.1 for chemical splash protection are required to be worn at all times in labs or instrument rooms, i.e. all parts of the lab, even when you are not handling chemicals.

b. A 100% cotton lab coat is required to be worn at all times in the labs. It must be 100% cotton as this adds additional protection when working with open flames or flammable materials.

c. Gloves are required in some experiments to protect you from absorption of chemicals through the skin.

   i. Nitrile disposable gloves should be worn unless a particular hazard/concern warrants the use of a different type. For information regarding glove choices go to http://www.chem.duke.edu/safety/, then choose “The Right Glove for the Job”.
   ii. Gloves should be changed immediately after a chemical is spilled on the gloves.
   iii. Gloves should be removed before exiting the lab.

d. Keeping your bench space tidy will minimize breakage and spills.

e. You are expected to clean up your own mess in community areas such as the balance room.

f. Keep your glassware and other equipment cleaned up as you work.

g. Be careful not to contaminate reagents with your spatulas or droppers. If you take too much of a reagent, give it to a needy neighbor - do no return it to the bottle.

h. Do not wander off with the only bottle of a reagent that everyone needs; keep it in its assigned location.

i. Be sure the aisles are passable.

j. Store backpacks and other personal belongings in the lockers provided in the back of the labs.

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3. In the Event of Accidents

a. In case of any accident or spill, notify the instructor immediately. Note the location of the eye wash fountains and safety showers, in case the need to use them arises.

b. Eye injuries are by far the most serious potential accidents. If chemicals are splashed into your eye(s), the affected eye(s) must be flushed with a continuous stream of water from an eyewash fountain for 15-20 minutes. Remove contact lenses, if applicable. Eyes must be forced open at the fountain for effective flushing.

c. Chemicals spilled onto arms, legs, or torso should be rinsed with water for 15-20 minutes and may require the removal of clothing and the use of the safety shower. Rapid and immediate treatment is essential; this is no time to be modest. Wet/contaminated clothes only serve to trap chemicals against the skin. Scrubs are available in the stockroom should you need to remove contaminated clothing.

d. In the case of serious accidents, the instructor must remain with the injured student. Other students should try to keep calm, inform the stockroom attendants, and be prepared to help or call for help.

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4. Safety Equipment

Your TA will show you where it is; remind yourself from time to time during the semester.

a. Fire Extinguishers for smothering fires. U of U policy regarding response to fires restricts the use of fire extinguishers to persons who are properly trained. Small fires may be extinguished by covering with a larger container or sand. This is also discussed later in section 7.

b. Safety Shower for rinsing chemicals off the body.

c. Eye Wash Fountain for rinsing chemicals from the eyes.

d. First Aid Kit - Note: even minor injuries must be reported to your instructor.

e. At least two exits.

f. Dustpan and broom for removing broken glass.

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5. Toxic Hazards

a. The materials used in the general chemistry lab are the safest we can find consistent with your need to develop skills in working with hazardous materials in your career in science.

b. Avoid eye irritation from rubbing your eye with a soiled glove or touching your phone during lab, transferring chemical to phone, then from phone to hand/face/eye after leaving the lab. Chemicals in the eye should be immediately flushed with copious amounts of water using the eyewash fountain.

c. To prevent inhalation of volatile organic and inorganic compounds, do experiments with these compounds in the fume hood.

d. If your need to determine the odor of any material, waft it gently toward your nose with your hand - don't stick your nose in the container and inhale.

e. Some compounds can be absorbed through the skin, so be careful about spilling things. Wear gloves to prevent contact with your skin, but treat the gloves as if they were bare skin, keeping them scrupulously clean. You might set aside a pen for laboratory work to minimize the possibility of contamination from your gloves via your pen to your hands and face. Obviously, chewing a pen or pencil that has been used in the lab is unwise.

f. Some vapors also can be absorbed into food, which you may ingest later. Moreover, any drinks brought into the lab could have things spilled into them. No food or drinks in the laboratory, not even stuffed in your backpack.

g. If you spill a liquid on the bench, immediately soak it up with paper towels and, if it is volatile, transfer the towels to the hood. Inform your instructor as to the nature of the spill in case further action is warranted.

h. Inform the instructor and/or the stockroom staff about any concentrated acid spill before attempting to clean it up. Spill kits are available in the stockroom. Concentrated acid spills are removed by ***carefully*** adding sodium carbonate or bicarbonate, solution or solid. Concentrated base spills are removed by adding dilute and/or weak acid (e.g. acetic). If your skin (or clothing) comes in contact with the spill, immediately flush the skin or clothing with water for 15 minutes.

i. Inform the instructor and/or the stockroom staff about any bromine spill before attempting to clean it up. Bromine solution spills should be treated immediately with sodium thiosulfate solution.

j. To dilute a concentrated acid, always pour acid slowly into water, while stirring the solution. Never pour water into concentrated acids.

k. Potential hazards and safety information for all chemicals can be found by locating the specific MSDS (Material Safety Data Sheet) or SDS (Safety Data Sheet) for a given chemical. MSDS forms can often be found by simply typing "MSDS for *Name of Chemical*" into Google, or by going to a chemical supplier website such as www.sigmaaldrich.com, searching for the chemical of interest, and then viewing its supplied MSDS.

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6. Heat Hazards

a. Some compounds are flammable and may catch fire even in the absence of flame at high temperatures.

b. If open flames are required, plan your experiments so that you never leave your flame unattended**.**

c. If you use a Bunsen burner, be sure to tie back your hair and be careful that hair or clothing are kept clear of the flame.

d. If there is a flame in the neighborhood, do not pour flammables; certain vapors are denser than air and will flow along the bench without alerting you by their odors.

e. Make sure you know the location of the nearest fire extinguisher and the nearest exit.

f. Reactions/solutions that are exothermic or are being heated must be monitored; do not leave them without having someone watch.

g. Never heat a closed system! Pressure will build up and cause the glass to fail, sending projectiles of glass in all directions. Do not depend on small leaks - a substantial air exit must be provided.

h. Never add boiling chips to a hot solution. Adding boiling chips to a hot solution may cause it to boil over rapidly.

i. If you know that you will be working with an open flame, a pyrophoric agent or flammable solvents and a heat source avoid wearing synthetic clothing to lab (polyester, nylon) and instead choose natural materials such as 100% cotton or wool. The synthetic materials melt and drip when they burn which can cause serious damage.

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7. If There is a Fire

a. In the lab where you are working.

i. Shout "fire" to alert your neighbors and instructor if you discover it.
ii. A small fire in a test tube or other small container (<500 mL) can usually be extinguished by covering the container with a larger container. If the fire cannot be extinguished by one extinguisher or by sand or water, you will be instructed to evacuate, following the procedure in b).
iii. One terrible possibility is that someone's clothing is set on fire. If the person runs the flame will be increased by increasing the supply of oxygen. Instead, remove the clothing that has caught on fire immediately, if possible. Items such as a lab coat and pants can be quickly removed. A sweater or shirt on fire would need to be cut off. If quick and safe removal is not possible move the person to the safety shower to extinguish the flames. If the shower is far away the person should stop drop and roll. Do not wrap a fire blanket or lab coat around a standing person to extinguish a fire as this may intensify the fire rather than extinguish it. .

b. Elsewhere in the building (fire alarm sounds):

i. Extinguish any flames and turn off electrical equipment.
ii. Close any internal doors near you.
iii. Walk quickly through the nearest exit to the hallway and leave the building by the nearest exit.
iv. Remain with your TA until you receive further instruction. Personnel in the General Chemistry Labs should gather in the parking lot at the southeast corner of the chemistry complex.

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8. Glassware

a. The most common laboratory injury is a cut occurring upon breakage of glass or porcelain. Most cuts can be prevented by careful work which prevents breakage.

b. The safe procedure for inserting a glass tube or thermometer into a stopper with a hole is as follows:

i. Be sure the tip of the tube is fire-polished.
ii. Lubricate the glass with glycerol or water.
iii. Be sure the hole in the stopper is large enough.
iv. Grasp the glass about 1" (no farther) from the end and push and twist to insert it into the stopper.
v. Be sure that the hand holding the stopper is not in line with the entering glass.
vi. As the glass begins to slide into the rubber, move the hand holding the glass back a little, always keeping it no more than 1" from the rubber.
vii. Most accidents occur because the glass snaps above the stopper from a force sideways (torque). Keeping your hand close to the stopper will help prevent your exerting a force sideways on the glass.
viii. The above considerations apply also to *attaching rubber hoses to glassware*. The glassware should be in your hand (not clamped to an apparatus) and gripped close to the lubricated connector being inserted into the hose.

c. Never use a thermometer as a stirrer! Always support a thermometer in a beaker or flask with a clamp. If a mercury (a silver liquid) thermometer breaks, immediately contact the laboratory instructor and restrict access to the area of contamination until cleanup can be arranged.

d. Graduated cylinders are metastable and tip easily with the touch of a sleeve.

e. Report breakage of glassware to your instructor for disposal instructions.

f. Always use a pipet bulb to draw liquid up into a pipet. Never pipet using your mouth. Pipet bulbs do NOT have to be and should NOT be forced onto a pipet. Rather, they only have to barely touch the edge of the pipette to create suction.

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9. Laboratory Electrical Equipment

a. You will use a variety of instruments to analyze your samples. As with all electrical equipment, a certain amount of care is needed to prevent fire, shock and damage to the equipment. Be careful not to bring water, especially on your hands, into contact with connected electrical equipment.

b. The hot plates you are provided are powerful and seldom need to be set on High.

c. Never pour into a container on an electronic balance - they often have the wiring and knife edge under the pan and are thus easily damaged.

d. Clean up spills on the balances immediately. Most spills can be removed easily with the brushes provided or a Kimwipe.

e. Turn off electrical equipment immediately after you have finished unless your instructor has stated otherwise.

f. Report frayed cords, or non-functional equipment to your instructor.

g. Do not wrap cords around a hot heating mantle or hot plate. The cords can become damaged.

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10. Waste Disposal

a. In order to minimize damage to the environment, and in compliance with State and Federal law, chemical wastes must be separated into categories and carefully labeled as to their contents. Please read and follow the labels on the waste bottles to ensure that your chemical wastes are treated safely and appropriately. You will find containers for:

i. Liquid Waste (for waste liquids and solutions)
ii. Solid Waste (for solid chemicals and chemical soiled weigh papers)
iii. Glove and Paper Towel Waste (for heavily soiled gloves and paper towels only)
iv. Other containers may include Lead, Silver, Heavy Metals, Acids and Bases from specific experiments.
v. Broken glass or porcelain is swept up into a dustpan and disposed of in a special container for broken glass. Please don't use your fingers.

GENERAL CHEMISTRY LABORATORY SAFETY WAIVER/AGREEMENT

(YOU MUST TURN IN A SIGNED COPY OF THIS FORM BEFORE YOU WILL BE ALLOWED TO ENTER THE LAB)

Student Name (please print legibly) _____

Course / Lab Section _____ Lab Room Number _____

Lab Professor Name _____

By signing this I acknowledge that I have received and read the Chemistry Department safety rules for the General Chemistry Laboratory that are provided to me for this course. I recognize and agree that it is my responsibility to read these safety rules carefully, to understand them, and to obey them completely and faithfully in order to ensure my own safety, and that of my fellow students and the lab instructors.

I will cooperate to the fullest extent with my lab instructor and fellow students to maintain a safe lab environment.

I realize that all chemicals and equipment are potentially dangerous; therefore, I must exercise care in handling them. If I am unsure of the potential hazards of any chemical or equipment, I must discuss this with my instructor prior to using the chemical or equipment in question and must follow my instructor's directions for using the chemical or equipment safely.

I will closely follow the oral and written instructions provided by the instructor.

I realize that wearing safety glasses in the laboratory is absolutely required. If I violate this rule I will receive a warning. Further violation could result in dismissal from the laboratory and receipt of a failing grade for the course. I also understand the dangers involved in wearing all types of contact lenses in the chemical lab. If I elect to wear contact lenses in the laboratory, I will inform my instructor and I will assume all responsibility for injury or damage caused by wearing them in the lab.

I will be responsible for the cleanliness of my own work area and any shared areas like the balance area.

If I have a physical or medical condition such as, but not limited to, hypo- or hyperglycemia, diabetes, epilepsy, pregnancy, heart ailments, or any other medical condition which may cause sudden loss of consciousness, I certify that I am under a doctor's care and that I have discussed my participation in this laboratory course and the experiments and chemicals described in the course materials with my doctor and that my doctor has given me explicit permission to participate in this laboratory course. (Please be aware that certain chemicals pose additional risks to those who are pregnant. A list of chemicals used in our course can be provided upon request. However, realize that there is always a risk of encountering chemicals outside of those used in our course). I will inform my instructor of any condition that may pose a danger to myself or others in the lab at the beginning of the semester, or as soon as I am aware of the existence of the condition.

I am aware that any violation of this contract that results in unsafe conduct in the laboratory or irresponsible behavior on my part, may result in dismissal from the laboratory and receipt of a failing grade.

Signed by (please PRINT LEGIBLY) _____

Student's Signature: _____ Date: _____