

PROFESSIONAL STANDARDS IN CHEMISTRY LABS

Part of your education in chemistry, and chemistry lab, involves learning about and abiding by the *Professional Standards* that support a positive work environment for everyone and are imperative for the proper function of a research or academic lab.

In general, the practices included under the umbrella of professional standards include:

- Laboratory safety guidelines, appropriate laboratory practices, and good lab “citizenry”;
- Comportment appropriate to a professional setting, including attendance, punctuality, submitting work on time, and appropriate interactions with peers and course instructors;
- Appropriate preparation for working in a lab setting, including working through background material (reading, videos, and office hours), advanced preparation of lab research notebooks (before attending the lab), and being proactive in anticipating the expected results of the experiment and possible hurdles;
- Attention to detail in the lab, taking effective lab notes, professional and polished communication; and
- Ethical conduct in the lab and in working with data and assignments. All students at Boston University are expected to maintain the highest standards of academic honesty and integrity.

As a student in our courses you will be expected to know and abide by the professional standards as they are outlined and explained in detail below. Some courses may have a modified, or amended, set of standards and you should make sure to get the full set of standards from your instructor.

All students are required to read through these standards before the beginning of lab work, and are responsible for complying with the professional standards and course regulations at all times.

Safety and Appropriate Practices in the Lab

Safety is the highest priority in any laboratory setting. Unlike other academic settings, the chemistry lab contains many hazards that must be taken seriously. In general, it is the responsibility of each student to become familiar with acceptable lab practices and to conduct themselves responsibly at all times.

This guide is a *brief* introduction to laboratory safety and etiquette. At your instructor's discretion, you may be required to attend a lecture where lab safety is discussed and / or you may be required to sign a lab safety agreement.

Appropriate Attire in the Chemistry Lab

Students must dress in an appropriate manner in the chemistry lab. Students dressed inappropriately, or missing safety equipment, will not be permitted entrance into the lab. Specifically, safety regulations require:

- Clothing must cover the entirety of the legs to protect against spills (no short pants or short skirts may be worn in the lab).
- Clothing must not be loose to avoid contact with mechanical equipment or hazardous chemicals. Similarly, hair must also be secured back and off the shoulders in such a way as to prevent it from unwanted contact with chemicals, supplies, and equipment.
- All shoes (and socks) must cover the entire foot and ankle. No open-toed shoes or sandals are permitted in the lab.

Additionally, students are required to own and wear personal protective equipment at *all times* when in the chemistry lab. This includes:

- A full (or 3/4) length lab coat,
- Chemical splash-proof safety *goggles* (face-forming goggles only), and
- Disposable gloves (you will be provided with gloves).

Eye Protection

Chemical splash-proof goggles must be worn at all times in the lab while experiments are being run, even if you are not working on an experiment yourself. If you need to remove your goggles, ask to be excused momentarily from the lab room. Once all experiments are finished, and if your lab instructor deems it appropriate, you may be permitted to remove your goggles for the remainder of the lab period.

Contact Lenses

Despite the splash-proof goggles, contact lenses are particularly dangerous in the chemistry lab. Contact lenses can absorb solvents and tend to cause hazardous chemicals to concentrate against the cornea; in such cases, they cause increased damage to the eye. Students are prohibited from wearing contact lenses in chemistry labs.

Conduct in the Lab

- Eating and drinking is strictly forbidden in the laboratory. If you need to drink, you may go outside with your instructor's permission. Individuals with blood-sugar disorders should inform their lab instructor at the first lab meeting; they will be permitted to exit the lab to adjust their blood sugar when needed. Never smoke in, or near, the chemistry lab.

- Only experiments that are explicitly authorized by your lab instructor may be performed in the lab.
- Students must be supervised at all times in the lab. This means that you are not permitted to enter the lab until a lab instructor is present, and it also precludes staying late in the lab. There is zero tolerance for violations of this guideline; students who violate this rule will no longer be permitted to attend labs and will be referred to the Dean's office for academic misconduct proceedings.
- There is no running or playing around in the lab.
- The use of iPods (or similar devices) presents a big safety risk and is not allowed in lab. Listening through headphones makes you less aware of your surroundings, prevents you from hearing instructions and warnings, and endangers the safety of yourself and others.
- Coats, backpacks, and all non-essential items should be left in the designated areas. Lab benches must be kept clear of all non-essential equipment and items. Use cubbies and lockers to store items not being used in the lab.
- In general, if you are unsure about any aspect of what you are doing while in the lab, ask your instructor for help.

Cell phones are strictly prohibited in the laboratory

Use of cellphones is strictly prohibited in all chemistry instructional laboratories as they pose a substantial risk to the user and others in the lab. In addition to cellphones being a dangerous distraction to their user, as well as other researchers in the lab, cellphones also are a common source of chemical contamination (which can be harmful or fatal) and increase the risk of fires or explosions.

Working with Chemicals and Equipment

- Never deliberately consume or smell a chemical. The practice of smelling, or wafting, chemicals is out-dated and dangerous.
- Never use mouth suction to pipette chemicals (or start a siphon). This practice is not only out-dated, but is extremely dangerous. There is no way to ensure that even the most innocuous-seeming chemicals are actually safe. Pipette bulbs must be used for pipetting at all times.
- Never remove stock reagent bottles from the fume hoods or other locations. Also, never use pipettes to remove reagent from stock reagent bottles.
- Dispense directly from stock bottles into a clean beaker, and never return excess reagents to stock bottles. Only take a maximum of 110% of the amount you intend to use. Dispose of excess reagents in waste containers.
- Waste must always be disposed of in the appropriate container. Never dispose of chemical solutions in the sinks or solid chemicals in the trash cans.

- Mixing incompatible wastes can be very dangerous. If you are unsure of where waste for a specific experiment is being collected, check with your laboratory instructor.
- Bench-side waste beakers can minimize trips to the large satellite waste drum. That said, be careful to never overfill waste beakers to the point where transport could lead to a spill. Also, waste beaker use must be limited to aqueous waste only.
- Know what chemicals you are using. Always read the label, *twice*, before dispensing a chemical from a bottle. Properly label your aliquots with the full chemical name (i.e., ethanol not EtOH).
- Alcohols, acetone, and many common reagents are highly flammable. Do not use/store flammable reagents near open flames.
- When diluting acids, acids are always added to water. If water is added to an acid, the heat of reaction may cause the water to be vaporized – sometimes violently.
- Experiments must never be left unattended.
- Never point a test tube that is being heated at yourself or anyone else. Eruptions are rare, but can occur without warning.
- Never leave lit burners unattended.
- Beware of hot glass. There is no difference in the appearance of hot and cold glass.
- Minor chemical spills can be cleaned up with paper towels. Larger spills of acids or bases (more than 5 mL) must first be neutralized with sodium bicarbonate (or another equivalent neutralizing reagent). Always inform your lab instructor before cleaning up large spills.
- Clean up all broken glassware immediately. Dispose of broken glass in the appropriately labeled ‘glass waste’ container. Inform your instructor immediately.
- It is always best to wash your hands after working in the lab (even though you were wearing gloves).
- Never touch your face or a computer with gloved hands, as this can spread hazardous residue.

Emergencies, Fire Alarms, and Evacuation

- If chemicals come in contact with your skin or eyes, flush the affected areas immediately with copious amounts of water. Have someone (or do it yourself) inform your instructor immediately. Do not stop flushing the affected area until you are instructed to stop by your lab instructor.
- Inform lab instructors and staff about any emergent situation **immediately**. Do not attempt to put out fires or remedy any situation yourself.
- Instructors and staff are not able to perform any first aid. Any injuries should be reported immediately and health services will be informed.

- There is always the potential for a possible emergency situation during any chemistry lab. The most important thing to remember is to remain calm and seek help from your lab instructor immediately.
- In the unlikely event of a fire alarm, or genuine evacuation, it is important to remember to follow the directions of your lab instructor. Don't panic. Turn off any burners, gas lines, or hotplates. Finally, calmly exit the building; wait in the designated area to re-enter and complete the lab.

Failure to heed any of these guidelines, or the instructions of a lab instructor, will result in you being ejected from the lab and forfeiting the points from that particular lab exercise. Safety is the most important part of a lab.

Lab Etiquette and Citizenry

Guidelines regarding teamwork and working with peers in the lab

When working with peers and instructors, make sure to keep the following in mind:

- Always take a respectful tone and demeanor with peers;
- Be respectful of others' equipment – do not take equipment or reagents from someone without their explicit permission;
- When working with a partner, or in a team, it is important that the work be divided in a fair and meaningful way. Never allow someone else do the majority of the work in a group, and never exclude someone from contributing adequately. Report any team dynamics issues to teaching staff immediately.
- Always be respectful of course instructors, staff, and others in the lab (and out of the lab).
- Use good judgement in decision-making in the laboratory and teamwork; be receptive to constructive feedback, ask for input from your lab mates and instructors, and seek assistance when you need it.

Common Items and Areas in the Lab

Students are responsible for the proper care of the glassware and equipment that they have been assigned. Keep your locker closed and locked when you are not present in the lab. Always make sure to clean glassware and equipment before returning them to your locker. Report any broken glassware or equipment to your laboratory instructor; excess breakage is not acceptable.

In addition to the equipment and glassware in your locker you will frequently use common equipment that is not in your locker. It is your responsibility to return the common equipment as clean as you received it (if not cleaner) and in perfect working order. Notify your lab instructor immediately if you find a balance, pH meter, spectrophotometer, LabPro interface, etc., that is not working properly or has been left in an unacceptable state.

Washing Glassware

Glassware in your locker should be clean from the last time that you used it and returned it to your locker. Rinse dirty glassware with small amounts of tap water several times. Use detergent only when you need to dislodge solid particles stuck to the glassware or for a thorough clean when it is warranted. After tap water, rinse the glassware with a small amount of deionized water. Always use deionized water from a squirt bottle, **never** directly from the tap. It is much more efficient to rinse with several small volumes than to wash once with a large volume. Finally, immediately before using a piece of glassware it should also be rinsed with a very small volume of the incoming solution.

Important note: if a piece of equipment has just been used with a hazardous chemical, then the first rinse is also considered hazardous waste and must be disposed of in the appropriate waste container. Subsequent rinses are not hazardous waste and should be disposed of down the drain.

Housekeeping and Lab Cleanliness

All students are expected to do their part in keeping the lab safe and clean. Keep the following important guidelines in mind:

- Make sure to clean up any spills promptly and inform your lab instructor about large spills.
- Broken glassware must be swept up immediately and placed in the special box for broken glass.
- Keep all aisles and row floors clear of belongings (backpacks, books, etc.). Use provided cubbies and cabinets to store your belongings during lab.
- Keep your bench-top uncluttered and clear of unnecessary equipment. Return clean and washed glassware to your locker when it is not in use.
- Sinks must be kept empty at all times. Never leave glassware, broken glass, or debris in sinks.
- Clean up your lab bench with water (and soap, if necessary) before leaving the lab.
- Keep common areas of the labs (balance areas, instrument rooms) clean and clear. Remove items that you bring with you to these areas and clean up spills immediately.

It is especially important to remember to keep the balance rooms and instrument rooms clean. These areas are shared by all students and must be collectively maintained. If a lab instructor notices that these areas are becoming cluttered or messy they will assign a student to clean them.

Important note: failure to keep the lab clean and safe will result in a large penalty to your lab performance grade. Students who continue to neglect their lab housekeeping duties will not be permitted to work in the lab.

Security

Despite our best efforts, theft of items has occasionally occurred from the labs. Students are advised to leave unnecessary valuables at home and to transfer those that are in bags to their person. Use assigned locations (cubbies) to hold coats and backpacks. Only items necessary for the performance of the labs are permitted out in the laboratory.

Course-specific Guidelines and Policies

Attendance

Students are required to arrive on-time and prepared for all labs. Students are expected to arrive a few minutes (3-5 minutes) before the start of the lab period, and to prepare for the beginning of lab (by putting on their safety equipment, retrieving their lab notebooks, and readying any work that is to be submitted).

Students arriving late will not be allowed to attend the lab, and will lose the points associated with that experiment. Also, students are not permitted to attend lab sections other than their registered section without advance permission from the professor. Repeated failure to arrive on time will result in a further loss of points or the inability to continue working in the lab.

Be prepared to use the full lab period for your work. After completing the experiment and data collection, the remaining in-class time will be used to start the data analysis. In many cases your instructor will expect you to show them part of the analysis before the end of the lab period.

Attendance may occasionally be taken in lab lecture and will count towards your grade. If you arrive late to lecture, please enter as inconspicuously as possible.

Appropriate preparation for work in the lab

As was stated above, arriving on time to the lab is a necessity. That said, it is equally important that you arrive with an appropriate degree of preparation for working a laboratory: a dangerous and expensive setting where small mistakes can have large ramifications.

To that end, it is absolutely necessary that all students are prepared for work in the lab by doing all of the assigned background preparation for the experiments (attending lectures, watching videos, readings, etc.). Additionally, students are required to prepare their lab research notebooks in advance of the lab (and may not work from the SOPs, protocols, or lab manuals).

Make-up Labs

Attendance at all labs is **mandatory**. In the rare event of an emergency absence (loss in the family or incapacitating medical emergency), please notify the professor by e-mail in advance, or *immediately after it becomes possible to do so*. During the summer there is no room in the schedule to allow for make-up labs. Students missing labs because of an emergency will be required to take an incomplete and complete that lab during the next semester when CH201 is offered.

Turning in Assignments

Pre-lab assignments are collected promptly at the beginning of labs, **before the lab begins**. Your lab instructor will indicate where pre-labs are to be submitted when you arrive in lab. Late pre-lab assignments will not be accepted. *Helpful hint:* many students find it useful to keep a copy or a picture of their assignments for reference when working on post-labs.

Notebooks must be complete and ready before arriving at lab. Students are not permitted to work from their lab manuals in lab. A student who arrives at the lab without their notebook ready is considered to have arrived unprepared and, for their safety and the safety of others, will not be allowed to complete the lab. Exceptions: lab 1 and lab 5 are workshops, and there are no notebook pages to complete for these labs.

Post-lab assignments and papers are at 7pm the day after the experiment is performed (exceptions to this will be announced and posted in the course schedule online) through TurnItIn on Blackboard. E-mailed assignments are not accepted. More details about the nature of the post-lab assignments are presented in the next section.

Receipts from Turnitin: Turnitin will send a confirmation email that your submission has been received. Make sure that you've received this email, or your assignment has not been received. Also, make sure to only submit PDF files or Turnitin will cause major (bad) structural changes to your paper – submitting a PDF makes it so that the instructor will evaluate the paper as *you* intended them to see it. It is your responsibility to ensure that your assignments are received and in the appropriate format.

Late assignments. Late assignments will be penalized starting when the assignment is due and will not be accepted for a grade more than one week late. In the unlikely and undesirable event that you need to submit a late assignment, make sure to contact the course instructor well-**before** the due date and time. Never leave an assignment on someone's desk or in a mailbox.

Backing-up your work

Cloud services such as Dropbox or Google Drive (both of which offer a limited amount of free storage) will allow you to keep your work saved to the Cloud just in case something happens to your computer. A file saved in one of these folders on your computer is automatically pushed to the Cloud, so your file is safe even in the case of a catastrophic crash. Some services, like Dropbox, also allow you to undelete files that you've recently deleted and see previous saved versions of a file. These features can come in very handy. Computer crashes are frustrating and time-consuming, but you shouldn't need to redo your work too. It is expected that you will work from Cloud-synced folders so that your work is backed-up properly.

Academic Integrity in Laboratory Courses

All students are expected to maintain the highest standards of academic honesty and integrity. It is the responsibility of every student to be aware of the Academic Conduct Code's contents and to abide by its provisions. Please note carefully that we treat all violations of the academic conduct code with **zero tolerance** – there are no *small* infractions. At minimum, the consequences of misconduct are that the score for work on which misconduct occurs will be reduced to a zero, a deduction will be made to the student's overall performance grade in the lab, and

a report will be filed with the Dean's office. Possible further consequences, at the discretion of the Dean's office, include referral to Academic Conduct Committee and more severe penalties. None of these consequences are at the discretion of the instructors, but rather are governed by the University's policies.

Unacceptable conduct in this lab course includes, but is not limited to, the following behaviors: (1) misrepresentation or falsification of lab data; (2) copying from an external source such as a paper, website or textbook without citing the source; (3) misrepresenting someone else's work as your own; and (4) allowing another student to use any part of your work.

To avoid the above scenarios, keep in mind the following guidelines:

- Students will often work in pairs or groups during labs. These partnerships are for the performance of the lab alone; all students are required to separately work-up their data and write their own report.
- Pre-lab and post-lab assignments are often a source of academic misconduct. The work that you turn in for these assignments must be solely your own. That does not preclude having discussions with your colleagues about how to approach certain problems. It does, however, mean that there should be no detection of the collaboration in the final products. Students may not submit any material generated by another student.
- Students are highly encouraged to form study groups. That said, while it is appropriate and encouraged for students to work together to understand their work and the analysis — this is a valuable way to aid understanding and learning of the material — work turned in for grading must be their own work, in their own words, and not copied from somebody else. In other words: students may work in the same place and at the same time, but they must each do their own analysis and work. If N students are working together, then there must be N laptops or notebooks actively being used; two students cannot share the same work product or work toward producing the same document, even if they will eventually edit or change it.
- Students are encouraged, and often required, to consult external sources for writing lab assignments. Always keep a note of the sources that you use and make sure to cite them appropriately in your report. Direct quotes from a source are not acceptable in chemistry and are not permitted. Copying images from sources is highly inadvisable and should be avoided; if this is necessary, make sure to indicate in the caption that it is “taken from” and include the source (and cite the source). See Writing Chapters 3 and 4 for details about finding information and citing your sources.
- Materials generated by another student, at this institution or any other, may not be referenced under any circumstances.
- Data must be recorded directly into your notebook, as it is measured, and not copied into your notebook after-the-fact. If corrections need to be made due to error, neatly draw a line through the erroneous data and make a brief note of why this was necessary.
- Sharing data with other students, or receiving data from another student, is not acceptable under any circumstances. Only data that you collected may be submitted in your assignments.

- Under no circumstances may a student give any part of their coursework (data, data analysis, assignment, paper, outlines, etc.) to another student – this includes giving a hard-copies, sending by email, or transfer by any other method (such as a Cloud service, etc.).
- Students may not use work submitted in this class for any other purpose. As a result, students are not permitted to post analyses, worksheets, or reports on the internet or any internal site.

Working together with other students is **strongly encouraged**. Conversations about chemistry concepts, lab techniques, preliminary data analysis, and calculations will help you to increase your understanding of the material and allow you to excel in your studies. That said, it is imperative that you do not cross the line that separates legitimate academic discourse and academic misconduct. It is perfectly acceptable to ask other students for help understanding concepts, procedures, and even calculations; you may not, however, have another person show you step-by-step how to do the work and copy their explanation.

The work that you submit must represent your intellectual property and academic achievement. Even though you may have worked in a group, the work that you produce and turn in for grading must be entirely your own. Also, remember that working with your lab instructor in lab and coming to office hours are great ways to get guidance in your work.