

General Chemistry

Laboratory Information and Policies

LABORATORY SAFETY AND RULES

The laboratory is equipped with various safety items for use in case of an emergency. With good judgment, the chance of an accident in this course is small. Nevertheless, some of the materials used in the laboratories can be dangerous if mishandled, so the following safety rules and precautions are essential.

Eye Protection

You will be issued a pair of chemical splash goggles during your first chemistry course at The University of Chicago. This pair of goggles will be required for all your remaining chemistry courses in the college. Use of goggles other than those provided from chemistry lab must be approved by the Laboratory Director.

Goggles must be worn at all times during experiments in the chemistry laboratory, even if you are not working on an experiment yourself. You may step out of the laboratory to remove goggles for a few minutes if needed, but you must put goggles back on before returning to the laboratory.

Clothing and Shoes

Besides eye protection, skin protection is another very important aspect of safety working in the chemistry laboratory.

1. Clothing must cover the entirety of the legs to protect against chemical spills.
2. Clothing must cover arms and shoulders to protect against chemical spills.
3. Clothing must not be loose or flowing to avoid contact with hazardous chemicals or mechanical equipment.
4. Shoes must cover the entire feet. Shoes with open toes or other exposed skin, e.g. sandals, are prohibited in the laboratory.

Contact Lenses, Hair, and Cosmetics

Because Contact Lenses may absorb certain solvents, they are prohibited in all chemistry laboratories.

Contact lenses represent a special hazard in the event of a chemical splash to the eyes. Contact lenses tend to concentrate hazardous chemical materials against the cornea and prevent tears from washing the hazardous chemical away.

Hair must be secured back and off the shoulders in such a manner as to prevent it from coming in contact with hazardous chemicals or mechanical equipment, and to prevent contamination of the work environment.

Application of cosmetics is prohibited in the laboratory.

Other Do's and Don'ts in the Laboratory

Laboratory safety must be followed at all times, including:

1. Rubber gloves must be worn during chemical manipulations.
2. Laboratory aprons must be worn in all chemistry laboratories.
3. Hand washing must be conducted before taking a break and at the end of each laboratory session.
4. Fume Hood Sash must be closed to the level indicated by the certification sticker. Keep head and torso outside the fume hood.
5. Experiments must never be left unattended.
6. Smoking is prohibited in the entire chemistry building.
7. Eating and drinking is not permitted in the laboratory.
8. Cell phones, iPod, iPad, computers, and other personal audio/video devices are prohibited in the laboratory.
9. Open flame devices must never be left unattended, e.g. hot plate, Bunsen burner, etc.
10. Electrical cords must be kept away from sinks and walkways. All damaged electrical cords should be reported to the Laboratory Director.
11. Aisles must not be obstructed in any way. No equipment, chairs, supplies are permitted in exit passageways or aisles.
12. Coats and book-bags must be stored in the hallway lockers. They will not be permitted in lab.
13. Doors to the laboratories will be kept closed during lab class time, but exit doors must not be blocked, bolted, or obstructed in any way to block access.

Housekeeping and Waste Disposal

Housekeeping should be performed continuously during your lab course and in each lab period.

1. Carefully follow the directions for disposal of waste solutions.
2. The lab work area must be kept neat and orderly. A disorganized and sloppy laboratory work environment represents a safety risk.
3. Any broken glassware, cracked or chipped, should not be used. Dispose of all broken glassware in the labeled broken-glass bins.

Emergencies

In the event of an injury, whether or not it involves chemicals, go immediately to your lab instructor for first aid, no matter how insignificant the injury may appear to be. Your lab instructor will have first aid available and can summon medical aid in case of a serious injury.

You must also know the location and operation of fire blankets, safety showers, fire extinguishers, eye wash stations, fire alarms, and exit doors.

A telephone for emergency use (i.e. not for personal use) is located in the laboratories. Emergency telephone numbers are listed near the telephone.

Attendance

The lab period begins promptly at 1:30 pm and ends at 5:30 pm. Attendance is mandatory.

You must be in lab at 1:30 PM. Any tardiness will not be tolerated. If you are more than 20 minutes late to lab or miss lab without a valid written excuse, you will not be allowed to perform the experiment and will have to make up the lab on a later date with a late penalty of 50 points deducted.

Arrive early to secure your coats, book bags, and any other personal belongings in the hallway lockers. You may be required to share a locker with a friend or a lab partner and will have to provide your own lock. Your lab instructor will start the lab class with important instructions and advices for the lab, e.g. lab demos. Repeated failure to arrive on time will result in a loss of points or expulsion from the lab.

Your laboratory work may only be performed during the scheduled lab hours. You will need to start cleaning and putting away your glassware fifteen minutes before the end of class.

Make-up Labs

If you miss an experiment for a valid reason, e.g., medical emergencies, official college business (sports etc.), or death in the family, you may make it up in another lab period during that same week.

You will need to present medical or legal documents to validate your absence. All arrangement must be made through the Laboratory Director and must be made if possible before the lab period you will miss. If you wish to reschedule a lab for something other than the valid reasons discussed above, you must see the Laboratory Director one week in advance in order to obtain possible approval.

Obtain a lab make-up permission form from the Lab Director. This form will be signed by the lab instructor who supervises your make-up experiment. You must attach the signed make-up form to your lab report so that your section TA will know you have completed the work. Reports without this make-up permission form will not be accepted.

No make-ups will be allowed during check-in and check-out weeks. You must be present in your assigned section during these two weeks.

The above make up procedures will be strictly adhered to.

LABORATORY FACILITIES

Equipment Drawer

You will be assigned an equipment drawer in the laboratory, containing a whole set of glassware and other frequently used items during your lab course. After check-in, you are responsible for all items in the drawer, not merely for their presence but also for their condition.

Lost keys will be replaced at a cost of \$5. If you do not return or pay for your keys in a timely fashion an additional \$15 administrative fee will be added to the cost of replacing the key.

Common Items

Common equipment, i.e. equipment shared and used during a specific experiment, must be returned in good shape to the proper place at the end of a laboratory session.

There will be common items to be used during some experiments. These items are usually placed on the central bench before the experiment. Your laboratory instructor will assign you the items to use. By the end of the experiment you must return these common items to the central bench, i.e. to your laboratory instructor.

Do not lock the common items in your own equipment drawer. Otherwise, you may be called in to return the items and receive a laboratory grade reduction for that specific experiment.

If you find a balance, pH meter, spectrophotometer, etc. that is not working properly, notify your laboratory instructor immediately so that it can be repaired or replaced.

Water

Drinking is not allowed in the laboratory.

You may drink water only from the drinking fountains in the halls, not from any of the water taps in the laboratory. Though the laboratory water supply is fed by pure Lake Michigan water, it can be contaminated in an instant. For instance, if one of the water aspirators develops back pressure during operation, chemicals will be sucked back into the laboratory water supply. There is a break protection in the water line so that the contamination cannot spread to the city water supply. However, the laboratory water supply can remain contaminated for hours or days.

Ordinary tap water contains dissolved substances in concentrations high enough to cause spurious results in most of your experiments. Whenever the experimental procedure requires the use of “water”, it means the use of “distilled water”. You should use the distilled water sparingly, to avoid it from being drained by mid-afternoon if all classes are wasteful.

Washing Glassware

Rinse dirty glassware with tap water several times. Do this at your laboratory bench area. There is no need to use detergent solution unless you want to dislodge solid particles or to get the surface so clean that water wets it uniformly. However, when you perform volumetric analysis, it is very important to do so.

Rinse the inner walls of glassware with 10–50 mL of distilled water from your wash bottle. To save the distilled water, do not rinse glassware from the distilled water tap.

When washing glassware, it is important to note that it is more efficient to wash with several small volumes of water than washing one time with the same total volume of water.

Hallway Lockers

Backpacks, coats, and other nonessential items are not permitted in the laboratory during a lab period, so as to avoid chemical contaminations.

You should store all your personal items in the hallway lockers. There is one locker for every two students. You may share your locker with your partner. You must provide your own lock to secure the items in the locker.

Be aware that no one should occupy a locker for long term personal use. Locks left on the lockers overnight will be removed so that students may use the lockers for the next day lab class.

NOTEBOOKS AND EXPERIMENTAL DATA

Notebooks

All the experiments require the use of a laboratory notebook.

The laboratory notebook must be bound and have yellow/blue detachable pages. The yellow/blue carbon copies of your laboratory notebook pages shall be turned in to your laboratory instructor by the end of each lab period.

Notebooks for the chemistry lab experiments are specially designed and can be found in the university bookstore with the other required chemistry textbooks.

If you have an old notebook from a previous class, you may use it but realize that you are responsible for being aware of the policy and safety information included in the new notebooks.

Calculators

Many of the experiments in general chemistry are quantitative and require some computation to extract chemical information from measurements of weights, volumes, etc.

A calculator capable of doing linear regression is needed in the laboratory. You should perform some preliminary calculations in the laboratory during each laboratory period, so that you can spot potential faulty data while there still is time to collect the data again. The rest of the calculations should be performed out of the lab prior to turning in the laboratory report.

Accuracy of Data

In everyday applications, it is usually sufficient to read the scale to the nearest full division. However, this is far from enough for data reading in the chemistry laboratory.

All data measurements in the chemistry laboratory must be determined and recorded to the highest accuracy possible. One of the minor skills to be mastered is the estimation of fractional scale divisions. On many instruments, e.g. thermometers, burettes, voltmeters, etc., the smallest scale division is several millimeters wide, which is much wider than the smallest spacing readily estimable by the eye.

You will have to estimate tenths or fifths of a scale division. This is simple if you take advantage of the fact that the human eye is much better at estimating ratios of lengths than absolute lengths. In reading a thermometer, for example, look at the mercury level and compare the distance to the mark below with the distance to the mark above. Therefore, for a temperature of 25.1°C, the ratio is 0.1: 0.9 = 1: 9; for 25.2°C, it is 0.2: 0.8 = 2: 8, etc. These ratios are different enough to be easily distinguishable.

Handling Data

For the analysis of the experimental data, it is very important to process it properly, including significant figures, error propagation, etc. For detailed information on data processing, please consult the Appendix "Data Handling".

LABORATORY REPORTS

Report Collection

Laboratory reports are due one week after the scheduled completion of the experiment and will be returned to you a week later.

Reports will be collected at the beginning of each laboratory period. The grade on last-due reports will be reduced by 5 points per working day, up to a possible maximum of 50 points, unless you can present valid reasons why the deadline should be extended.

Writing the Report

The preparation of a laboratory report is an exercise in logical and scientific writing which requires a thorough evaluation and interpretation of experiment data.

A laboratory report is not merely a set of data mathematically massaged to give a desired result. It should contain connecting prose, giving it continuity and meaning. The prose must meet reasonable standards of style, organization, grammar, and spelling. Discussion part of the report may need your critical thinking. An excellent laboratory result has a much reduced value if poorly described in writing.

The laboratory report must be written on 8.5×11 inch paper with smooth edges. If your handwriting is legible it can also be accepted. Copies of the laboratory notebook pages are not acceptable as a substitute for the report. Emailing lab report to lab instructor will not be accepted.

Laboratory reports usually comprise several sections including, but not limited to, introduction, experimental procedure, data analysis, and discussion. Length and content of each section may vary from case to case, but the scope is essentially fixed, as described below.

Introduction

This section should consist of only a few sentences, stating the nature and purpose of the experiment and the techniques used. It can be a very concise paraphrase of the introduction in the laboratory manual.

Experimental

This section is usually used to describe your experiment, but should be brief. Generally, you may report only deviations from the standard procedure. Otherwise, do not need to copy anything from the lab manual.

Data Analysis

This section should contain the essential and final data from your analysis.

Whenever possible, summarize and show data in tables and/or graphs. Sample calculations, one of each kind, should be included in the data analysis which will help the laboratory instructor to track down any systematic errors in your data reduction.

For the data analysis, you must perform all data calculations with proper significant figures. When calculating interim results, it is always a good idea to carry an extra figure and to round off at the very end. This will reduce the chance of rounding errors that may accumulate in consecutive steps and degrade the accuracy of your experimental result.

Discussion

A discussion section in lab report is always required.

The discussion section will give you a chance to examine the validity and discuss the meaning of your experimental results, e.g. do your results make sense and are they close to accepted values or expectations? In addition, for some experiments there will be assigned questions that you have to answer.

GRADING

The maximum possible laboratory grade for each experiment is 100 points. The lab grade will comprise 35% of your total course grade in a general chemistry class.

The 100 point grading system for each lab is broken down as follows:

20-25 points go to the pre-laboratory assignments and to the signed data sheet that will be turned in to the laboratory instructor at the end of each laboratory experiment. It is mandatory that this be turned in at the end of the laboratory for any credit to be given.

75-80 points are the maximum score points on a laboratory report. The penalty for late reports is five points per working day, i.e. 25 points/week, with a maximum penalty of 50 points, prior to the deadline for all laboratory assignments at the end of the quarter. Reports more than three weeks late will not be accepted.

By the end of the quarter, there will be a maximum 100 points of laboratory instructor evaluation grade. These are points to be awarded at the discretion of the laboratory instructor and will be given based on students' performance related to pre-laboratory assignments, technical skills, notebook preparation, housekeeping duties, general laboratory demeanor, participation at the discussion hour, quizzes, etc.

ACADEMIC DISHONESTY

Academic dishonesty will not be tolerated!

Even though you may work with a partner in the general chemistry laboratory, you are expected to work independently in making experimental observations, doing final calculations, and writing final interpretations. Conversations with other students about chemical topics, including laboratory techniques, preliminary data interpretations, etc., are strongly encouraged. Going through such discussions, you will thereby sharpen your understanding of chemical concepts and gain experience in using the language of the subject.

However, be careful not to cross the line that separates such legitimate help from outright cheating. It is fine to ask for explanations of concepts, procedures, techniques, calculations, etc., and then to tackle the work on your own. It is not all right to copy another student's work, including pre-labs, report outlines, data and calculations, etc. Nor should you let your lab partner or anyone else copy your work.

Any assignment turned in should represent your intellectual achievement, not a copy or paraphrase of someone else's work. Even if you have collaborated with other students, you should write your report separately. If it appears that you are too dependent on others while working in the lab, your TA will deduct points from your lab grade.

It goes without saying that all forms of cheating are forbidden, e.g., faking of data, using crib sheets on exams, etc. Anyone caught cheating will be reported to the Dean of Students in the College. In addition, the total grade for the experiment in question will be reduced to zero, and the course grade (not merely lab grade) may be reduced as well.