University of Texas at Tyler
CHEM 3153: Physical Chem I Lab
Fall 2023

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Instructor Information

Instructors:

001 - Dr. Rachel Mason

- rmason@uttyler.edu
- 903/565-5641
- RBS 3002
- Office Hours:
  MWF 9–10 am
  MW 4– 5 pm
  Or by appointment

002—Dr. Kai Zhang:

- kzhang@uttyler.edu
- 903/566.6276
- RBS 3010A
- Office Hours:
  TR 9-11 am
  F 9-10 am
  Or by appointment

Course Description

Physical Chemistry is concerned with the physical principles underlying the properties of chemical substances. In order to learn physical chemistry, students must become familiar with the experimental foundations on which the theoretical principles are based. Generally, the ability to utilize the principles requires an intimate knowledge of experimental techniques. For this reason, the lecture course in physical chemistry is accompanied by this laboratory course.

Student Learning Outcomes

By the end of the course the students should be able to:

- Thoroughly understand and apply principles, laws and theories of introductory physical chemistry discussed in lecture.
- Utilize common laboratory apparatus, instruments and equipment to measure physical properties of substances.
- Demonstrate good laboratory technique and skills.
- Competently communicate results.
- Work cooperatively with others.

Meeting Times and Locations

The class will meet on from 20 August to 30 November 2023, except for the week of Thanksgiving (21&23 Nov). Normally the class will meet in RBS 4014. However, the experiments utilize a variety of instruments located throughout the Department. A **tentative** schedule of experiments is provided on page 3.

Section 001—Tuesdays 4:30 - 9:30 pm (Dr. Mason)
Section 002—Thursdays 1:30 - 6:30 pm (Dr. Zhang)

Important Dates

Administrative Dates to Know:
September 1st (Fri) – Census date, last day to file for grade replacement
September 4th (Mon) – Labor Day holiday, no classes held
October 1st (Sun) – FINAL deadline for Fall 2023 graduation
October 30th (Mon) – Last day to drop or withdraw from courses with a W
November 1st (Wed) – Enrollment for Spring 2024 opens for Seniors (Nov 2nd for Juniors)
November 20th–25th (Mon-Sat) Thanksgiving Holiday, no classes

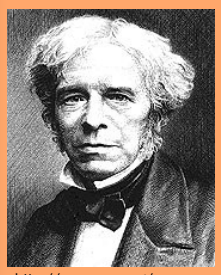
Pre-Requisites and Co-Requisites

- General Chemistry I & II lab/lecture
- Organic Chemistry I & II lab/lecture
- Analytical Chemistry
- Physical Chemistry I lecture (Co-req)
- University (or College) Physics I & II
- Calculus I, & II

Additionally, students must show credit for or be concurrently enrolled in Chem 3354: Physical Chemistry II Lecture.

Thus Faraday approached both his science and his everyday conduct unhampered by ego, envy, or negative emotion. In his work, he assumed the inevitability of error and failure; whenever possible, he harnessed these as guides toward further investigation. Faraday adhered to no particular school of scientific thought. Nor did he flinch when a favored hypothesis fell to the rigors of experiment."

— Alan Hirshfeld, *The Electric Life of Michael Faraday*



http://www.aps.org/publications/apsnews/200108/history.cfm

Instructional Materials:

Required Textbook:

There is no required textbook for the course. All instructional material will be posted on the course Canvas site. Students are expected bring the printed laboratory exercise to class with them.

Additional Supplies:

Students are required to have:

- Laboratory notebook:
  Bound 8 x 10" notebook with cross-lined and removable duplicate pages.
- Splash proof ANSI Z87 goggles
- Scientific calculator
- Access to a computer with excel. Having a latptop/table is essential.

Grade Computation

Grades will be tentatively based on a 90/80/70/60 scale, but may be adjusted on my evaluation of the class.

Course grade will be determined by:

Lab Reports	85%
Lab Practices	10%
Teamwork	5%
Requisitions	5%

Generally five to six experiments are assigned during the semester. The instructor reserves the right to adjust this number if conditions warrant the deletion and/or the addition of exercises or reports.

All assigned experiments must be completed with submitted reports to receive a passing grade.

The lab practices grade includes technique, safety, professional attitude, work ethic, *etc.*

Students are strongly encouraged to use literature in the writing of their lab reports, but cautioned against plagiarism. Please see the plagiarism information posted on the course Canvas.

Students will be placed in groups to complete the laboratory exercises.

Safety Notice

Physical Chemistry students have a bad habit of believing that they are advanced chemists and no longer need to follow safety rules. **This is NOT TRUE**. Physical Chemistry students must recognize that while their increased knowledge allows them to participate in laboratory exercises utilizing a wider array of chemicals, procedures, and equipment, these things carry increased risk and possibility for danger if used careless or incorrectly. Many of the experiments have the potential to cause serious injury. Students are expected to utilize safe lab practices and abide by all Departmental safety policies. (Found on Pages 5-8 of this document.) **Safety goggles must be worn in the laboratory at all times!!!**

Appropriate lab wear should be worn. This includes long pants or skirts and shorts with sleeves. Tank tops, tube tops, shirts with spaghetti straps, strapless shirts, sleeveless shirts and crop tops are all examples of inappropriate clothing. Closed toes shoes which fully encase the foot are also required. Students who come to lab inappropriately attired will be asked to leave.

Safety goggles must be worn in the laboratory at all times!!! At this level it should go without saying that safety goggles are a necessity. Goggles must be splash-proof (indirectly vented) and meet ANSI Z87 criteria.

Students must have a safety contract for the current semester on file with the Department prior to participating in the first laboratory exercise. Please see page 13. The safety contract may be found on the last page of this document.

That's all very well in practice, but will it work in theory?

- G. Hill

Education in Chemistry

1992 (1), 28.

Possible Experiments:

Laboratory exercises will be assigned to students from the following:

- Plagiarism Avoidance
- Error Analysis
- Gas Relations with Adiabatic Expansion
- Vapor Pressure of a Pure Liquid/ Heat of Vaporization
- Solution Calorimetry
- Bomb Calorimetry
- Heat-Capacity Ratios for Gases
- Partial Molar Volume
- Binary Liquid-Vapor Phase Diagram
- Binary Solid-Liquid Phase Diagram
- Kinetic of Reactions

Line engraving by Louis Jean Desire Delaistre, after a design by Julien Leopold Boilly

The impossibility of separating the nomenclature of a science from the science itself, is owing to this, that every branch of physical science must consist of three things; the series of facts which are the objects of the science, the ideas which represent these facts, and the words by which these ideas are expressed. Like three impressions of the same seal, the word ought to produce the idea, and the idea to be a picture of the fact.

— Antoine-Laurent Lavoisier *Elements of Chemistry* (1790), trans. R. Kerr, Preface, xiv.

Tentative Schedule

This is a tentative schedule of proposed experiments. We reserve the right to alter the schedule and/or experiments performed as needed throughout the course of the term.

Experimental procedures will be posted to Canvas prior to the lab period. Students are responsible for downloading and reading the materials prior to the lab period. See page 4 Course Responsibilities—Come Prepared for more information about the students' pre-lab responsibilities, including the requisition lists.

Date	In Class	Assignments Due
Aug 22/24	Safety & Plagiarism	Plagiarism Assignment
Aug 29/31	Error Analysis	Safety Contracts & Training
Sep 5/7	Excel Workshop	---
Sep 12/14	Heat Capacity of Gases	Error Analysis
Sep 19/21	Data Workshop	
Sep 26/28	Group A: Bomb Calorimetry Group B: Solution Calorimetry	Heat Capacity of Gases
Oct 3/5	Data Workshop	
Oct 10/12	Group A: Solution Calorimetry Group B: Bomb Calorimetry	Group A: Bomb Calorimetry Group B: Solution Calorimetry
Oct 17/19	Data Workshop	
Oct 24/26	Phase Diagram	Group A: Solution Calorimetry Group B: Bomb Calorimetry
Oct 31/ Nov 2	Data Workshop	
Nov 7/9	Kinetics	Phase Diagram
Nov 16/18	Data Workshop	
Nov 21/23	Thanksgiving	
Nov 28 / 30	TBD	Kinetics

Don't despise empiric truth. Lots of things work in practice for which the laboratory has never found proof.

- Martin H. Fischer in *Fischerisms* (1944).

Physics is the taking of very accurate measurements on impure and poorly defined materials. Chemistry is characterized by sloppy measurements on very pure materials. Thus Physical Chemistry is sloppy measurements on impure and poorly defined material. Although they like to think of themselves as the only ones making very accurate measurements on very pure materials.

—Reed Howard, Montana State University

Course Responsibilities

Students must keep a record of their work in their lab notebook.

This will be a complete record of all experiments performed. All prelab notes, procedures, data, calculations and observations should be written in either a physical or digital notebook. The data should be submitted to the instructor BEFORE leaving the class.

Lab reports are required.

A formal word-processed report is to be prepared and submitted (usually within one week) after each experiment is completed unless stated otherwise. Late reports will be penalized with a letter grade deduction per day unless arrangements have been made with the instructor. Report grades will be based on requisitions, formatting, completeness, clarity, experimental results, calculations, discussion of results and error, and understanding of the theory involved in the experiment. More information will be posted on the course Canvas page.

Proper references are required.

All information obtained from a source (not from yourself) must be referenced. This includes procedures, diagrams, physical constants and literature values. Primary sources are strongly preferred. Wiki references are not acceptable (anyone can edit that stuff!)

Come prepared.

Study the experiment and be familiar with the theory, apparatus, design and procedure before coming to lab. A requisition requesting all equipment and chemicals needed for the experiment must be submitted by noon two days preceding the experiment. Number & sizes of glassware and volumes/masses of chemicals are mandatory information in the requisition. You will only be supplied with the items and chemicals you requisition.

Take care of the equipment.

Much of the equipment used in the laboratory is expensive and or/difficult to replace. Handle all equipment very carefully and leave it clean and in good condition. Report any damage to the instructor as soon as it occurs or is noticed.

Work appropriately with your partners.

For most experiments, you will work together in teams composed of two to six students. All students in the team are expected to contribute to the completion of the experiment. Groups are required to vary job assignments throughout the term. Students are encouraged to discuss the experiment outside of class. However, each group must submit their own original lab report unless otherwise directed. Excel spreadsheets should not be shared. Please note changing font is NOT original work.

Do not plagiarize.

Plagiarism and other forms of cheating will not be tolerated. University regulations are explicit about academic dishonesty and will be enforced. These regulations are contained in *A Student Guide to Conduct and Discipline at UT Tyler,* which may be obtained in the Office of Student Affairs or accessed at http://www.uttyler.edu/mainsite/conduct.html. In the laboratory, an honor code will apply under which students are not to copy material from any source without proper citation. Students are expected to help enforce this code.

Student Resources

The following are resources available to UT Tyler students. Many of these offices provide additional programming throughout the academic year.

- Student Counseling Center (www.uttyler.edu/counseling or 903566-7254)
  Dealing with stress/anxiety, improving study skills, time management, etc (all confidential)
- UT Tyler Student Health and Wellness (www.uttyler.edu/wellness)
  Get more information about substance abuse, household violence, good eating habits, etc.
- Academic Success (www.uttyler.edu/success or 903/565-5964 or tutoring @uttyler.edu)
  Supplemental Instruction, Student Learning Communities, and PASS tutoring center.
- The Writing Center (www.uttyler.edu/writingcenter or 903/565-5995 writingcenter@uttyler.edu)
  Assistance with writing projects and skills.
- The Mathematics Learning Center, RBN 4021, this is the open access computer lab for math students, with tutors on duty to assist students who are enrolled in early-career courses.

Experiment is the sole source of truth. It alone can teach us something new; it alone can give us certainty.

- Henri Poincare

***Science and Hypothesis* (1902), trans. W. J. G. and preface by J. Larmor (1905), 140.**

Images Hubble M87

An experiment in nature, like a text in the Bible, is capable of different interpretations, according to the preconceptions of the interpreter.

- William Jones

***Physiological Disquisitions* (1781), 148.**

In Case of Illness

Students who are feeling ill or experiencing symptoms such as sneezing, coughing, digestive issues (e.g. nausea, diarrhea), or a higher than normal temperature should stay at home and are strongly encouraged to do so. Students who suspect they have been exposed to or tested positive for COVID should use the UT Tyler COVID-19 Information and Procedures website to review protocols, check symptoms, and report possible exposure.

Students are reminded that the spread of most communicable diseases can be reduced by using good health hygiene practices such as covering coughs and sneezes, frequent hand washing, surface cleaning and staying home when ill. Students are further encouraged to maintain a healthy immune system through practicing good self-care. College is stressful enough without getting sick!

Additional Accommodation

Students needing additional accommodations may contact the Office of Student Accessibility and Resources at University Center 3150, or call (903) 566-7079 or email saroffice@uttyler.edu.

Course Format

The course is conducted in person. Students usually will work in groups of three with the following roles alternating between students after the first lab. All students are expected to hold each role at least once across the term. Each student will complete an assessment for the group after each report is submitted. Groups may be subject to change throughout the term.
In some instances data may be shared between multiple groups. In the Error Analysis lab data is shared across the entire class, though each individual student will complete their own report.

Advance

1. Identify safety concerns.
2. Complete & Submit requisition.
3. Suggest reasonable division of labor.
4. Lead Introduction & Methods sections of Report.

Data Handler

1. Identify needed data
2. Prepare data collection plan.
3. Lead Calculations for Report.
4. Provide relevant figures and tables.

After Action

1. Coordinate Group for report writing.
2. Lead on Discussion section of Reports.
3. Responsible for citations.
4. Compile, edit and submit report.

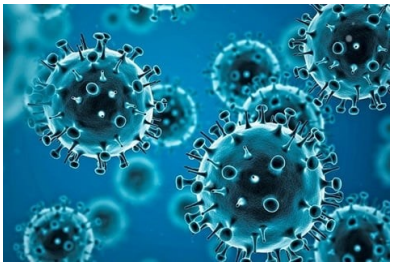
Extraordinary Circumstances

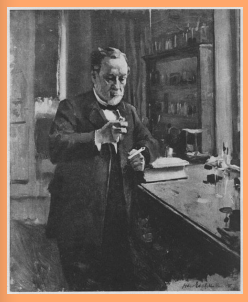
COVID Mitigation

UT Tyler guidelines for COVID mitigation will be followed.

Campus Closure

Should the University mandate remote learning, this class will shift to an online format. It is anticipated that will be Zoom sessions at the scheduled course time. Details will be provided on the course Canvas page in this event.





https://commons.wikimedia.org/wiki/File:Albert_Edelfelt_Louis_Pasteur.jpg

Without laboratories men of science are soldiers without arms.

- Louis Pasteur

***As quoted in The Wellcome Research Institution and the Affiliated Research Laboratories and Museums Founded by Sir Henry Wellcome* (1932), 3.**

University Policy Highlights

These are just some selected highlights from the University policies. For the full and more complete list, please visit: www.uttyler.edu/academicaffairs/syllabuspolicies.pdf

UT Tyler Honor Code

Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

Students Rights and Responsibilities

To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: http://www.uttyler.edu/wellness/rightsresponsibilities.php

Campus Carry

We respect the right and privacy of students 21 and over who are duly licensed to carry concealed weapons in this class. License holders are expected to behave responsibly and keep a handgun secure and concealed. More information is available at http://www.uttyler.edu/about/campus-carry/index.php

UT Tyler a Tobacco-Free University

All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors. Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), bidis, kreteks, electronic cigarettes, smokeless tobacco, snuff, chewing tobacco, and all other tobacco products. There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support. For more information on cessation programs please visit www.uttyler.edu/tobacco-free.

Grade Replacement/Forgiveness and Census Date Policies

Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. Grade Replacement Contracts are available in the Enrollment Services Center or at http://www.uttyler.edu/registrar. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar. Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract.

The Census Date is the deadline for many forms and enrollment actions of which students need to be aware. These include:

- Submitting Grade Replacement Contracts, Transient Forms, requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
- Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
- Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)
- Being reinstated or re-enrolled in classes after being dropped for non-payment

Complete the process for tuition exemptions or waivers through Financial Aid.

State-Mandated Course Drop Policy

Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date). Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

"In my own field, x-ray crystallography, we used to work out the structure of minerals by various dodges which we never bothered to write down, we just used them. Then Linus Pauling came along to the laboratory, saw what we were doing and wrote out what we now call Pauling's Rules. We had all been using Pauling's Rules for about three or four years before Pauling told us what the rules were."

J.D. Bernal

The Extension of Man: A History of Physics Before 1900

University Policy Highlights—Continued

Disability/Accessibility Services
In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University of Texas at Tyler offers accommodations to students with learning, physical and/or psychological disabilities. If you have a disability, including a non-visible diagnosis such as a learning disorder, chronic illness, TBI, PTSD, ADHD, or you have a history of modifications or accommodations in a previous educational environment, you are encouraged to visit https://hood.accessiblelearning.com/UTTyler and fill out the New Student application. The Student Accessibility and Resources (SAR) office will contact you when your application has been submitted and an appointment with Cynthia Lowery, Assistant Director of Student Services/ADA Coordinator. For more information, including filling out an application for services, please visit the SAR webpage at http://www.uttyler.edu/disabilityservices, the SAR office located in the University Center, # 3150 or call 903.566.7079.

Student Absence due to Religious Observance
Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

Student Absence for University-Sponsored Events and Activities
If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

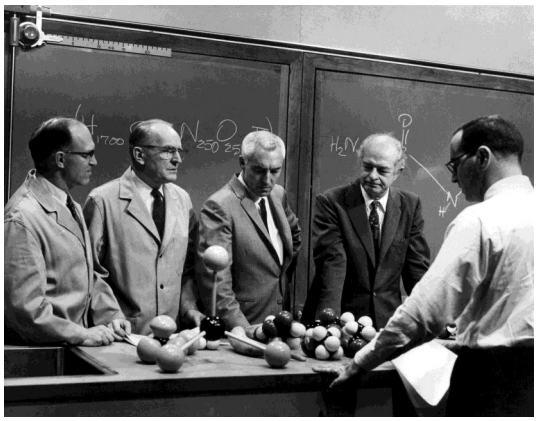
Social Security and FERPA Statement
It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

Emergency Exits and Evacuation
Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

Student Standards of Academic Conduct
Disciplinary proceedings may be initiated against any student who engages in scholastic dishonesty, including, but not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts.

i. "Cheating" includes, but is not limited to:

- using, buying, stealing, transporting, or soliciting in whole or part the contents of an unadministered test, test key, homework solution, or computer program;
- falsifying research data, laboratory reports, and/or other academic work offered for credit;



http://www.achievement.org/achiever/linus-pauling/

ii. "Plagiarism" includes, but is not limited to, the appropriation, buying, receiving as a gift, or obtaining by any means another's work and the submission of it as one's own academic work offered for credit.

iii. "Collusion" includes, but is not limited to, the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any section of the rules on scholastic dishonesty.

iv. All written work that is submitted will be subject to review by plagiarism software.

http://
www.nobelprize.org/
nobel_prizes/physics/

A scientist in his laboratory is not a mere technician: he is also a child confronting natural phenomena that impress him as though they were fairy tales.

Marie Curie

***Madame Curie : A Biography* (1937) by Eve Curie Labouisse, trans. Vincent Sheean, p. 341**

Laboratory Safety Guidelines

Purpose

Chemistry is a hands-on laboratory class. You will be doing many laboratory activities, which require the use of hazardous chemicals. Safety in the chemistry laboratory is the number one priority for students, instructors, and assistants. To ensure a safe chemistry laboratory, a list of rules has been developed and provided to you in this student safety contract. These rules must be followed at all times. The student safety contract and signature page are provided to you and the signature page must be returned to the laboratory instructor before you can participate in the laboratory.

Student Lab Safety Training

You are required to view the *Chemical and Biological Hygiene* training that is provided on Canvas. This presentation must be viewed before working in the lab and a passing score of 80% or better on the *Lab Safety Test* must be achieved before working in the lab.

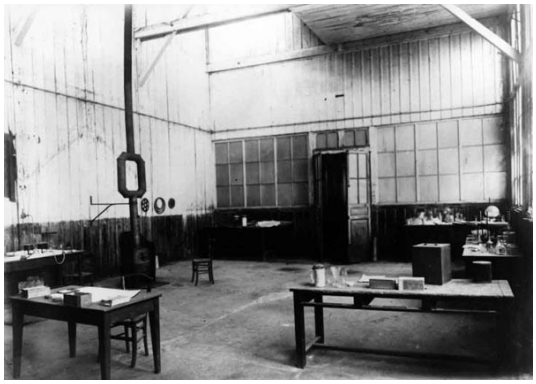
General Guidelines

1. Conduct yourself in a responsible manner at all times in the laboratory.

2. Follow all written and verbal instructions carefully. If you do not understand a direction or part of a procedure, ask the instructor before proceeding.

3. Never work alone. No student may work in the laboratory without an instructor present.

4. When first entering a chemistry laboratory, do not touch any equipment, chemicals, or other materials in the laboratory area until you are instructed to do so.



The Curie Lab was so well ventilated that leaves and snow sometimes accumulated overnight. Source: *www.aip.org/history/curie.htm*

5. Do not eat food, drink beverages, or chew gum in the laboratory. Do not use laboratory glassware as containers for food or beverages.

6. Perform only those experiments authorized by the instructor. Never do anything in the laboratory that is not called for in the laboratory procedures or by your instructor. Carefully follow all instructions, both written and oral. Unauthorized experiments are prohibited.

7. Be prepared for your work in the laboratory. Read all procedures thoroughly before entering the laboratory. Never fool around in the laboratory. Horseplay, practical jokes, and pranks are dangerous and prohibited.

8. Observe good housekeeping practices. Work areas should be kept clean and tidy at all times. Bring only your laboratory instructions, worksheets, and/or reports to the work area. Other materials (books, purses, backpacks, etc.) should be stored in the classroom area.

9. Keep aisles clear. Protect personal gear—backpacks, pocketbooks, briefcases, coats, *etc.*—by placing them in the lab drawers or other locations designated by the instructor.

10. Know the locations and operating procedures of all safety equipment including the first aid kit, eyewash station, safety shower, fire extinguisher, and fire blanket. Know where the fire alarm and the exits are located.

11. Always work in a well-ventilated area. Use the fume hood when working with volatile substances or poisonous vapors. Never place your head into the fume hood.

When you can measure what your are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind.
-Lord Kelvin

Electrical Units of Measurement" (3 May 1883), published in *Popular Lectures* Vol. I, p. 73;

Laboratory Safety Guidelines Continued

14. Labels and equipment instructions must be read carefully before use. Set up and use the prescribed apparatus as directed in the laboratory instructions or by your instructor.

15. Keep hands away from face, eyes, mouth and body while using chemicals or preserved specimens. **Wash your hands with soap and water after performing all experiments.**

16. Clean (with detergent), rinse, and wipe dry all work surfaces (including the sink) and apparatus at the end of the experiment. Return all equipment clean and in working order to the proper storage area.

17. Experiments must be personally monitored at all times. You will be assigned a laboratory station at which to work. Do not wander around the room, distract other students, or interfere with the laboratory experiments of others.

18. Students are never permitted in the chemistry storage rooms or preparation areas unless given specific permission by their instructor.

19. Know what to do if there is a fire drill during a laboratory period; containers must be closed, gas valves turned off, fume hoods turned off, and any electrical equipment turned off.

20. When using knives and other sharp instruments, always carry with tips and points pointing down and away. Always cut away from your body. Never try to catch falling sharp instruments. Grasp sharp instruments only by the handles.

Lord Kelvin's diffusion experiment has been running a University of Glasgow lecture hall since 1872. Source:http://cen.acs.org/articles/91/i33/Old-Experiment-Even-Older-Curiosities.html

Clothing

1. Any time chemicals, heat, or glassware are used, students will wear laboratory goggles. **There will be no exceptions to this rule!**

2. Contact lenses should not be worn in the laboratory unless you have permission from your instructor.

3. Closed toes shoes, long pants/full length skirts and shirts having sleeve and covering the entire torso are required. Additionally, lab aprons are available, and you are encouraged to wear them to provide additional protection.

4. Long hair, dangling jewelry, and loose or baggy clothing are a hazard in the laboratory. Long hair must be tied back and dangling jewelry and loose or baggy clothing must be secured.

Accidents and Injuries

1. Report any accident (spill, breakage, etc.) or injury (cut, burn, etc.) to the instructor immediately, no matter how trivial it may appear.

2. If you or your lab partner are hurt, immediately obtain the instructor's attention.

3. If a chemical should splash in your eye(s) or on your skin, immediately flush with running water from the eyewash station or safety shower for at least 20 minutes. Notify the instructor immediately.

https://www.llnl.gov/str/Oct07/Libby.html

[Chemistry] laboratory work was my first challenge. ... I still carry the scars of my first discovery—that test-tubes are fragile.

— Edward Teller

Edward Teller with Judith L. Shoolery, *Memoirs: A Twentieth-Century Journey in Science and Politics* (2001), 42.

Laboratory Safety Guidelines Continued

Handling Chemicals

1. All chemicals in the laboratory are to be considered dangerous. Do not touch, taste, or smell any chemicals unless specifically instructed to do so. The proper technique for smelling chemical fumes will be demonstrated to you.

2. Check the label on chemical bottles twice before removing any of the contents. Take only as much chemical as you need.

3. Never return unused chemicals to their original containers.

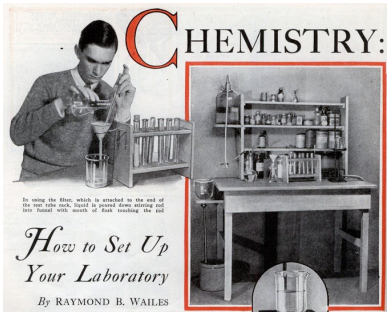
4. Never use mouth suction to fill a pipet. Use a rubber bulb or pipet pump.

5. When transferring reagents from one container to another, hold the containers away from your body.

6. Acids must be handled with extreme care. You will be shown the proper method for diluting strong acids. Always add acid to water, swirl or stir the solution and be careful of the heat produced, particularly with sulfuric acid.

7. Handle flammable hazardous liquids over a pan to contain spills. Never dispense flammable liquids anywhere near an open flame or source of heat.

8. Never remove chemicals or other materials from the laboratory area.



The February 1932 issue of Popular Mechanics gives advice on setting up a home laboratory. . Helpful advice includes not tasting chemicals, handling acids with care and "consult[ing] the lady of the house before usurping the bathroom or the laundry tubs."

9. Take great care when transferring acids and other chemicals from one part of the laboratory to another. Hold them securely and walk carefully.

10. **Solid materials are never allowed in the sinks!**

11. **Never discard liquids in the sinks unless specifically indicated by your instructor!**

12. Pay particular attention to the waste disposal instructions specific to each experiment.

Handling Glassware and Equipment

1. Carry glass tubing, especially long pieces, in a vertical position to minimize the likelihood of breakage and injury.

2. Never handle broken glass with your bare hands. Use a brush and dustpan to clean up broken glass. Place broken or waste glassware in the designated glass disposal container.

3. Inserting and removing glass tubing from rubber stoppers can be dangerous. Always lubricate glassware (tubing, thistle tubes, thermometers, etc.) before attempting to insert it in a stopper. Always protect your hands with towels or cotton gloves when inserting glass tubing into, or removing it from, a rubber stopper. If a piece of glassware becomes "frozen" in a stopper, take it to your instructor for removal.

4. Fill wash bottles only with distilled water and use only as intended, e.g., rinsing glassware and equipment, or adding water to a container.

5. When removing an electrical plug from its socket, grasp the plug, not the electrical cord. Hands must be completely dry before touching an electrical switch, plug, or outlet.

Liebig taught the world two great lessons. The first was that in order to teach chemistry it was necessary that students should be taken into a laboratory. The second lesson was that he who is to apply scientific thought and method to industrial problems must have a thorough knowledge of the sciences. The world learned the first lesson more readily than it learned the second.

— Ira Remsen Address to the Industrial Chemistry Society, Glasgow (1910). Quoted in Frederick Hutton Getman, *The Life of Ira Remsen* (1980), 121-122.

Laboratory Safety Guidelines Continued

6. Examine glassware before each use. Never use chipped or cracked glassware. Never use dirty glassware.

7. Report damaged electrical equipment immediately. Look for things such as frayed cords, exposed wires, and loose connections. Do not use damaged electrical equipment.

8. If you do not understand how to use a piece of equipment, ask the instructor for help.

9. Do not place hot glassware in cold water or on cold surfaces; it may shatter.

Heating Substances

1. Exercise extreme caution when using a gas burner. Take care that hair, clothing, and hands are a safe distance from the flame at all times. Do not put any substance into the flame unless specifically instructed to do so. Never reach over an exposed flame. Light gas (or alcohol) burners only as instructed by the teacher.

2. Never leave a lit burner unattended. Never leave anything that is being heated or is visibly reacting unattended. Always turn the burner or hot plate off when not in use.

3. You will be instructed in the proper method of heating and boiling liquids in test tubes. Do not point the open end of a test tube being heated at yourself or anyone else.

4. Heated metals and glass remain very hot for a long time. They should be set aside to cool and picked up with caution. Use tongs or heat-protective gloves if necessary.

5. Never look into a container that is being heated.

6. Do not place hot apparatus directly on the laboratory desk. Always use an insulating pad. Allow plenty of time for hot apparatus to cool before touching it.

7. When bending glass, allow time for the glass to cool before further handling. Hot and cold glassware have the same visual appearance. Determine if an object is hot by bringing the back of your hand close to it prior to grasping it.

This page is intentionally blank so that you can sign the Safety Contract, tear it off the syllabus , turn it and still have a copy of all information included in the syllabus.

Bruce Banner

"I mean, what are we, a team? No, no, no. We're a chemical mix-ture that makes chaos."

in The Avengers (2012)

In the meantime enjoy this picture of the CHEMICAL AVENGERS!

http://pauling.library.oregonstate.edu/exhibit/column28.htm

Like thousands of other boys, I had a little chemical laboratory in our cellar and think that some of our friends thought me a bit crazy.

- Linus Pauling

in 'Langmuir Winner Stumped Einstein", *New York Times* (23 Aug 1931), N2.

UT-Tyler Department of Chemistry Safety Contract

Name: _____ Course & Sec.: 3153-001 / 3153-002

Student ID Number: _____ Semester: Fall 2023

I. Are you color blind? □ YES □ NO

Do you intend to wear contact lenses during lab? □ YES □ NO

I hereby release the Department of Chemistry at The University of Texas at Tyler and its agents from any responsibility for any injury to my person or damage to my contact lenses as a result of wearing contact lenses in the laboratory. I understand and agree to these special regulations.

Student Initials: _____

II. List any specific allergies (if none, enter NONE):

_____

_____

III. List any other medical conditions about which your instructor might need to inform emergency service personnel.

_____

_____

Student Initials: _____

Agreement

I have read and agree to follow all of the safety rules set forth in this contract. I realize that I must obey these rules to ensure my own safety, and that of my fellow students and instructors. I have viewed the *Laboratory Safety Training for Students* presentation and have achieved a score of 80% or better on the *Student Lab Safety Test*. I will cooperate to the fullest extent with my instructor and fellow students to maintain a safe lab environment. I will also closely follow the oral and written instructions provided by the instructor. I am aware that any violation of this safety contract that results in unsafe conduct in the laboratory or misbehavior on my part, may result in being expelled from the laboratory, receiving a failing grade, and/or dismissal from the course.

Student Signature: _____

Date: _____