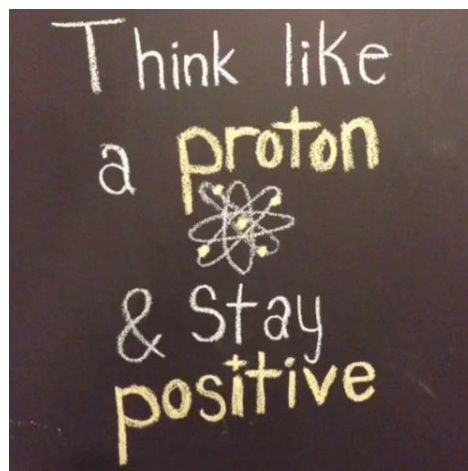


# Chemistry 203L

## Fall 2022

Instructor: Dr. Douglas Mulford

Office: Atwood 306  
Phone Number: 727-6989  
E-Mail: douglas.mulford@emory.edu  
Class Hours: Various throughout the week  
Room: All pre-lab meetings in Atwood 240 then to lab A for work.



### Course Level Learning Objectives

1. You will be able to monitor reaction progress and determine final materials produced.
2. You will be able to use spectrographic techniques (mass spec, NMR, IR) and identify molecules and predict reactivity.
3. You will be able to choose appropriate evidence and use that evidence to support the assessment of molecular structure, behavior, or transformations.
4. You will be able to use several new lab techniques including separatory funnels, microscale synthesis and reflux.

### Course Expectation

*This is an independent, 2-unit course, and will cover conceptual information as well as laboratory procedures and techniques.* Though significant amount of time will be spent performing the lab experiments, you should treat this as its own course with learning goals and expectations. You are responsible for pre-lab lecture material; I recommend taking notes! Please do not consider it “just lab” and blow it off (I saw this based on past experience!)<sup>1</sup>. This is a ‘real’ class! And you will be assessed through a final exam. OK, rant done...back to your regularly scheduled syllabus.

### Pre-/Co-Requisites:

All CHEM 203L students must be concurrently enrolled in CHEM 203 lecture or have previously completed that courses or its equivalent. ***If you withdraw from CHEM 203 lecture and do not have prior credit, you must withdraw from the laboratory as well.***

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<sup>1</sup> According to Emory's accrediting agency (SACS, <http://www.sacscoc.org/pdf/081705/CreditHours.pdf>), a credit is defined as for every one credit hour there should be "a minimum of two hours out of class student work each week for approximately fifteen weeks for one semester." This definition is actually based on a Federal guideline established under President Obama. This is the minimum and more commonly, 3 hours outside of class are expected for every credit hours by the accrediting agency. So, for a 2 unit class we should expect a minimum of 4 hours, and closer to 6 hours, outside of class each week. In addition, we actually only meet for 11 weeks, and not the expected 15 weeks.

### Required Materials:

- **OneNote**, We will be using Microsoft OneNote as our electronic lab notebooks this semester. Your Emory365 account has free access to OneNote for you. You will need to use a device to access the notebook during lab. You can use a laptop, tablet (best for handwritten notes), or smartphone for this purpose.
- **Safety Glasses/Goggles**: Federal regulation (rule 10 CFR 1910.133) requires the use of eye protection for all individuals in a laboratory setting. This rule applies to everyone occupying a laboratory, not just those engaged in laboratory work at any given moment. Safety glasses or safety goggles meeting ANSI Standard Z87 are available for purchase in the University Bookstore or will be offered for sale in the Department of Chemistry by the Pi Alpha Chemistry Society (dates TBD). **Please be sure to choose protective eyewear that you can comfortably wear continuously for the entire laboratory period.**
- **Proper clothing**: Shoulders and legs (down to the ankles) must be covered with closed-toed shoes.
- **Spartan Student Edition V. 8**. We will use this molecular modeling program throughout the semester and the university has arranged for a site license for the program. Follow this link(<https://www.wavefun.com/spartan-latest-version>) chose Spartan **Student** Edition V.8. After installing chose the "network option" and use "vmch-ecllicense2.cc.emory.edu" as the license server. It may take 2 or 3 tries and you must be on campus or using a VPN. **DO THIS NOW BEFORE YOU NEED IT TO WORK OUT ANY ISSUES WITH INSTALLING.**
- A **100% cotton t-shirt** or the like to tie dye on June 15
- **GroupMe access**: Free program that we will use for immediate interaction and questions. Join our group at: [https://groupme.com/join\\_group/86770781/QbR8BHFS](https://groupme.com/join_group/86770781/QbR8BHFS)
- Note: If the cost of textbooks & other materials presents a financial hardship for you, please contact Emory Student Assistance and Services via the following web form: <https://www.eclmach.emory.edu/OSSPS/view.php?id=38616>

### Suggested Materials:

- **ChemDraw**: Chemical drawing software. This software is provided free-of-charge to students via an Emory University site license. Head to <http://sitelicense.cambridgesoft.com/sitelicense.cfm?sid=9Your> and enter your Emory email. You will get an email with instructions.

### Class Resources<sup>2</sup>

#### Course Site:

Course materials, course calendar, announcements, and grades will be accessed through the course site at <https://canvas.emory.edu>. Announcements will be made through the Canvas site, and you are able to have these announcements sent to your Emory University (@emory.edu) email address, Note that any images are removed from the email versions of announcements so check the site!

#### Office Hours:

I will hold office hours on Monday and Wednesday from 11:30-12:30. I will be available via email and zoom at other times. Office hours are typically open-door group discussion affairs; if you wish to speak with me about a sensitive personal issue that you would prefer no to be addressed in front of other students, please contact me directly to make an appointment.

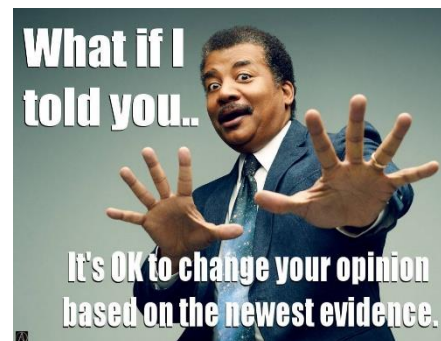
A note on evening and weekend email: I try to respond to all student emails in a timely manner. However, evenings and weekends are family time and as such I do not usually answer emails at those times.

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<sup>2</sup> Note: sections adapted from Dr. Llewellyn.

## Background<sup>3</sup>

Chemistry is a discipline in which scientists inquire about the microscopic and macroscopic worlds around us to understand the chemical nature of our surroundings. The basis for this inquiry is experimentation in which chemists probe for answers to scientific questions we face in our world. Sometimes, chemists explore the microscopic world with well-established experimental techniques. More often, however, they must design their own experiments, adapting techniques to their specific problems. We hope that this laboratory experience helps you to develop important problem-solving skills necessary for success in our competitive, technological society. With guidance from your laboratory instructor, the techniques described in this packet, and your textbook, you are free to use your creativity in solving the problems posed here.



Some of the ideas you will confront in lab will **not** be examined in lecture because they are issues appropriate only for the laboratory. For example, we hope that this lab experience helps you develop experimental design skills. These skills are not easily developed in a lecture setting. While experimental skills depend on conceptual knowledge, they differ from the concepts you will learn in lecture. Some of the investigations will ask you to draw on conceptual information that may seem unfamiliar. Don't panic when you are confronted with these concepts. The textbook for the lecture component of this class will be a valuable resource in helping you relate the unfamiliar material to the problem at hand. Practicing scientists must often consult textual resources and colleagues to solve their problems. They often encounter difficulties, solutions for which are not neatly outlined in detailed laboratory procedures. Instead, they design their own experiments with the knowledge of experimental techniques in mind. Hopefully, this lab experience will expose you to the critical thinking skills used by practicing chemists; that is, we hope that from the lab experience you can "learn to learn," a skill demanded by employers of college graduates in any discipline.

## Course Policies

### Course Culture:

In general, experimental work will be done in pairs. All reporting work will be done *individually*. **An easy rule of thumb is that if you are answering questions that will be turned in, or are manipulating data for the purposes of a report, then you should be working individually. Do not send your report to a friend to "help out."** This is a violation of the honor code for this course.

This course is not graded on a curve, and you are not in competition with one another for "scarce" good grades. It is entirely possible that every student in this course finishes with an A (and honestly, nothing would please me more!). Therefore, be cooperative, helpful, and encouraging to peers who may be having a tough time. Be courteous to others by keeping the communal spaces and equipment clean and keeping supplies in their proper place.

### Attendance:

You are expected to attend all sessions and to arrive on time in order to hear the pre-lab lecture and any special instructions for the day's experiment. Attendance and punctuality will be a part of the course grade. Make-up labs are only offered for excused and unavoidable absences, and must be arranged directly with Dr. Mulford at least one week before the scheduled lab meeting time.

<sup>3</sup> Adapted from Bauer, Birk, and Sawyer Laboratory Inquire in Chemistry, Books/Cole, Pacific Grove, CA, 2001.

### Accommodation of Disabilities:

Students with disabilities who believe they may need accommodations for this laboratory are encouraged to visit the Office of Accessibility Services (OAS) office as soon as possible to ensure that such accommodations are implemented in a timely fashion. Please see me as soon as possible once you have been issued a Letter of Academic Accommodation. For more information on academic accommodations, please visit the OAS website at <http://equityandinclusion.emory.edu/access/index.html>.

### Academic Integrity:

As a student of Emory University, you agree to uphold the [Emory Honor Code](#) *whether or not you have actually read it*. All of the work you submit in this course must be your original work. While you are encouraged to collaborate with your classmates while working on pre- and post-lab assignments by discussing your thoughts and general class concepts, all work you submit for grading must be your own original work, calculations, words, images, etc. reflecting your understanding of the material. ***You may not submit pictures, chemical structures, illustrations, graphics, text, or any other materials that you copy from the web or any other source.*** (This includes Wikipedia!) You may not falsify data by alteration or invention. You may not copy or use any data from another person without giving credit to the person who generated that data, and ***only with your Graduate Instructor's approval***. You are permitted to use a non-internet enabled scientific calculator during the final Theory and Practice Examination.

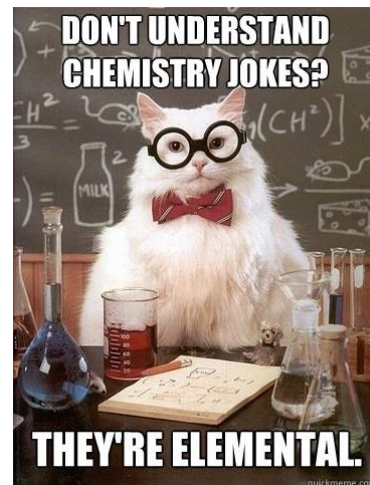
### Missing Data/Unsuccessful Experiments

If there arises a situation where you are unable to generate a product and/or data in a particular week you must speak with Dr. Mulford or your graduate instructor (who will check with Dr. Mulford) and they will advise you on what to do. Unauthorized use of another student's data is a violation of the Emory honor code as you are submitting someone else's work as your own. Successful completion of the experiments is an expected part of your class performance and as such, if you are authorized to use another student's data there will be a 10% penalty assessed on your post-lab. Dr. Mulford will adjust this policy if there is a global problem out of your control (like a missing reagent or incorrect preparation of a stock solution).

### Laboratory Conduct and Safety:

Your first concern at all times should be safety. You are responsible for reading the Safety section of the lab experiments and complying with all safety guidelines. You must wear approved eye protection at all times that you are present in the laboratory, ***regardless of whether you yourself are engaged in labwork at the time***. You must also obey any instructions given by any laboratory staff member at all times. You are expected to not create distractions or hazardous conditions in the laboratory, and to help your classmates to be safe as well; eg. if you see someone without their safety glasses on, remind them! They'd much rather hear it from you than from the teaching staff! Students who threaten the safety of the laboratory will be removed.

You are responsible for the contents of your shared equipment drawers. In the event of glassware breakage, contact your TA who will assist you in cleaning up the accident. All broken glassware should be placed in the broken glassware receptacle. Keep the work area free of debris. No trash or chemicals should be left on the bench tops. Store books and backpacks in the cubbyholes provided, NOT on the bench tops! Any equipment taken from the cabinets should be returned to its appropriate place. Leave chemical reagents where you find them. Never take reagent bottles to your bench. You must clean any spills and trash before leaving the lab. Your TA should check your workstation before leaving. **Always remove your gloves before you leave the laboratory. Gloves should not come in contact with the lab doors or handles.**



<sup>4</sup> <https://xkcd.com/2038/>

You are expected to come to lab familiar with the day's experimental procedure and ready to work efficiently. To this end, **laboratory manuals are not permitted in the laboratory**. Prior to each lab session, you should complete necessary pre-lab information for each experiment in your notebook. For more details, see the "Keeping a Notebook" on Canvas. **REMINDER: Notebooks pre-lab work must be done by 12:30 on the day of lab.**

You are expected to take care of the equipment and lab space that you use. Each lab period, four possible lab clean-up points are awarded by your Graduate Instructor **to their whole lab class as a group**. If your lab is left in disarray, you and everyone else in your section will lose points for lab clean up. **A good rule of thumb is that if there are things that your Instructor must clean up, then your lab has lost points**. The following is a list of things that are expected of you:

1. No spilled chemicals and no trash in hood or at workstations.
2. Balances are clean (all chemicals brushed off) and used weigh paper is put in disposed of properly.
3. Sink areas – clean, organized, and restocked as necessary (look under the sink for restocking items).
4. Chemicals in hood are capped properly (for the entire laboratory period).
5. UV lamps & propane torch returned to pull out shelf.
6. Micropipettes pulling area cleaned up.
7. Solvent bottles are returned to the solvent cabinet.
8. Aqueous solutions, drying agents, and acids are returned to the cabinet.
9. All equipment stored properly:
  - a. Ring stands, heater/stirrers, aluminum blocks - one in each cabinet.
  - b. Common glassware - clean and returned to the island glass racks.
  - c. Water tubing – draining on the island glass racks.
10. All waste handled properly:
  - a. Liquid organic waste - organic waste jug in main hood (funnel lid must be shut at end of lab).
  - b. All other paper towels, gloves, and empty boxes – trash can.
  - c. Any specific lab wastes - recovery jar, as directed by lab manual.

## Coursework and Grading

### Notebook:

20% of your course grade. We will do two notebook checks in the semester. *Dr. Mulford will lock your notebook pages in OneNote when the post-lab has been submitted for each experiment*. Notebooks will be checked for completeness after 2-3 labs into the semester and then again at the end of the semester. The first check will be worth 6% and the second 14%. Notebook pages for a particular experiment must be completed by the time the post is due for that experiment. More details in class!

### Theory and Practice Test:

20% of your course grade. One Theory and Practice Test examining your understanding of laboratory procedures, principles, and interpretation of data will be given in lab on June 23, 2021. A sample test may be found on Canvas.



**Pre-Lab Assignments:**

20% of your course grade. Note that pre-lab assignments are administered as “quizzes” on Canvas. You ARE encouraged to work with you fellow student on these but make sure that you submit your own answers and understand what you submit.

Late assignments will NOT be accepted. Pre-lab assignments are due at the beginning of your scheduled lab period.

**Post-Lab Assignments:**

30% of your course grade. Specific details regarding the content of post-lab assignments will be posted to Canvas for each experiment. Post-lab assignments vary in format from experiment to experiment and are tailored to suit the learning goals of each particular laboratory. Note that a portion of this score will come from the accuracy of your results in select experiments.

**Lab Attendance and Preparedness:**

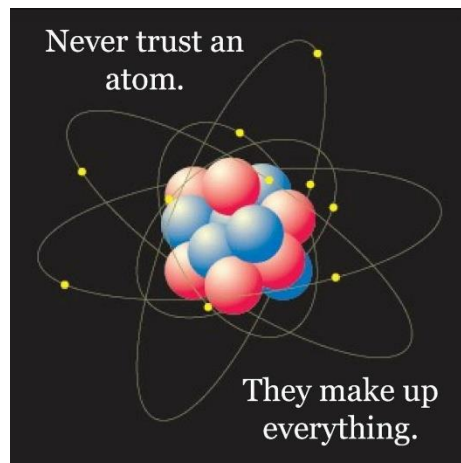
5% of your course grade. You will be evaluated daily on attendance, punctuality, appropriate lab attire, and completion of pre-lab notebook materials.

**Lab Clean-Up:**

5% of your course grade. See the “Laboratory Conduct and Safety” section for explanation of communal lab clean-up points.

**Late Work Policy:**

Pre-labs are not accepted late. Post-lab assignments that are not completed on time without a documented, valid excuse are subject to a penalty of 10% percentage points per 24-hour period (or part thereof) after the due date. That is, an assignment handed in or missed test made up 24 hours or less after the due date can earn a maximum score of 90% the standard value of the assignment without an excuse; an assignment completed between 24 and 48 hours late can earn a maximum score of 80%, and so on. Assignments that are not completed on time with a documented, valid excuse will not be subject to a grade penalty; please notify the instructor as soon as you are aware that you will not be able to complete your assignment on time so a make-up date can be arranged promptly.



## Grading Rubric:

You may be accustomed to being "graded on a curve." What this usually means is that if an average test score is not at an arbitrarily determined level, the teacher will adjust the scores or grade range-breaks so that the average does meet this numerical criterion. A curve tends to promote unhealthy competition which interferes with an atmosphere of cooperativity and friendly competition. In this course your grade will be based on your final course average and determined by a fixed scale. An advantage to this scale is that there is no requirement to give the same number of F's as A's—each student will receive the grade they earn. Note that grades are NOT rounded. Points earned are counting numbers and therefore have infinite precision and rounding is not appropriate. Also, the cut-offs below are defined values which therefore have infinite precision. The department targets a B- average over all sections of CHEM 203L



<u>Course Average</u>	<u>Grade</u>
93.00%	A
90.00	A-
87.00	B+
84.00	B
80.00	B-
etc.	

Students who attend all labs, submit all assignments on time, and do reasonably well (passing) on the Notebook Quiz and Theory and Practice Examination should expect to earn at least a B-. If necessary, the grading rubric will be adjusted at the end of the semester to reflect this expectation. Individual assignments will not be curved. In the event that significant variation is observed in grading across different Graduate Instructors, grades assigned by Graduate Instructors may be normalized across different sections at the end of the semester at the Dr. Mulford discretion.

## Course Schedule for Chem 203L Su22

16-May-22	17-May-22	18-May-22	19-May-22	20-May-22
1. Biodiesel		2. Liquid-Liquid		
23-May-22	24-May-22	25-May-22	26-May-22	27-May-22
3. IR and NMR		4. Virtual Mass Spec and Spartan		
30-May-22	31-May-22	1-Jun-22	2-Jun-22	3-Jun-22
Memorial Day		5. DMAP and CH <sub>3</sub> I		
6-Jun-22	7-Jun-22	8-Jun-22	9-Jun-22	10-Jun-22
6. Fisher Esterification of Scent Molecules		7. Grignard of Dyes		
13-Jun-22	14-Jun-22	15-Jun-22	16-Jun-22	17-Jun-22
8. Suzuki		9. NAS Tie Dye		
20-Jun-22	21-Jun-22	22-Jun-22	23-Jun-22	24-Jun-22
10. Diels Alder		T&P Test		