

# CHEMISTRY 1460, Exploring Chemistry II

University of Vermont, Spring Semester, 2024

## General Information

**Instructor:** Prof. Christopher Landry

**E-mail:** christopher.landry@uvm.edu

**Meeting Time:** Thursday, 1:15 – 5:15 pm

**Office Hours:** Tuesday and Wednesday, 10:00-11:30 am

**Office:** Innovation E356

**Phone:** 656-0270

**Lab room:** Discovery Hall, W213 and W211

**Teaching Assistants:** Bradley Cech, Maddie Hatch

*The instructor reserves the right to change everything, with notice.*

## Course Description

**Course content:** From the UVM course catalogue: "Second semester of a discovery-based laboratory addressing foundational chemical principles and experimental methods. For first-year Chemistry and Biochemistry majors also enrolled in CHEM 1550".

**Course overview:** We continue experimental exploration of foundational chemistry, begun last semester in CHEM 1450. This semester we will start out with a collaborative effort with CHEM 1550, and explore qualitative/structural analysis using spectra from chemical instrumentation (e.g., NMR, IR, and Mass Spec). We will then focus on laboratory experiences exploring chemical equilibrium (solubility, acid-base, and complex-ion), kinetics, thermochemistry, and electrochemistry.

**Textbook and other course materials:** As with Chem 1450, there are no required texts for this course. Handouts for each laboratory exercise will be provided, as needed, and will include literature references as necessary. You can continue to use the same lab notebook, safety goggles, etc. that you used last semester.

**Learning goals:** From the Chemistry Department's B.A. and B.S. learning goals:

- Demonstrate general knowledge in chemistry across all subdisciplines and be able to apply chemical and physical principles in the solution of qualitative and quantitative chemical problems.
- Solve qualitative and quantitative problems by developing a rational strategy, including the ability to estimate the solution and test the validity of the solution.
- Demonstrate proficiency in experimental chemical techniques and be able to apply these to practical and current problems in research.
- Describe the objective of a chemical experiment, execute the experiment correctly, and collect and analyze relevant data, akin to the scientific method.
- Understand and adhere to procedures and regulations for the safe handling, use, and disposal of chemical reagents.
- Collect data digitally and analyze such data with appropriate software.

**Learning outcomes:** Together with CHEM 1550, you will obtain a foundational understanding of the major ideas in chemistry, often demonstrated with organic compounds. This course serves to both support the work done in CHEM 1550 as well as to explore other chemical concepts and methodologies fundamental to all areas of chemistry.

We will continue to use a discovery or guided-inquiry structure in this course so that, in addition to the subject-based content, you will be exposed to and directed to solve chemical problems in the laboratory using the scientific method. It is our hope that the critical thinking and problem-solving skills you will learn and employ in learning chemistry this year will serve you as you explore disciplinary areas other than chemistry and will provide you with a template for exploration throughout your life. Most importantly, this is not a course in which the destination is the most important; rather, we will be more concerned with *process*, i.e. *how* we come to understand the fundamentals of chemistry. I am less concerned that you know "the answer" and more concerned that you understand how to figure out what "the answer" is!

Some specific learning objectives of this course include understanding the following topics:

- The scientific method as a process for problem-solving and learning chemical principles
- Chemical equilibrium
- Acid/base chemistry, including pH,  $pK_a$ , and  $pK_b$
- Reaction kinetics and mechanisms
- Reaction energetics (thermochemistry)
- Spectroscopic identification of organic compounds

**Course structure:** This is a laboratory course meets each Thursday. The first meeting will be used to go over the syllabus and get to know each other; the last two class meetings will be used for standardized testing and to check out your laboratory equipment. There are a total of ten laboratory sessions.

**Assessment:** Your course grade will be determined by your point total at the end of the semester. There are 100 possible points that can be earned, according to the following distribution categories:

- Attendance: 20% (20 points). There are 10 lab classes this semester which, at 2 pts each, gives a total of 20 possible points for the semester. However, since this is a laboratory course, you are expected to be in lab each week for each experiment/exercise. **It is not possible to pass this course with more than two absences (excused or unexcused), but should you be unable to attend lab or do the work for the lab due to illness this semester, please be assured that we will work with you to make appropriate accommodations for you to complete the required number of experiments/exercises.**
- Lab Notebook: 20% (20 points). You will be expected to keep a notebook documenting your preparation for and work in the lab. Your lab notebook “carbonless copies” will be collected after each lab class session and assessed relative to the expectations and good laboratory practice presented to you in class. Each of these ten assessments will be worth 2 points, for a total of 20 possible points for the semester. While many of our labs will not require any advance preparation, for those that do require it, lack of evidence of preparedness for a laboratory experiment/exercise could result in your expulsion from the lab for the day, if it is determined that you are not prepared for working safely in the laboratory.
- Participation: 20% (20 points). We will rely heavily on working collaboratively in this course and your behavior in the laboratory will be assessed relative to your efforts to support the learning objectives of the class as a whole. No single person in this course will be able to perform all of the experimental measurements necessary to test the hypotheses posed and to answer the questions raised – collaboration and sharing of data and observations are essential to the success of the entire class. At the end of the semester, each student will be awarded up to 20 points based on their participation in the lab across the entire semester.
- Lab Reflections/Reports: 30% (30 points). While there will not be formal lab reports you will need to write for this course, after each lab experience there will be some kind of *prompt* to which you will be expected to think about and turn in a written reflection or (very brief) report prior to the next lab period. Typically, these will be no more than one page and will be assigned by Saturday of each week and due by the start of lab each week. There will be 10 of these assignments and they will be graded on a scale of 0 to 3 points.
- ACS Exams: 10% (10 points): Near the end of the semester, you will be asked to re-take Part 1 of the General Chemistry standardized, multiple-choice exam created by the American Chemical Society (ACS) (you took this exam early last fall). While you do not need to study for this, it would be a good idea to do a brief review of General Chemistry material – you will be allowed to use a scientific non-graphing calculator (no other electronic devices will be allowed). Ten points will be awarded for taking the exam - points awarded are not based on your score on the exams, but it is expected that you do your best and complete the exam during the time allotted (for which you will receive the full 10 points).

**Communication:** I guarantee that I will be available during office hours. If for some reason I cannot be available, I will send a message to the class. Outside of office hours, e-mail is generally the best way to get in touch with me. I am available by e-mail from 8am to 6pm Monday – Thursday, and from 8am to 3pm Friday. If you send me a message during this time, I will try to respond within one business day.

Week		Topic	Experiment
1	January	18 Syllabus and first meeting	-
2		25 NMR, IR, and Mass Spec	-
3	February	1 NMR, IR, and Mass Spec (demos)	-
4		8 Solubility Equilibria	Ksp, periodicity, acid-base titrations
		15 Exam Week	-
6		22 Kinetics	Iodine clock kinetics
7		29 Thermodynamics	Hot and cold packs
8	March	7 Acid/base equilibria	potentiometric titration
		14 Spring Break	-
10		21 Acid/base buffer equilibria	Buffers
		28 Exam Week	-
12	April	4 Electrochemistry I	Echem and equilibrium constants
13		11 Electrochemistry II	Electrolytic and galvanic cells
14		18 ACS exams	-
15		25 Exam Week	-
16	May	2 Checkout/cleanup	LN2 Ice Cream

## Diversity, Equity, and Inclusion

While the field of chemistry has not always been inclusive and diverse, our current chemistry community increasingly reflects the world outside of the laboratory. Science and scientists are not immune to bias, but we can make ourselves aware of it and actively work against it in our everyday lives. In this class, we will discuss ways to find out the track record of a company on diversity, equity, and inclusion (DEI) issues and how to think about those issues when considering whether to accept a job. Several of our alumni speakers are from groups traditionally underrepresented in chemistry on the basis of race, gender, or other reasons, and I would encourage you to ask them about their own experiences in the workplace. Finally, it is my intention to create an environment where all beliefs are valued. No one should feel afraid to state their opinion, and everyone should feel confident and supported by the group. If you experience any form of bias in our class or at UVM, please feel free to use me as a resource. A list of other resources focused on DEI are included on the next page of this syllabus.

### **Division of Diversity, Equity, and Inclusion**

<https://www.uvm.edu/diversity>

The Division of Diversity, Equity, and Inclusion believes excellence should be inclusive of the entire University of Vermont (UVM) community and is steadfastly committed to this belief. Every day, our Division strives to make our work accessible, affirming, and action-oriented to help ensure excellence is inclusive of everyone.

### **UVM Prism Center**

<https://www.uvm.edu/prism>

The Prism Center serves the diverse queer and trans communities at the University of Vermont. We support and empower lesbian, gay, bisexual, transgender, and queer students, as well as students whose identities fall in between or expand beyond those categories, and work to create a campus community where people of all sexual and gender identities can thrive.

### **Interfaith Center**

<https://www.uvm.edu/interfaithcenter>

Each of us engages questions about life differently, perhaps through a religious tradition, philosophy, or spiritual practice. No matter how you make meaning of your life, you are welcome at the Interfaith Center for reflection, spiritual practice, education, and community building.

### **Mosaic Center for Students of Color**

<https://www.uvm.edu/mcsc>

The Mosaic Center for Students of Color (MCSC) Vision is to create a diverse and rich community of empowered, engaged, and enthusiastic students of color at UVM. We fully support the holistic development of self-identified students of color so that they can obtain their goals for academic achievement, personal growth, identity formation, and cultural development.

### **Women & Gender Equity Center**

<https://www.uvm.edu/wagecenter>

The UVM Women & Gender Equity Center cultivates joyful community while advancing gender equity across identities. We envision a brave, diverse, and equitable learning environment for all members of the UVM community. We provide advocacy services for those in our community who have experienced sexual or intimate partner violence, and strive to provide programming, education, and events that ask our community to explore the intersections of their gender and other identities.

## University Policies and Procedures

**Student Learning Accommodations:** In keeping with University policy, any student with a documented disability interested in utilizing accommodations should contact SAS, the office of Disability Services on campus. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter. All students are strongly encouraged to meet with their faculty to discuss the accommodations they plan to use in each course. A student's accommodation letter lists those accommodations that will not be implemented until the student meets with their faculty to create a plan.

**Contact SAS:** A170 Living/Learning Center; 802-656-7753; [access@uvm.edu](mailto:access@uvm.edu), [www.uvm.edu/access](http://www.uvm.edu/access)

**Religious Holidays** <https://www.uvm.edu/registrar/religious-holidays>: Students have the right to practice the religion of their choice. If you need to miss class to observe a religious holiday, please submit the dates of your absence to me in writing by the end of the second full week of classes. You will be permitted to make up work within a mutually agreed-upon time.

**Academic Integrity** <https://www.uvm.edu/policies/student/acadintegrity.pdf>: The policy addresses plagiarism, fabrication, collusion, and cheating.

**Grade Appeals** <https://www.uvm.edu/policies/student/gradeappeals.pdf>: If you would like to contest a grade, please follow the procedures outlined in this policy.

**Grading** <https://www.uvm.edu/registrar/grades>: This policy contains information on grading and GPA calculation.

**Code of Student Conduct** <http://www.uvm.edu/policies/student/studentcode.pdf>: This policy reaffirms the principle of student freedom coupled with personal responsibility and accountability for individual action and the consequences of that action so that UVM students can be healthy, successful and engaged.

**FERPA Rights Disclosure** <http://catalogue.uvm.edu/undergraduate/academicinfo/ferparightsdisclosure/>: The purpose of this policy is to communicate the rights of students regarding access to, and privacy of their student educational records as provided for in the Family Educational Rights and Privacy Act (FERPA) of 1974.

**Promoting Health & Safety:** The University of Vermont's number one priority is to support a healthy and safe community.

**Center for Health and Wellbeing:** <https://www.uvm.edu/health>.

**Counseling & Psychiatry Services (CAPS):** (802) 656-3340

**C.A.R.E.:** If you are concerned about a UVM community member or are concerned about a specific event, we encourage you to contact the Dean of Students Office (802-656-3380). If you would like to remain anonymous, you can report your concerns online by visiting the Dean of Students website at <https://www.uvm.edu/studentaffairs>.

**Final Exam Policy** <https://www.uvm.edu/registrar/final-exams>: The University final exam policy outlines expectations during final exams and explains timing and process of examination period.