# Chemistry 104: General Chemistry II

## Spring 2018, Section 002

**Credits:** Chemistry 104 is a 5-credit course.

**Whole-class meetings:** MWF 11:00 am – 11:50 am in Chemistry Building 1351 (150 minutes per week)
**Discussion meetings:** Times, locations vary by discussion section (two 50-minute classes/week)
**Laboratory meetings:** Times, locations vary by lab section (one 3-hour lab/week; 10 labs/semester)

**Course website:** https://canvas.wisc.edu/courses/76016
Bookmark this course site – it is important to visit daily! It is the hub for our course and contains crucial materials for each day of class.

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**Instructor:** Dr. Linda Zelewski
**Office Hours:** MWF 12:00 pm – 1:20 pm in Chemistry Building 2126
**Contact Information:** ***Piazza*** (accessible through course website) should be used for course content and policy questions.
***Email messages*** (sent to zelewski@wisc.edu) should be used for individual situations or confidential matters. Tips for successful email communications:

- Use your @wisc.edu email account.
- Include "CHEM 104" and a short descriptor (e.g. "family emergency") in the subject line.
- Provide your name, discussion section, and TA's name in your message. This helps the course instructor respond faster.

Refer to the "Communications" section of this document for more information on using Piazza and email effectively.

**Teaching Assistants:**

| | | Section(s) |
|---|---|---|
| Kushal Bagchi | kbagchi@wisc.edu | 721, 722 |
| Courtney Botelho | cbotelho@wisc.edu | 723, 724 |
| Batul Kachwala | kachwala@wisc.edu | 735, 736 |
| Brandon Lamb | blamb3@wisc.edu | 727, 728 |
| Lei Lu | llu56@wisc.edu | 725, 726 |
| Laura Muehlbauer | lmuehlbauer@wisc.edu | 729, 730 |
| Nathan Neff-Mallon | neffmallon@wisc.edu | 731, 732 |

**CHEM 104 Help Desk:** Free drop-in tutoring provided by current Chemistry 104 TAs in Room 1201

- Mon and Wed: 7:45 am – 6:40 pm
- Tue and Thurs 8:50 am – 6:40 pm
- Fri 7:45 am – 2:15 pm

# Official Course Information

### *Course Designations and Attributes*

- Level: Elementary
- Breadth: Physical Science
- L&S Credit Type: C

### *Instructional Mode*

Chemistry 104 is taught in a "blended" learning environment, meaning students interact with course content, instructors, and peers via in-person classroom time and online learning and engagement platforms. The structure and design of Chemistry 104 is guided by UW-Madison's campus-wide goal of achieving pervasive active learning in its courses.

### *Credit Hour Determination*

Chemistry 104 is a 5-credit class that meets three times weekly for 50 minutes, plus students participate in a lab section (3 hours per week) and discussion section (two times weekly for 50 minutes each) for this class. Over the course of the semester, students are expected to do a total of about 225 hours of learning activities, which includes: whole class and discussion class attendance, lab attendance, reading, studying, preparation, problem sets, lab reports, and other learning activities.

### *Course Description*

Principles and application of chemical equilibrium, coordination chemistry, oxidation-reduction and electrochemistry, kinetics, nuclear chemistry, introduction to organic chemistry. Lecture, lab, and discussion.

### *Course Requisites*

CHEM 103 and MATH 112, 114, or 171; not open to students who have taken CHEM 109 or 115

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# Why Take Chemistry 104?

Chemistry is the science of making things and transforming things. Chemistry is often called the central science because it connects so strongly to other sciences, among them physics, biology, engineering, medicine, materials science, and pharmacology. In Chemistry 104 students will build on concepts from Chemistry 103 as they explore characteristics of chemical reactions related to chemical kinetics, chemical equilibrium, acid/base and organic chemistry, thermodynamics, and electrochemistry.

# How Does This Course Fit with Preparation for Your Major?

Chemistry 104 is the second-semester course for the two-semester General Chemistry sequence at UW-Madison. The Chemistry 103-104 sequence serves as a prerequisite for advanced courses such as Organic Chemistry and Analytical Chemistry and is required by many other majors (such as engineering, many biological and agricultural sciences, pre-health professions, and L&S breadth requirements).

# Goals and Learning Objectives

We want you to learn to think like a chemist. With that in mind, this course has been designed and organized to help you learn chemistry. We will do our best to guide you, but no course or instructor can learn for you. Successful students are proactive about their learning and establish patterns of study.

We have two overarching goals for our chemistry program: 1) You will conceptualize the invisible by understanding the atomistic model of matter and the role of energy in transformations, and 2) you will operate as a scientist by learning how to think logically, communicate effectively, and solve problems methodically.

By the end of Chemistry 104, you will:

1. Describe fundamental chemical concepts and principles, including: three dimensional molecular structure, kinetics and reaction mechanisms, and equilibria/free energy as applied to organic chemistry, acid-base chemistry, and electrochemistry.
2. Solve a wide variety of integrative chemistry problems that connect ideas across topics, such as the prediction of battery voltages with time.
3. Apply submicroscopic models of matter to explain observed macroscopic phenomena, including: chemical and physical characteristics of organic molecules, activation energies of chemical reactions, chemical processes favored or disfavored by entropy, and flow of electrons and ions between electrochemical cells.
4. Visualize and apply chemical and mathematical models to determine reaction rates, to predict equilibrium concentrations of chemical species before and after system disturbances, to deduce the spontaneity of chemical processes, and to calculate the voltages of electrochemical cells.
5. Design, conduct, and analyze experiments pertaining to organic synthesis, kinetics, equilibrium, thermodynamics, acid/base chemistry, and electrochemistry while augmenting fundamental safety and analysis practices.
6. Demonstrate growth as reflective, self-directed learners through assessing their work, identifying misconceptions, and critically evaluating information from a variety of sources.
7. Articulate the rationale behind experimental results and answers to conceptual problems in verbal communications and written assessments using scientifically appropriate language.

## Big Ideas

The seven "Big Ideas" will be described in broad strokes at the outset of the semester; these ideas will provide a backdrop to new concepts as they are introduced throughout the semester. Big ideas for entire course:

1. All matter is comprised of atoms; atoms are made of subatomic particles (protons, neutrons, and electrons).
2. Atomic structure and molecular structure affect chemical and physical properties of atoms, molecules, and ions.
3. Forces of attraction / repulsion exist between subatomic particles, between individual atoms, and between molecules; these forces, along with structure, influence chemical and physical properties.
4. Atoms, molecules, and ions are in constant motion and possess kinetic energy; kinetic energy influences how often atoms, molecules, and ions collide into and therefore interact with each other.
5. Chemical bonds and intermolecular attractions can be broken and reformed; equilibrium occurs when these two processes occur at the same rate.
6. Breaking chemical bonds (and/or overcoming intermolecular forces) consumes energy; making bonds releases energy.

7. Climate change is one of the biggest scientific challenges facing the world today; chemistry is central to the solution to this problem.

You will learn more about the learning objectives and big ideas as the semester progresses.

## Chemistry 104 Learning Environment and Expectations

Chemistry 104 is a fun and enlightening course, and we enjoy teaching it. We owe each other professional behavior and mutual respect. As partners in learning, we all have responsibilities for every class period. We have prepared an interactive and engaging set of activities for which your pre-class preparation is critical. Each component is important for your success. Do not overlook any of them.

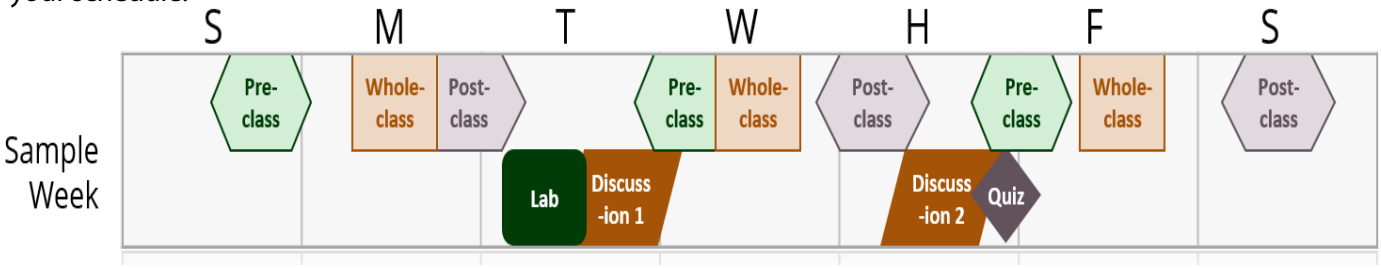
Come prepared to be engaged, present, and active in this environment. Make notes about questions you have or points you don't understand. Come to us with your questions and struggles with the material; that's why we're here. **To succeed, you must practice solving chemistry problems every day! Please be prepared to commit 10 to 15 hours outside of class each week working on Chemistry 104 materials.**

We know that success in this course depends upon your ability to solve problems. Developing your problem-solving skills is a key aim of this course. We will give you a lot of opportunities to practice problem solving. The most successful students devote most of their study time to problem solving. We advise you to practice problem solving every day. In emphasizing problem-solving skills, we aim to cultivate your ability to connect these problems to broader chemistry concepts.

We promise that by the end of Chemistry 104, you will be a more mature learner, a stronger thinker, and have a much better grasp of how to think like a chemist. To be successful in Chemistry 104, you must learn to be an independent learner and problem solver.

## Course Components

To give you an idea of what a weekly schedule might look like, here is a sample week for a MWF class. Your particular weekly schedule may look slightly different, but these same course components will always be part of your schedule.




*Pre-class Activities*

**Due dates:** These activities are due at the start of your whole-class session (example: If your whole-class session meets at 9:30 AM, your pre-class activities are due at 9:30 AM.

**Activities include:** Readings, videos or demos, interactive tutorials, short quizzes

*Whole-class Session*

**Activities include:** Group work, individual and group problem-activities, instructor-led demos, instructor-led content presentation, ConcepTests, and Learning Activities

*Post-class Activities*

**Due dates:** These activities are due at 1pm each Monday.

**Activities include:** OWL homework, problem sets, additional content materials (videos, readings)

*Laboratory*

**Due dates for pre-lab video quizzes:** Each lab experiment has a pre-lab video and associated quiz. The deadline for completing the pre-lab quizzes is 1pm on Monday of the week that experiment is performed.

**Due dates:** Information on lab due dates is included in the "Laboratory Information" section of this syllabus. Please consult the last page of this syllabus or the course website home page to find your lab schedules.

**Activities include:** designing experiments and interpreting data, using laboratory equipment properly, working with your fellow students in the laboratory, communicating your ideas about the data through discussions and writing / submitting lab reports.

*Discussion Sections*

**Due dates:** You will have discussion section meetings twice/week. During one meeting per week, there will be a graded quiz.

**Activities include:** Group problem-solving work, exam and lab preparation when needed, discussion quizzes

*Exams I, II, III, and Final Exam*

**Due Dates:** Please consult the last page of this syllabus or the course website home page to find the dates of your three midterm exams, as well as the date and time of your final exam.

## Course resources

We have chosen course materials that best address the learning objectives and that are the most useful resources to you in your study, lab, and group work. There are seven total materials: one textbook, one lab manual, one lab notebook, safety goggles, Top Hat, a calculator, and OWL online homework access. These items will cost you roughly $200. These items are essential for your learning, and we have negotiated with the publishers to receive highly discounted textbook pricing. Please contact us if you cannot afford these items. If you took Chemistry 103 here at UW-Madison, you may already have many of these items and can reuse these in Chemistry 104.

### *Textbook*

The textbook for the course is *Chemistry: The Molecular Science,* 5th edition, by Moore and Stanitski. A custom package for UW students is available at the University Bookstore at a reduced price, which includes the e-text and online homework system (OWLv2). You may purchase either the hardcover edition or a less expensive unbound edition. If you prefer, you may purchase only the electronic version (e-text), which includes access to the homework system. The e-text/homework bundle can be purchased at the bookstore for ~$100 or directly from the publisher for ~$80, follow the instructions under "OWLv2 Registration" on the "Getting Started" portion of our Learn@UW page. Note that the paper (hardcover or unbound) textbooks already come bundled with the e-text and homework at no additional charge.

### *Lab Manual and Notebook*

The *Chemistry 104 Laboratory Manual* and carbonless laboratory notebook can be purchased (WisCard only) in room 1375 (chemistry computer lab) during the first two weeks of classes and later through the first-floor stockroom. Lab notebooks (with carbonless copies) purchased from the University Bookstore are also acceptable, and you may reuse the remainder of your Chemistry 103 carbonless lab notebook if you have enough unused pages available.

### *Safety Goggles*

Industrial quality eye protection is **required** in all chemistry laboratories. Safety goggles that fit over regular glasses can be purchased from the University Bookstore or along with the lab manual and notebook. Contact lenses should not be worn in the laboratory because fumes or splashes may be caught between them and your eye. Please note that sandals are not acceptable footwear in the laboratory.

### *Top Hat software*

The whole-class sessions will make extensive use of student "voting" concept tests, surveys, and other questions. We will be using the Top Hat (www.tophat.com) classroom response system in class. You will be able to submit answers to in-class questions using Apple or Android smartphones or tablets (via the Top Hat app), laptops (via their website), or through text message (tutorial link here). Top Hat is the supported student response tool at UW-Madison, and you may be using Top Hat in multiple classes throughout the academic year.

You can visit the Top Hat Overview, which outlines how you will register for a Top Hat account and provides a brief overview to get you up and running on the system. You can register via the Top Hat website. This registration will cost $16 for one semester, $20 for one year or $54 for life. Follow these directions to set up your account. Your instructor will have a section-specific course code to share with you; use this code to register for your Chem 104 section. Please see the homepage of your course site under Announcements (right side of homepage) to find this code. Should you require assistance with Top Hat at any time, please contact their Support Team directly by way of email (support@tophat.com), the in-app support button, or by calling 1-888-663-5491.

### *Calculator*

An inexpensive calculator capable of calculating square roots, logarithms and exponential operations is needed for this course. The calculator will be used on exams, homework assignments, and in the lab. A programmable calculator may be used as long as no information is stored on it, such as chemical formulas or equations. It must be of the type allowable on an ACT or SAT exams (no cell phone or iPod calculators). You must clear the memory before entering the exam room.

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## Laboratory Information

The laboratory experiments are a vital part of this course; you will develop skills that are not easily learned or demonstrated in lectures. These skills include:

- Designing experiments, interpreting data, and using laboratory equipment properly
- Working with your fellow students in the laboratory
- Communicating your ideas about the data through discussions and writing

*You must successfully complete the laboratory assignments to receive a passing grade in this course.*

### *Laboratory Preparation*

You **must** prepare in advance for each laboratory exercise by writing an introduction and procedural outline in your lab notebook. During the lab period, you will carry out the experiment, take notes, and complete your data analysis. A record of your work **must** be turned in at the end of the period in the form of the duplicate pages

from your lab notebook. You will be graded on your pre-lab preparation, in-lab experimental technique and data analysis, and on your observation and notetaking skills.

### *Laboratory policies*

**Attendance policy:** You must attend all laboratory sessions. There is no opportunity to make up a lab that you miss; a grade of zero will be recorded for unexcused absences. Below are specific attendance details:

> ***Late attendance:*** Any student showing up to lab 30 minutes late or later is not allowed to participate in lab. This is considered an unexcused absence and students are not allowed to make this up.
>
> ***Unexcused labs:*** Any student missing a lab because of late arrival or not showing up at all will NOT have the opportunity to make this up. You may not reschedule a lab period simply to fit your personal schedule. Make-up labs are not scheduled. Exceptions to this policy are made only in unusual circumstances and are at the discretion of the Lab Director.
>
> ***Excused labs:*** Students who must miss labs due to University reasons (UW varsity athletics or band) should arrange for a time with their instructor two weeks prior to their scheduled lab date to make up the lab. Students who must miss labs for personal emergencies or illness should contact their TA and instructor as soon as possible to discuss how they can make up the lab. Students who must miss a lab for religious observance should contact their TA and instructor as soon as possible to discuss how they can make up the lab.

**Late lab reports:** Unless otherwise announced, lab reports are due to TAs/FAs approximately 24 hours from the end of the lab session; your TA will provide you with specific deadlines. Please note that late laboratory reports are not graded.

**Falling behind during lab time:** The laboratory will take a significant amount of preparation time in addition to the time spent in the laboratory. Most of the experiments have been scheduled so that students can finish everything (including the report) required in the laboratory period. However, you may not be able to finish the experiments if you are not prepared when you enter the laboratory. If you regularly fail to finish the experiments, ask your instructor how you can schedule your lab time more effectively.

**Early departure:** You are expected to spend the entire three hours in lab. You may only leave lab before the end of the allotted time if you turn in your completed lab report to your TA before you leave the laboratory.

# Grades

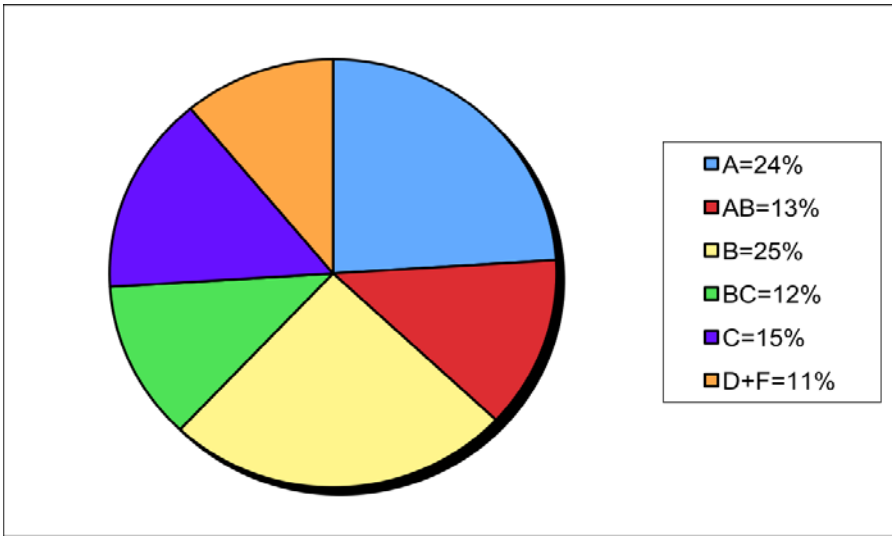
### *Evaluation of your learning*

Your scores are always available to you at our Learn@UW course site. There are no opportunities for extra credit. **You must successfully complete the laboratory assignments to receive a passing grade in this course.**

| | |
|---|---|
| Three midterm exams (given during designated whole class sessions) | 33% |
| Pre-class activities (completed online) | 7% |
| Post-class activities (online homework) | 10% |
| Laboratory | 20% |
| Quizzes (given in discussion sections) | 7% |
| Whole class ConcepTest questions (answered via TopHat) | 3% |
| Final exam | 20% |
| **Total** | **100%** |

### *Grade scale*

The approximate distribution of final grades is given below. It is important to note that the distribution will be adjusted upwards if class performance exceeds our expectations. For example, we guarantee that at least 24% of the grades will be A, and it may be higher.




# Course and UW-Madison Policies

### *Academic Integrity*

We expect all students to conduct themselves with honesty, integrity, and professionalism. Remember that it is not ok to simply copy and paste material from the Web or from another student into your own work. The Writing Center describes how to cite material that is not yours: http://writing.wisc.edu/Handbook/QuotingSources.html.

Passing off someone else's lab reports or exam answers as your own work is academic misconduct. Misrepresenting your class attendance by asking a student to answer ConcepTest questions for you when absent from class or by answering questions remotely while not in class is also academic misconduct. Submitting an altered exam question for regrading is academic misconduct. Such behavior is not tolerated and is grounds for a failing grade in this course and other disciplinary actions. To learn more about university policies on academic misconduct, see http://www.students.wisc.edu/doso/academic-integrity/.

### *Accessibility and Accommodations for Disabilities*

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility.

Students are expected to inform their instructor of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. We will work either directly with you or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA.

### *Religious Accommodations*

In accordance with regent and faculty policy, instructors should not schedule mandatory exercises on days when religious observances may cause substantial numbers of students to be absent from the university. UWS 22 states that "students' sincerely held religious beliefs shall be reasonably accommodated with respect to scheduling all examinations and other academic requirements." Exams and requirements include any course requirement made by the instructor that will be considered in the course. See "Religious Observances" under the Academic Calendar for more details.

Students must notify the course instructor within the first two (2) weeks of the semester/term of the specific dates conflicting with an exam or assignment. Instructors are also strongly encouraged to make students aware of this policy within the first week of the semester/term. For more details and protocol information, see the UW-Madison policy on religious observance and exam conflicts.

### *Make-up exams*

There are no make-up exams given in this course. If you have a family emergency or other extenuating circumstances that might impact your ability to sit for an exam, please talk to or email your instructor as soon as possible.

# Communications

### *Office Hours and Help Desk*

Your Chemistry 104 instructors are dedicated to maximizing your learning experience. We rely heavily on you to take the initiative in coming to seek our help. In the past, the most successful students took good advantage of help desk hours and instructor office hours on a weekly basis. They came with lists of questions and clearly identified problems that they needed help solving. This engagement led to great discussions and a very effective use of time.

There is a **CHEM 104 Help Desk** available to all CHEM 104 students, located in the main TA/FA office in Chemistry 1201. This is a drop-in spot for all CHEM 104 students to find help from a TA/FA who is staffing the Help Desk. Help Desk hours are provided at the bottom of Page 1 of this syllabus

### *Piazza*

We use the Piazza online discussion board (accessible through our course website) for students to pose questions to their peers, TAs, and instructors. If you have a question, start by searching Piazza to see if anyone has already asked the same question. If you can't find a similar question, post your question. Check back often to view responses from students, course TAs, the instructor, and other academic staff.

> **Types of queries:** Piazza should be used for all questions related to chemistry content, course policies, course website issues, and other general questions.

### *Email*

Email is used for situations that are specific and/or personal to an individual student. In order to expedite the response by your course instructor to email messages, please use your @wisc.edu email account, include **Chemistry 104** in the subject line of all email messages, and provide your name, discussion section, and TA's name in your message.

> **Types of queries:** Emails to your whole class instructor should be limited to logistical questions, concerns about grades, requests for alternate office hours, or any non-content related course questions.

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# Student Contract

You will be asked to agree to the following contract after you've completed the "Getting Started (Module 0)" set of activities on the course website.

*I have read the syllabus and understand the expectations of this Chemistry 104 learning environment. I understand that I am expected to contribute to a productive atmosphere, to show respect to my peers, to be responsible for my work and my preparation for deadlines, and to ask for clarification when I need it. I expect to participate fully in an engaging learning experience in Chemistry 104 and to optimize the learning opportunities available to me. Finally, in all face-to-face components of this course, I will contribute to positive classroom etiquette by:*

1. *being seated before the bell rings,*
2. *refraining from packing up until after the class is over, even if the bell rings (this will not happen often), and*
3. *using my phone for **only** TopHat during class, not texting or using my phone for other reasons.*

| Chemistry 104 (Section 002) Spring 2018 - Dr. Zelewski | | | | |
|---|---|---|---|---|
| **Week** | | **Topic** | **Quiz** | **Lab** |
| 1 | 22-Jan | W Module 0: Course Intro, Module 1: Fundamental Organic Chem | NO QUIZ | NO LAB |
| | | F Module 1: Fundamental Organic Chemistry (Chapter 10) | | |
| 2 | 29-Jan | M Module 1: Fundamental Organic Chemistry | Quiz 1 | Molecular Structure |
| | | W Module 1: Fundamental Organic Chemistry | | |
| | | F Module 1: Fundamental Organic, Module 2: Chemical Kinetics | | |
| 3 | 5-Feb | M Module 2: Chemical Kinetics (Chapter 11) | Quiz 2 | Synthesis of Biodiesel |
| | | W Module 2: Chemical Kinetics | | |
| | | F Module 2: Chemical Kinetics | | |
| 4 | 12-Feb | M Module 2: Chemical Kinetics | Quiz 3 | Kinetics 1 |
| | | W Module 2: Chemical Kinetics | | |
| | | F Exam Review | | |
| 5 | 19-Feb | **M Exam 1 (February 19)** | NO QUIZ | NO LAB |
| | | W Module 3: Chemical Equilibrium (Chapter 12) | | |
| | | F Module 3: Chemical Equilibrium | | |
| 6 | 26-Feb | M Module 3: Chemical Equilibrium | Quiz 4 | Kinetics 2 |
| | | W Module 3: Chemical Equilibrium, Module 4: Acids & Bases | | |
| | | F Module 4: Acids and Bases (Chapter 14) | | |
| 7 | 5-Mar | M Module 4: Acids and Bases | Quiz 5 | Chemical Equilibrium & LeChatelier's Principle |
| | | W Module 4: Acids and Bases | | |
| | | F Module 4: Acids and Bases | | |
| 8 | 12-Mar | M Module 4: Acids and Bases, Exam Review | NO QUIZ | NO LAB |
| | | **W Exam 2 (March 14)** | | |
| | | F Module 5: Aqueous Equilibria (Chapter 15) | | |
| 9 | 19-Mar | M Module 5: Aqueous Equilibria | Quiz 6 | Esters and Amides |
| | | W Module 5: Aqueous Equilibria | | |
| | | F Module 5: Aqueous Equilibria | | |
| | 26-Mar | *Spring Break -- No Classes* | | |
| 10 | 2-Apr | M Module 5: Aqueous Equilibria | Quiz 7 | Acid and Base Solutions |
| | | W Module 5: Aqueous Equilibria | | |
| | | F Module 6: Thermodynamics (Chapter 16) | | |
| 11 | 9-Apr | M Module 6: Thermodynamics | Quiz 8 | Titrations |
| | | W Module 6: Thermodynamics | | |
| | | F Module 6: Thermodynamics | | |
| 12 | 16-Apr | M Module 6: Thermodynamics, Exam Review | NO QUIZ | NO LAB |
| | | **W Exam 3 (April 18)** | | |
| | | F Module 7: Electrochemistry (Chapter 17) | | |
| 13 | 23-Apr | M Module 7: Electrochemistry | Quiz 9 | Chemical Equilibrium & Thermodynamics |
| | | W Module 7: Electrochemistry | | |
| | | F Module 7: Electrochemistry | | |
| 14 | 30-Apr | M Module 8: | Quiz 10 | Electrochemical Cells |
| | | W Module 8: | | |
| | | F Module 8: | | |
| | | **FINAL EXAM Sunday, May 6, 10:05am - 12:05pm** | | |