

# Course Syllabus

## Chemistry 31A, Summer 2023: Chemical Principles I: Structure & Energetics

Dr. Nathaniel Brown

### Course Overview:

The science of chemistry evolves through a process of observation, hypothesis, modeling, and experimentation. This course is structured to develop your skills to participate in this process while building your understanding of how chemical phenomena shape our world. Content assumes no background in college level chemistry.

### Course Objectives:

- *Develop your ability to analyze and solve chemical problems through improved critical thinking.*
- *Improve your ability to use conceptual models to qualitatively explain a wide range of chemical phenomena and to make quantitative estimations.*
- *Deepen your understanding of atomic and molecular structure: Identify the interactions among nuclei, electrons, atoms, and molecules, and how they determine the structures and properties of pure substances and mixtures.*
- *Deepen your understanding of energetics: Determine the types and amounts of energy change accompanying reactions and phase changes*
- *Be prepared for the study of chemical dynamics in Chem 31B: Chemical Principles II.*

### General Information

**Instructor:** Dr. Nathaniel Brown

**Email:** nbrown17@stanford.edu

**OH:** Tues, 11:30am – 12:30 pm (STLC 212D)

**Lecture TA:** Laura Leibfried

**Email:** lleibfri@stanford.edu

**OH:** Mon-Wed: 2:30-3:0 pm  
Thurs: 11:30 am – 12:30 pm  
See Calendar for Locations

**NOTE: for all general, administrative, or accommodations related course questions please contact the Lecture TA.**

**Lab TAs:**

Laura Weiler:

*lweiler@stanford.edu*

Max Moncada Cohen

*moncadac@stanford.edu*

**Important Dates** (<https://summer.stanford.edu/admissions/dates-and-deadlines>):

- First Day of Class: Monday, June 26
- Preliminary Study List Deadline: Monday, June 26, 5 pm (**and deadline to enroll in Chem31A**)
- **Midterm 1:** Monday, July 3, 9:30-10:20 am
- Final Study List deadline (last day to drop classes): Friday, July 7, 5 pm
- **Midterm 2:** Thursday, July 13, 9:30-10:20 am
- Course Withdrawal/Change of Grading Basis deadline: Friday, July 14 (for 1/2-term courses)
- **Final Exam:** Thursday, July 20, 9:30-11:20 am (last day of Chem31A)

**Attendance and Course Pace:** We have intentionally crafted a course structure that builds in many opportunities to interact with the material and turn things in online. There is flexibility in grading to account for missing a lecture or lab or missing a homework deadline. **HOWEVER**, the summer quarter moves **extremely** quickly. Labs are every Monday and Wednesday, and we will have a quiz or exam every Tuesday and Thursday. Missing one lecture during the summer is equivalent to missing nearly a week's worth of material in a normal 10-week quarter.

***For this reason we do not accept new enrollments after the first lab on June 26, 2023.***

If you end up missing lecture and/or lab, please let the Lecture TA known and make sure you are attending office hours to ensure you are staying abreast of the material. If you know you will be missing multiple days of class during the course, this may not be the right quarter for you. Please reach out to Dr. Brown if you have questions about the schedule.

## Required Items

- Text:** Tro, "Principles of Chemistry: A Molecular Approach" 4<sup>th</sup> Edition (etext is fine)
- Problem Set:** All Chem 31A students must have a valid license\* for the web-based
- Software** "**Mastering Chemistry**" program (based on our Tro textbook). **You can access (and purchase) Mastering Chemistry & etext through Canvas.**

\*You may purchase the required access code for MasteringChemistry as part of a package with an electronic version of the textbook (for Mastering Chemistry and the e-book together) **through Canvas**. You may also purchase an access code bundled with your textbook in the bookstore. See the FAQs and instructions to register for the Mastering Course – **only apply your access code through the Canvas link. Mastering Chemistry is also required for Chem31B. An 18-week license will be enough to make it through both 31A and 31B in summer 2023, but if you plan on taking 31B during the academic year make sure to purchase a 24-month license.**

**Poll Everywhere:** All Chem 31A students must register for a FREE Poll Everywhere account and log in during lecture to answer in-class questions drawn from assigned readings. Questions provide immediate feedback as to your understanding of the current material. **Register on Poll Everywhere by Monday 6/26** by going to Stanford's Poll Everywhere page and click on "Access your free Stanford Poll Everywhere account". Make sure your Wifi device is enabled on the Stanford network before class ( [Wireless Network and Services | University IT \(stanford.edu\)](#))

**Gradescope:** All exams and pre-labs are returned *via* Gradescope. Before the first day of class you will receive an invitation to Gradescope – sign into gradescope with your Stanford email credentials and you will be able to access the Chem31A Summer 2023

## Course Structure

**Lectures:** Lectures are held **daily from Monday-Thursday each week from 9:30-11:20 am in STLC 111** (no lecture on July 4). Lecture attendance is compulsory. Readings assigned for each lecture are expected to be completed **before** that associated lecture.

Students who miss lecture due to illness should reach out to the Lecture TA as soon as possible, and make sure they attend office hours when they are recovered in order to make sure they are able to stay in touch with the pace of the course. If you know you will miss a lab or exam due to illness, please reach out to the Lecture TA IMMEDIATELY to discuss your options. Given the pace of the course and the need to provide timely feedback to students, makeup exams are rarely offered and require special circumstances. Makeup labs are not available.

**Office hours** Office hours (**OH**) are designated times available to further clarify lecture concepts or assist students in developing an approach towards tackling chemistry problems. Students are highly encouraged to rework misunderstood problems from returned exams and Mastering Chemistry and bring them to office hours.

**Labs:** **In addition to lecture, you must enroll in one lab section on Axxess by Monday, June 26th.** Lab provides hands-on, guided-inquiry experiments to build your conceptual understanding and problem-solving skills with group learning. Attend **ONLY** the lab time for which you signed up on Axxess. Due to lab availability and logistics, we cannot hold make-up labs, and additional sections other than those currently open on Axxess will only be opened if enrollment requires it. **Lab Sections 2 & 3: Every Monday and Wednesday, 12:30-2:20 pm**

**Personal Protective Equipment** Students entering the Sapp teaching laboratories must wear appropriate **Personal Protective Equipment (PPE)**, which includes department-specific laboratory safety glasses and laboratory coat, a face mask, and appropriate street clothes (**PPE**), which includes long pants, socks, and solid shoes that cover your entire foot. See PPE Guidelines and announcements on Canvas for more details. **Students must always wear their safety glasses/goggles and lab coat during the entire lab section.**

**\*\*PPE will be provided to all students before the first lab on Monday, June 26<sup>th</sup>\*\***

**Course Web Site:** <https://canvas.stanford.edu/courses/175771>

The Chem 31A Canvas website contains all course materials, course announcements, and your scores on graded work. This is also where you will access “Mastering Chemistry” to complete and turn in problem sets (PLPs) for the course. “Mastering Chemistry” registration instructions can be found in the “Files” section of the canvas site in the “General Course Information” folder.

**\*\*All course communication will occur through the Chem 31A Canvas website.\*\***

**Assignments and Graded Work: All due dates can be found on the course calendar and Canvas Calendar.**

**Graded Work** The grading scheme for Chem 31A is designed to reward students who engage actively with the course. There are many opportunities to earn credit. This course is graded on a 1000-point basis in 4 components: Quizzes and Course Engagement (max 120 pts.), Labs (max 120 pts.), Midterm Exams (360 pts.), and Final Exam (400 pts.). Details of these components are below:

**1. Course Engagement:** Course participation points can be accumulated through **any combination** of poll questions, quizzes, and pre-lecture problems (PLPs) *to a maximum* of 120 pts. Details of course engagement components are below:

- **Lecture Participation: Poll questions: (At least 35 points available)**

In-lecture poll questions will be posed throughout the quarter, related to the assigned reading, Pre-Lecture Problems, labs, and lecture discussion. **Each correct answer is worth 1 point.**

- **Quizzes (10 points each - 50 points available)**

Every Tuesday and Thursday at the beginning of lecture (9:30 am) there will be a closed-book, 10-minute quiz based on material from the previous lectures. On exam days (July 13, July 20) or holidays (July 4) there will be no quiz. Quizzes will be graded for correctness out of 10 points.

- **Pre-Lecture Problems: (3 pts. each; 39 total pts. available)**

The night before each lecture, you must complete your Pre-Lecture Problems (PLP) through the web-based *MasteringChemistry* system by 11:59pm. You are allowed and encouraged to work on the problems with others, but you must compose your final answers to each problem set on your own. Late assignments will receive partial credit (no matter how late) as long as they are submitted prior to the last Wednesday of the course (July 19). No additional work will be scored after this point. Note: all PLPs will be scaled to out of 3 points at the end of the quarter.

**2. Labs:** Each week there will be 2 labs that will engage with the material discussed in lecture through prelab assignments, attendance and participation, and post-lab questions. You can count a *maximum* of 120 points. There are a total of 144 points available, allowing flexibility for missed assignments or attendance.

**If you are ill or will be missing lab for any reason, please email the Lecture TA BEFORE the start of lab.**

**Prelab: (6 pts. each; 48 pts available):**

Before each lab, students are expected to read the pre-lab assignment and answer any questions posed. Pre-labs must be submitted to Gradescope by 12:30 pm the day of lab. You may also bring a completed hard copy to lab.

**\*\*You must have a completed pre-lab to lab in order to attend lab\*\***

**Lab Participation and Safety Adherence: (6 pts. each; 48 pts available):**

Because Labs are based on participation in groups and will begin with important safety information, it is critical to arrive on time. Students who are more than 10 minutes late will forfeit their participation points, as will students who are dismissed from lab for not adhering to safety policies or failing to help clean up after the experiment. **If you arrive at lab after the safety presentation has been delivered you may not attend lab that day.**

**Post-Lab: (6 pts. each; 48 pts available):**

At the end of each lab, students will be expected to turn in their post-lab assignment, verifying proper clean-up protocols have been followed and summarizing the main ideas or skills learned in the lab.

**3. Midterm exams** (Total of 360 pts.): There are two 50-minute midterm exams (180 pts. each) held at the beginning of class (9:30 am) on **Monday, July 3**, and **Thursday, July 13**. We will start immediately at 9:30 am and continue class once the exam is finished (following a short break).

**4. Final exam** (Total of 400 pts.): **A cumulative final exam will be held on the last day of class (Thursday, July 20) from 9:30 am – 11:20 am** and will be worth 400 pts. **Make sure that you are available for this time before enrolling.**

**Exam Times:** It is Department of Chemistry policy that exams & quizzes are not given earlier than scheduled.

**Grade:** Your final grade is determined on an absolute scale according to the total number of points you have accumulated for course engagement & labs (max 120pts. each), two midterms (360 pts.) and the final (400 pts.):  
 A/A- ≥ 900pts    B/B+/B- ≥ 750pts    C/C+/C- ≥ 600pts    D/D+/D- ≥ 450pts    CR ≥ 600pts  
 Final cut-offs for +/- scores within each grade bucket will be determined at the end of the quarter.

To be more equitable and ease student stress **we have built in grading flexibility up front** rather than having students request exceptions for temporary illness or other one-off issues (*e.g.* late PLPs, technical issues, late arrival at labs or absences due to travel/illness) in the moment. Our best advice is to be prompt in arriving at lectures, labs, and exams, be prompt in delivering assignments, and to prepare for and participate in labs. Special exceptions that are accommodated include documented disabilities (through OAE), University sanctioned absences and extraordinary life events. Such accommodations should be requested from the Lecture TA **as soon as possible** in advance.

**Return of Work:** All exams are returned via Gradescope the day following the exam. PLPs are automatically graded, and solutions shown on *MasteringChemistry*. As timely feedback and reflection is critical to effective learning, we encourage all students to promptly review their graded work and bring questions to office hours.

**Regrades:** A regrade request clearly explaining what was overlooked in grading should be made on Gradescope no later than 5:00 pm the day following the exam. When an exam is submitted for a regrade, the entire exam will be reevaluated, with the possibility of a net gain or loss of points.  
**Generally, successful regrades require minimal explanation because it should only point out specific pieces in the original work submitted. Additional work or explanation that was not already on the exam cannot be considered.**

**Students with Documented Disabilities** Students who may need an academic accommodation based on the impact of a disability must initiate the request with the Office of Accessible Education (OAE). Professional staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an Accommodation Letter for faculty dated in the current quarter in which the request is being made. Students should contact OAE (<https://oae.stanford.edu/students>) as soon as possible since timely notice is needed to coordinate accommodations. In addition, please inform the Chem31A Lecture TA as soon as possible. At least one week lead time is needed to set-up exam accommodations.

**Names & pronouns** In this classroom, we endeavor to refer to people using their preferred names and personal pronouns. You are invited (not required) to use NameCoach to record the correct pronunciation of your name, as well as add preferred pronouns. A link to NameCoach can be found under the "Student" tab on Axess (<https://registrar.stanford.edu/staff/student-services-administrators/name-coach>).

## CHEM 31A Summer 2023 Course Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday
<p>June. 25</p>	<p><b>26 – Classes Start - PLP 1 Due [11:59PM]</b></p> <ul style="list-style-type: none"> <li>● <b>Lecture 1</b> <ul style="list-style-type: none"> <li>- Problem Solving in Chemistry</li> <li>- Atomic Theory Conservation of Mass</li> </ul> </li> </ul> <p><u>Reading Due:</u></p> <ul style="list-style-type: none"> <li>● Chapter 1; Chapter 2.1 – 2.7</li> </ul> <p><u>Lab 1: 12:30 – 2:20 pm (Pre-Lab 1 Due)</u> Safety, Problem Solving and Study Tool Kit</p> <ul style="list-style-type: none"> <li>● Laura L OH: <ul style="list-style-type: none"> <li>- 2:30 - 3:30 pm (STLC 118)</li> </ul> </li> </ul>	<p><b>27 - Quiz #1 - PLP 2 Due [11:59PM]</b></p> <ul style="list-style-type: none"> <li>● <b>Lecture 2</b> <ul style="list-style-type: none"> <li>- Mole and Formula Mass</li> <li>- Reactions and Stoichiometry</li> </ul> </li> </ul> <p><u>Reading Due:</u></p> <ul style="list-style-type: none"> <li>● Chapter 2.8 – 3.7; Chapter 3.8 – 3.10</li> </ul> <ul style="list-style-type: none"> <li>● Dr. Brown OH: <ul style="list-style-type: none"> <li>- 11:30 am- 12:30 pm (STLC 212D)</li> </ul> </li> <li>● Laura L OH: <ul style="list-style-type: none"> <li>- 2:30 - 3:30 pm (STLC 118)</li> </ul> </li> </ul>	<p><b>28 - PLP 3 Due [11:59PM]</b></p> <ul style="list-style-type: none"> <li>● <b>Lecture 3</b> <ul style="list-style-type: none"> <li>- Limiting Reagent</li> <li>- Solution Stoichiometry/Stoich. Practice</li> </ul> </li> </ul> <p><u>Reading Due:</u></p> <ul style="list-style-type: none"> <li>● Chapter 4.1 – 4.4; Chapter 5.1 – 5.6</li> </ul> <p><u>Lab 2: 12:30 – 2:20 pm (Pre-Lab 2 Due)</u> Stoichiometry Lab</p> <ul style="list-style-type: none"> <li>● Laura L OH: <ul style="list-style-type: none"> <li>- 2:30 - 3:30 pm (STLC 114)</li> </ul> </li> </ul>	<p><b>29 - Quiz #2</b></p> <ul style="list-style-type: none"> <li>● <b>Lecture 4</b> <ul style="list-style-type: none"> <li>- Ideal Gas Law</li> <li>- Partial Pressures and Stoich. of Gases</li> </ul> </li> </ul> <p><u>Reading Due:</u></p> <ul style="list-style-type: none"> <li>● Chap 6.1 – 6.7; Chapter 6.6 – 6.7</li> </ul> <ul style="list-style-type: none"> <li>● Laura L OH: <ul style="list-style-type: none"> <li>- 11:30 am- 12:30 pm (STLC111)</li> </ul> </li> </ul>
<p>July 2</p> <p>PLP 4 Due [11:59PM]</p>	<p><b>3 – Week 2 - No PLP due tonight (due 7/4)</b></p> <ul style="list-style-type: none"> <li>● <b>Midterm Exam #1 9:30-10:20 am</b></li> <li>● <b>Lecture 5 – 10:30 am-11:20 am</b> <ul style="list-style-type: none"> <li>- Kinetic Molecular Theory (KMT) and Temperature</li> </ul> </li> </ul> <p><u>Reading Due</u></p> <ul style="list-style-type: none"> <li>● Chapter 6.8 – 6.10</li> </ul> <p><u>Lab 3: 12:30 – 2:20 pm (Pre-Lab 3 due)</u> Behavior of Gases</p> <ul style="list-style-type: none"> <li>● Laura L OH: <ul style="list-style-type: none"> <li>- 2:30 - 3:30 pm (Chem Gazebo)</li> </ul> </li> </ul>	<p><b>July 4 – No Class/OH - PLP 5 Due [11:59PM]</b></p>	<p><b>5 – PLP 6 Due [11:59PM]</b></p> <ul style="list-style-type: none"> <li>● <b>Lecture 6</b> <ul style="list-style-type: none"> <li>- First Law of Thermodynamics</li> <li>- Energy and Enthalpies of Reactions</li> </ul> </li> </ul> <p><u>Reading Due</u></p> <ul style="list-style-type: none"> <li>● Chapter 7.1-7.5</li> </ul> <p><u>Lab 4: 12:30 – 2:20 pm (Pre-Lab 4 due)</u> Kinetic Molecular Theory</p> <ul style="list-style-type: none"> <li>● Laura L OH: <ul style="list-style-type: none"> <li>- 2:30 - 3:30 pm (STLC 114)</li> </ul> </li> </ul>	<p><b>6 - Quiz #3</b></p> <ul style="list-style-type: none"> <li>● <b>Lecture 7</b> <ul style="list-style-type: none"> <li>- Calorimetry</li> <li>- Hess' Law, Heats of reaction</li> </ul> </li> </ul> <p><u>Reading Due</u></p> <ul style="list-style-type: none"> <li>● Chapter 7.6-7.10</li> </ul> <ul style="list-style-type: none"> <li>● Laura L OH: <ul style="list-style-type: none"> <li>- 11:30 am- 12:30 pm (STLC 111)</li> </ul> </li> </ul>
<p>Jul. 9</p> <p>PLP 7 Due [11:59PM]</p>	<p><b>10 – Week 3 - PLP 8 Due [11:59PM]</b></p> <ul style="list-style-type: none"> <li>● <b>Lecture 8:</b> <ul style="list-style-type: none"> <li>- Light and Spectroscopy</li> <li>- The oddity of electrons</li> </ul> </li> </ul> <p><u>Reading Due</u></p> <ul style="list-style-type: none"> <li>● Chapter 8.1 –8.6</li> </ul> <p><u>Lab 5: 12:30 – 2:20 pm (Pre-Lab 5 due)</u> Calorimetry</p> <ul style="list-style-type: none"> <li>● Laura L OH: <ul style="list-style-type: none"> <li>- 2:30 - 3:30 pm (Chem Gazebo)</li> </ul> </li> </ul>	<p><b>11 – Quiz #4 - PLP 9 Due [11:59PM]</b></p> <ul style="list-style-type: none"> <li>● <b>Lecture 9:</b> <ul style="list-style-type: none"> <li>- Electronic Configurations</li> <li>- Trends in atomic and ionic properties</li> </ul> </li> </ul> <p><u>Reading Due</u></p> <ul style="list-style-type: none"> <li>● Chapter 9.1 – 9.8</li> </ul> <ul style="list-style-type: none"> <li>● Dr. Brown OH: <ul style="list-style-type: none"> <li>- 11:30 am- 12:30 pm (STLC 212D)</li> </ul> </li> <li>● Laura L OH: <ul style="list-style-type: none"> <li>- 2:30 - 3:30 pm (STLC 118)</li> </ul> </li> </ul>	<p><b>12 - PLP 10 Due [11:59PM]</b></p> <ul style="list-style-type: none"> <li>● <b>Lecture 10:</b> <ul style="list-style-type: none"> <li>- Types of Chemical Bonds</li> <li>- Covalent Bonds and Lewis Structures</li> </ul> </li> </ul> <p><u>Reading Due</u></p> <ul style="list-style-type: none"> <li>● Chapter 10.1 – 10.8</li> </ul> <p><u>Lab 6: 12:30 – 2:20 pm (Pre-Lab 6 due)</u> Spectroscopy</p> <ul style="list-style-type: none"> <li>● Laura L OH: <ul style="list-style-type: none"> <li>- 2:30 - 3:30 pm (STLC 114)</li> </ul> </li> </ul>	<p><b>13</b></p> <ul style="list-style-type: none"> <li>● <b>Midterm Exam #2 9:30-10:20 am</b></li> <li>● <b>Lecture 11:</b> <ul style="list-style-type: none"> <li>- Resonance</li> </ul> </li> </ul> <p><u>Reading Due</u></p> <ul style="list-style-type: none"> <li>● Chapter 10.9-10.11</li> </ul> <ul style="list-style-type: none"> <li>● Laura L OH: <ul style="list-style-type: none"> <li>- 11:30 am- 12:30 pm (STLC 111)</li> </ul> </li> </ul>
<p>Jul. 16</p> <p>PLP 11 Due [11:59PM]</p>	<p><b>17 – Week 4 - PLP 12 Due [11:59PM]</b></p> <ul style="list-style-type: none"> <li>● <b>Lecture 12:</b> <ul style="list-style-type: none"> <li>- Predicting Molecular Shapes</li> <li>- Molecular Shape, polarity, hybridization</li> </ul> </li> </ul> <p><u>Reading Due</u></p> <ul style="list-style-type: none"> <li>● Chapter. 11.1 – 11.7</li> </ul> <p><u>Lab 7: 12:30 – 2:20 pm (Pre-Lab 7 due)</u> Periodic Trends and Bonding</p> <ul style="list-style-type: none"> <li>● Laura L OH: <ul style="list-style-type: none"> <li>- 2:30 - 3:30 pm (STLC 118)</li> </ul> </li> </ul>	<p><b>18 – Quiz #5 - PLP 13 Due [11:59PM]</b></p> <ul style="list-style-type: none"> <li>● <b>Lecture 13:</b> <ul style="list-style-type: none"> <li>- MO Theory</li> <li>- Intermolecular Forces</li> </ul> </li> </ul> <p><u>Reading Due</u></p> <ul style="list-style-type: none"> <li>● Chapter 11.8; Chapter. 12.1 – 12.4</li> </ul> <ul style="list-style-type: none"> <li>● Dr. Brown OH: <ul style="list-style-type: none"> <li>- 11:30 am- 12:30 pm (STLC 212D)</li> </ul> </li> <li>● Laura L OH: <ul style="list-style-type: none"> <li>- 2:30 - 3:30 pm (STLC 118)</li> </ul> </li> </ul>	<p><b>19 - All late PLPs due before 5 pm</b></p> <ul style="list-style-type: none"> <li>● <b>Lecture 14:</b> <ul style="list-style-type: none"> <li>- Vapor Pressure</li> <li>- Phase Diagrams</li> </ul> </li> </ul> <p><u>Reading Due:</u></p> <ul style="list-style-type: none"> <li>● Ch. 12.5 – 12.9</li> </ul> <p><u>Lab 8: 12:30 – 2:20 pm (Pre-Lab 8 Due)</u> Heats of crystallization</p> <ul style="list-style-type: none"> <li>● Laura L OH: <ul style="list-style-type: none"> <li>- 2:30 - 3:30 pm (STLC 114)</li> </ul> </li> </ul>	<p><b>20 – Last Day of Class</b></p> <ul style="list-style-type: none"> <li>● <b>Final Exam: 9:30-11:20 am</b></li> </ul>