

CHEM 139A
Chemical Problem Solving I: Learning to Think Like a Scientist
Summer Session II 2020 (5 units)

MW 1:00 – 4:30 pm

07/27/20 - 08/28/20

Instructor: **Alex Ayzner**
aayzner@ucsc.edu

TA: **Anna Johnston**
ajohnst3@ucsc.edu

Grading

Problem Sets	40%
Quizzes	10%
Midterm	25%
Final	25%

Exams:

Midterm: TBD

Final: TBD

Course Goals

On your path to becoming a scientist, you must become proficient at approaching and ultimately solving diverse scientific problems. Doing so is not only critical to the success in the classroom, but it is also of utmost importance for professional success beyond the university. The overarching goal of this course is to systematically learn the skills and techniques needed to substantially improve your problem-solving abilities in an active, highly interactive environment. On the path to becoming an expert problem-solver, the course will lead you to acquire proficiency in the following areas:

- problem restatement in a form favorable to the search for solutions;
- construction of diagrams that assist the search for solutions;
- hierarchical knowledge organization and concept mapping;

- utilizing divergent and convergent critical thinking;
- working together: teamwork and community building.

The purpose of our class differs from a regular class, where a specific knowledge domain usually takes center stage. Instead, we will be concerned with building broad skills that transcend any specific chemistry area. That said, the specific *vehicle* with which we will use to learn problem-solving techniques and strategies can be called Chemistry and Light. Using this topical vehicle, we will discuss concepts like energy, intermolecular forces, macromolecular structure and temporal change. These concepts are central to almost all chemical subdisciplines. Our pedagogical approach will be directly based on pioneering problem-solving research in cognitive science and science education.

Engaging with the Course

To accomplish what we have set out to do over 5 weeks, our class will have to be action-packed. We will meet 2 times per week for 3.5 hours each. During this unprecedented time, all instruction will have to be remote. However, our times together will still be very interactive! During our regular class meeting times, we will get together via Zoom. Please use this link to learn about working with Zoom and much more: <https://keeplearning.ucsc.edu/>. During our meetings, I will make relatively short presentations at the beginning, but the bulk of in-class work will be done in a collaborative group setting. We will think critically, form arguments and learn together as we strive towards problem-solving proficiency. On most days before our class meets, you will be required to watch videos to prepare for our meetings. These videos will be filmed in my low-tech garage studio and posted to my YouTube channel, which can be found here: https://www.youtube.com/channel/UCFYkJNey151965q8aVjWN-w?view_as=subscriber

You will also have two weekly 1-hour discussion sections led by the TA. Both the TA and I will have weekly office hours. I expect that you will spend > 20 hours per week (on average > 3 hours per day) outside of our scheduled meetings to work on problem sets, read course materials, practice the techniques that you will learn in this course, and prepare for exams.

This course is hosted on Canvas, our learning management software. You do not need to sign up for an account; simply login with your CruzID and Gold Password at canvas.ucsc.edu. See Canvas Getting Started Student Guide.

Approximate Course Trajectory

<u>Week</u>	<u>Problem-Solving Topic</u>	<u>Knowledge Domain</u>
Week 1	Organizing knowledge. Importance of qualitative and quantitative reasoning. Constructing helpful diagrams.	Light as a wave. Light as a particle. Introduction to light absorption.

Week 2	Systematic decision-making in problem-solving. Building a problem-solving strategy. Dynamically updating the knowledge hierarchy.	Light absorption and probability. Elementary kinetics. Light emission.
Week 3	Working with the knowledge hierarchy in complex problems. Introduction to the divide-and-conquer approach.	Molecular structure. Macromolecular structure. Intermolecular forces and potential energy.
Week 4	Mathy derivation problems and multistep logic chains. More complex divide-and-conquer applications.	Probability waves and quantum weirdness.
Week 5	Towards expert problem-solving. Constructing knowledge clusters. Achieving problem-solving efficiency.	Molecules and the “dark reactions” of photosynthesis.

Please note: The precise trajectory is likely to change, though the core features likely will not.

Course Materials

Because of the nontraditional nature of our class, there is no standard textbook that exists for the material that we will cover at the level appropriate to this course. Learning materials will primarily comprise YouTube recordings, videos, articles, handouts, problems and abridged clusters of information that we will share with you.

Problem Sets

You will receive a weekly problem set to directly practice the ideas we learn in class. It is extremely important that you do your best to earnestly attempt the problem set. You will be asked not to simply attempt a solution but to also *carefully explain your reasoning about how arrived at your ultimate approach*. The goal is for you to ultimately reap class and professional benefits from being skilled at problem-solving. You will not get there unless you put your best foot forward and challenge yourself by doing the problems. We stand ready to assist you with all of your roadblocks, so long as you put forth a real, good-faith effort! Know that in so doing, you will be setting yourself up to build a foundation of scientific critical-thinking skills.

Please do not wait until the last minute to attempt problems. I expect you to think hard, actively seek out help and to collaborate with your classmates. Collaboration, however, is very different from copying someone else’s work. I expect that throughout the course you will keep yourself honest and try to critically evaluate whether your effort corresponds to your best shot.

Format of Midterm and Final Exam

On both exams, you will be faced with a few chemical problems. You will be tasked with not only solving them but also explicitly demonstrating command of the techniques that we will work on together in class Zoom meetings. In fact, grading emphasis will be placed *on your approach to solution and your reasoning!* I will be looking to see the written details of your method and solution.

Important Summer Session Remote 2020 Deadlines

Session 1:

Drop: Monday, June 29

Request for “W”: Friday, July 10

Session 2:

Drop: Monday, August 3

Request for “W”: Friday, August 14

8-Week:

Drop: Monday, July 6

Request for “W”: Friday, July 24

10-Week:

Drop: Monday, July 6

Request for “W”: Friday, July 24

Summer is unique. **You will not be dropped for non-attendance or non-payment.** You must drop yourself. Dropping before the deadline results in a full-tuition reversal/refund. Withdraw posts a W for the grade and full tuition is charged (no refund).

For all dates and deadlines, including ‘change of grade option’ (P/NP) and grades due, here is the summer academic calendar: <https://summer.ucsc.edu/studentlife/index.html>

For questions about dropping, requesting a W grade for a course, or withdrawing from the summer quarter, email summer@ucsc.edu.

Small Group Tutoring

Small Group Tutoring (SGT) supports students academically to advance educational equity by designing inclusive learning environments outside of the classroom. In SGT, you can expect the

Tutor to facilitate cooperative group activities designed to have students work together on the course content and develop study skills for the course. SGT is offered at least three times each week for the entire quarter. The Tutor is an undergraduate student who took the class, did well, and is trained to facilitate group sessions to focus on students' needs to succeed in the course. SGT is open to all students enrolled in the class and they must sign up on our online system: TutorTrac. When students sign up for SGT, they are committing to attend every week. For Summer 2020, students can begin signing up for tutoring on **Monday, June 22rd** and tutoring will begin **Wednesday, June 24th**. Students only have to sign up once for tutoring and their appointments will repeat weekly. Sign-ups will close on **Friday, August 14th** for all Summer Session Sign-Ups. This means that after **August 14th**, no new students can sign up for tutoring.

Want SGT to be successful for you? Bring your books, lecture notes, questions, and be open to working collaboratively with your peers. You can sign up using this link: <https://ucsc.go-redrock.com/tracweb40/NoAccess.4sp?errText=insufficient%20credentials%20to%20view%20content>

You can also find the link on our website: <https://lss.ucsc.edu/index.html>

Academic Integrity

Academic integrity is the cornerstone of a university education. Academic dishonesty diminishes the university as an institution and all members of the university community. It tarnishes the value of a UCSC degree. All members of the UCSC community have an explicit responsibility to foster an environment of trust, honesty, fairness, respect, and responsibility. All members of the university community are expected to present as their original work only that which is truly their own. All members of the community are expected to report observed instances of cheating, plagiarism, and other forms of academic dishonesty in order to ensure that the integrity of scholarship is valued and preserved at UCSC.

In the event a student is found in violation of the UCSC Academic Integrity policy, he or she may face both academic sanctions imposed by the instructor of record and disciplinary sanctions imposed either by the provost of his or her college or the Academic Tribunal convened to hear the case. Violations of the Academic Integrity policy can result in dismissal from the university and a permanent notation on a student's transcript.

For the full policy and disciplinary procedures on academic dishonesty, students and instructors should refer to the [Academic Integrity page](#) at the Division of Undergraduate Education.

DRC

UC Santa Cruz is committed to creating an academic environment that supports its diverse student body. If you are a student with a disability who requires accommodations to achieve

equal access in this course, please submit your Accommodation Authorization Letter from the Disability Resource Center (DRC) to me privately during my office hours or by appointment, as soon as possible in the academic quarter, preferably within 1 week. I also encourage you to discuss with me ways we can ensure your full participation in this course. I encourage all students who may benefit to learn about the DRC and the UCSC accommodation process. You can visit the DRC website at drc.ucsc.edu. You can make an appointment and meet in-person with a DRC staff member. The phone number is 831-459-2089, or email drc@ucsc.edu.

CARE

UCSC Campus Advocacy, Resources & Education (CARE) believes that all people deserve to live and engage in an environment free from violence. We believe in promoting an environment where people can learn and work while being safe and healthy. We celebrate the differences on this campus and believe in working collectively to create a community that is free from violence, exploitation, and harassment and instead promotes safety and equity. For an appointment, call 831-502-2273 or email care@ucsc.edu.

TITLE IX

The university cherishes the free and open exchange of ideas and enlargement of knowledge. To maintain this freedom and openness requires objectivity, mutual trust, and confidence; it requires the absence of coercion, intimidation, or exploitation. The principal responsibility for maintaining these conditions must rest upon those members of the university community who exercise most authority and leadership: faculty, managers, and supervisors.

The university has therefore instituted a number of measures designed to protect its community from sex discrimination, sexual harassment, sexual violence, and other related prohibited conduct. [Information about the Title IX Office](#), the [online reporting link](#), applicable campus resources, reporting responsibilities, the [UC Policy on Sexual Violence and Sexual Harassment](#), and the UC Santa Cruz Procedures for Reporting and Responding to Reports of Sexual Violence and Sexual Harassment can be found at titleix.ucsc.edu.

The Title IX Office is actively responding to reports and requests for consultation. If you are not currently working with someone in the office and want to make a report/request a consult, you can expect the fastest response by using our [online reporting link](#).

For more information please visit the [Title IX Operations under Covid-19](#) page.

Chemistry Department Statement Regarding Diversity and Inclusion

As a community, we acknowledge the richness of commonalities and differences we share, the intrinsic worth of all who work and study here, and that physics education is enhanced by investigation of and reflection upon multiple perspectives. We also aspire to create respect for and appreciation of all persons as a key characteristic of our campus community and to achieve an environment that welcomes and supports diversity as well as ensuring full educational opportunities for all who teach and learn here. This work is essential to furthering the widely shared purposes of maintaining our premier status, noted for its excellence, richness and vibrancy. We are thus deeply committed to ensuring the continued diversity of our campus and will do whatever we can, legally and appropriately, to preserve and expand the diverse nature of our community.