



Chem 1211

Honors General Chemistry I

Fall 2021

Instructor: Prof. Ryan P. Steele
Office: Thatcher 4611
Phone: 801-587-3800
Email: ryan.steele@utah.edu or via Canvas
Office Hr:
Tues 11:50-1:00pm (in person)
Note: Due to COVID considerations, this office hour will tentatively be held in CSC 206.
Wed 4:00-5:00pm (on Zoom)
or by appointment

Teaching Assistants: TBD
Office hrs will be announced during 1st week

Course: Lecture: M/T/Th 9:40-10:30am CSC 205
Discussion: W/F 9:40-10:30am CSC 205
Website on Canvas (Campus CIS, <https://gate.acs.utah.edu>)

Textbook: *Chemistry: Structure and Properties* (Tro, 2nd ed.)
Note: This text also contains the material for General Chemistry II, and we have coordinated the two Honors courses so that you only need to purchase one textbook.

Also useful...

Top Hat General Chemistry modules (Ow)

Chemistry: An Atoms First Approach (Zumdahl & Zumdahl)

Objectives: Chemistry is a “bottom-up” discipline, in which we posit that what happens at the molecular level dictates macroscopic properties. The objective of this course, therefore, is to deeply solidify fundamental, atomic- and molecular-level chemical principles, while also surveying a breadth of modern chemical applications.

Outcomes include:

- developing molecular-level critical thinking skills
- solving quantitative-reasoning problems
- knowing the time, length, and energy scales on which chemical processes occur
- understanding the meaning of measurements and types of error
- connecting atomic/molecular properties and macroscopic observables
- explaining and predicting trends in atomic properties and chemical bonding
- explaining and predicting molecular bonding and structure
- connecting common approximation methods, such as molecular orbital theory, to standard chemical conceptual frameworks
- connecting molecular properties to the behavior of collections of molecules, such as gases, liquids, and solids
- formulating a framework for explaining chemical dynamics, kinetics, and thermodynamics
- connecting fundamental chemical principles to modern chemistry applications
- speaking and writing the language of chemistry

- Grades:** 20% Homework
10% In-class activities & quizzes
5% Mini-lesson taught by you (in discussion section)
5% Seminar attendance
10% Mid-term exam #1
10% Mid-term exam #2
10% Mid-term exam #3
10% Mid-term exam #4
20% Final exam
+5% Bonus: Class safety
- Homework:** Homework assignments will be given weekly and are **due at the start of class every Thursday**. The homework will be collected as lecture begins. Late homework will receive a progressively more significant penalty as the semester progresses. Any homework submitted after the answer key has been posted will not be accepted. Detailed keys will be posted on the course website, and graded homework will be returned to you by the following Wednesday.
- Exams:** The majority of your grade in this course will be determined by examinations. The four mid-terms will be in-class exams, which will vary in format. No make-up exams will be administered. Simply put, do not miss an exam. If you have an unavoidable academic conflict—defined as a university-sponsored activity (club sports do not count)—please provide notice at least two weeks prior to the exam date. A justification letter from the organization’s head, on official University letterhead, is required. These conflicts will be evaluated on a case-by-case basis. The final exam date/time is set by the University, and no exceptions will be made.
- Lesson:** On an almost-weekly schedule, groups of 4-6 students will together present a 15-minute mini-lesson in discussion section. The topic, schedule, and grading will be provided on the course website. The format of the lesson should be similar to what you would teach in a course of your own. It should be live (no video recordings of the presentation) but can be a “chalk talk”, PowerPoint, or some combination of the two. Demonstrations and/or class participation are allowed and encouraged. The 15-minute time limit, however, will be strictly enforced. The material covered in these lessons *is* fair game for exams. Please be courteous to your colleagues and arrive on time for these presentations.
- Seminar:** A portion of your total grade will be based on attendance at two research seminars in the chemistry department throughout the semester. These seminars occur weekly in TBBC 4630, although they will likely be almost all online this semester. One of these seminars must be from the physical chemistry division (Mondays at 4pm), and the other may be from any division of chemistry. You may choose any two to attend, but I will occasionally direct you toward particularly relevant and accessible topics. The schedule for these seminars may be found on the [chemistry department webpage](#). A short form will be provided at the seminar; this form must be filled out during the seminar and handed to your professor or TA at the end of the seminar. *Since these seminars occur beyond our scheduled class time, please let me know *in the first week of class* if you have unavoidable scheduling conflicts.
- Attendance:** This class meets five days per week (three lectures, two discussions). Your attendance is required at all class meetings. Detailed attendance records will not always be kept; however, quizzes, “clicker questions,” and in-class participation records may be kept and will contribute to your grade. My attendance philosophy: Your job is to be present and participate; my job is to make it worth your while to attend.

Disabilities: “The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.” *Please notify me of any requested accommodations within the first week of class.*

Academic

Honesty: Collaborating with fellow members of this course is strongly encouraged and will be an essential tool in your progress. All assignments should, however, be completed by you. Furthermore, any form of cheating on exams will not be tolerated. Penalties for academic dishonesty can include expulsion from the university. Do not end your career for an exam in General Chemistry! Please refer to the University regulations for more information. (<http://www.regulations.utah.edu/academics/6-400.html>)

Safety: The University of Utah values the safety of all campus community members. To report suspicious activity, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu.

Cell Phones: As a courtesy to me and to your colleagues, please do not use cell phones during class except during active student-response questions. *No cell phones or smart watches are allowed during exams.* If your cell phone rings or is seen during an exam, you will have the option to keep your phone or your exam...not both.

Homework

“Rules”: Each week, two additional points will be given for the homework. One point will be given for legibility; one will be given for following rules 2-5. These points are given at the sole discretion of the grader.

1. Print legibly. We can only grade what we can read. If your handwriting is hopelessly messy, type your homework.
2. Staple your pages together before submitting your homework.
3. Submit the problems in the same order as presented on the assignment. You may, of course, complete them in any order you wish, but please put them in order for your submission.
4. Do not staple over the problem numbers. Be sure to leave room in the corner of your page for your staple.
5. If your pages come from a spiral notebook, please remove the rough edges prior to submission.

About the Course:

General Chemistry is likely the first college chemistry course—and, possibly, the first college science course—in your curriculum, and for this reason, it is exciting! We will cover chemical processes that range from bizarre, laboratory-based phenomena to real-world, everyday occurrences. Most importantly, we will attempt to *explain* these processes at the level of atoms and molecules.

General Chemistry also, historically, has a reputation as a challenging course without the payoff of overwhelmingly new understanding, and some of this reputation is deserved. Rather than presenting this course as a disconnected series of chemistry topics, we will approach the course very systematically, building from the properties of atoms up to molecules and then substances/materials and their reactions. In doing so, we will provide you a conceptual framework on which you can drape the wide array of topics covered. I hope that you all succeed and enjoy the wonderful world of chemistry!

"I would establish the conviction that Chemistry, as an independent science, offers one of the most powerful means toward the attainment of a higher mental cultivation; that the study of Chemistry is profitable, inasmuch as it promotes the material interests of mankind, but also because it furnishes us with insight into those wonders of creation which immediately surround us, and with which our existence, life, and development are most closely connected."

- Justus von Liebig (1859)

About My Expectations:

Chem-Is-Try

My teaching style will require you to participate. This style will be uncomfortable for some of you, and I fully appreciate this fact. However, I would be doing you a disservice by allowing you to merely observe the course. All of your future endeavors will require you to "perform" verbally, and this course is simply part of this training. The classroom environment *will* be friendly and respectful, allowing you to make mistakes without fear of repercussions or embarrassment. Mistakes are an inherent part of learning, and each mistake exposed during class is one that can be corrected before more public situations. Please respect this environment and your colleagues.

This class is a college-level science course, and for many of you, it will be a sudden change in expectations. I expect your effort to match these demands. I expect you to be able to recall material from previous courses and use this information to solve general chemistry problems. I expect you to internalize the material and be able to apply it to problems not covered in homework assignments. Exam questions may be different from the homework, lectures, and your textbook. This design is not intended to trick you or set you up for failure. It is intended to test your ability to *apply* chemical principles to new situations, which is the ultimate aim of this course. We will practice such exercises throughout the semester.

Some tips for success...

- My lectures are for you, not to hear myself talk. Come to class. I will provide information that goes beyond the textbook and will teach you how to think about chemistry problems. (Our department has firm data showing that attendance is the largest determining factor in end-of-semester grades!)
- General chemistry is a team sport. Do homework in groups, seek help from colleagues, and provide help to them when they ask. Teaching can be as much of a learning experience as asking.
- If you need help, get help. I have office hours, your TA is available, and you have many intelligent classmates. Take advantage of these resources.
- Your textbook is very good but is not the only source. If the explanation in the text does not make sense to you, seek out other texts at the library or find internet sources. They're free!
- Finally, the onus is on *you* to succeed in this course. Your success is dictated by your effort and ambition, not your professor, not your TA, not your textbook. I will provide all of the necessary tools for you to succeed; it is up to you to make use of them.

Important Dates:

- 03 Sep (Fri) – Add/Drop deadline
- 13 Sept (Mon) – Exam I
- 08 Oct (Fri) – Exam II
- 04 Nov (Thurs) – Exam III
- 12 Nov (Fri) – Withdraw Deadline
- 29 Nov (Mon) – Exam IV
- 13 Dec (Mon) – Final Exam Part 1
- 14 Dec (Tues) – Final Exam Part 2 (ACS, required)

<i>Week 1</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
Unit I – Atoms & Molecules	Aug 23	Aug 24	Aug 25	Aug 26	Aug 27
Topics Covered	<ul style="list-style-type: none"> · Introduction · Brief history · The Chemistry Rules · Wave nature of matter · Policies & procedures 	<ul style="list-style-type: none"> · Quantum mechanics · Atomic structure I: Hydrogen atom 	<ul style="list-style-type: none"> · Orders of magnitude · Sig Figs · Unit Conversions · Homework questions 	<ul style="list-style-type: none"> · Atomic Structure II: Polyelectronic atoms 	<ul style="list-style-type: none"> · Atomic Structure III: Structure of the periodic table · Periodic trends
Material Due				Problem Set 1	
Reading Assignment	For Tues – 1.1-1.8 2.1-2.4		For Thurs – 2.5-2.6	For Fri – Ch 3 (all)	For Mon – 1.9-1.10 4.8-4.12
Important Deadlines					<ul style="list-style-type: none"> · Notify Prof. Steele of any exam accommodations · Notify Prof. Steele if you are not on the mini-lesson schedule

<i>Week 2</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
	Aug 30	Aug 31	Sep 1	Sep 2	Sep 3
Topics Covered	<ul style="list-style-type: none"> · Atoms → Molecules · Atomic masses · Moles 	<ul style="list-style-type: none"> · General Chemical Bonding I: What is a bond? Types of bonds · Ionic/covalent limits · Dipole moments 	<ul style="list-style-type: none"> · Homework questions 	<ul style="list-style-type: none"> · General Chemical Bonding II: Lewis structures · Octet rule · Resonance structures 	<ul style="list-style-type: none"> · Student Mini-Lesson · Activity: Moles
Material Due				Problem Set 2	
Reading Assigned	For Tues – 4.1-4.3	For Thurs – 4.4-4.7 5.1-5.5		For Tues – 5.6-5.10	
Important Deadlines					Add/Drop Deadline

<i>Week 3</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
	Sep 6	Sep 7	Sep 8	Sep 9	Sep 10
Topics Covered	Labor Day – No Class	<ul style="list-style-type: none"> · Binary-compound nomenclature · Molecular Structure: Introduction to the VSEPR Model · Wrap-up of Unit I 	<ul style="list-style-type: none"> · Homework questions · Careers in Chemistry 	<ul style="list-style-type: none"> · Hybridization and localized electrons · Practice problems 	<ul style="list-style-type: none"> · Exam Q&A
Material Due				Problem Set 3	
Reading Assigned		For Thurs – 6.2-6.3			
Important Deadlines					

<i>Week 4</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
Unit II – Bonding, Structure, and Collections of Molecules	Sep 13	Sep 14	Sep 15	Sep 16	Sep 17
Topics Covered	[Exam day]	· Exam post-mortem	· Molecular Orbital Theory I: Fundamentals, Homonuclear diatomics	· Molecular Orbital Theory II: Heteronuclear diatomics, Polyatomics Connection to resonance structures	· Student Mini-Lesson · Activity: MO diagrams
Material Due				Problem Set 4	
Reading Assigned	For Wed – 6.4				For Mon – 6.5
Important Deadlines	Exam I (Covers through Sep 8)				

<i>Week 5</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
	Sep 20	Sep 21	Sep 22	Sep 23	Sep 24
Topics Covered	· Molecular Orbital Theory III: Connection between valence-bond and molecular-orbital theories · Bonding in metals and semi-conductors	· Gases I: The Gas Laws Single-component gases	· Homework questions · How to study for a college course	· Gases II: Mixtures of gases Real gases	· Student Mini-Lesson · Gas practice problems
Material Due				Problem Set 5	
Reading Assigned	For Tues – 10.1 10.4-10.6 12.8		For Thurs – 10.2-10.3 10.7-10.11		
Important Deadlines					

<i>Week 6</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
	Sep 27	Sep 28	Sep 29	Sep 30	Oct 1
Topics Covered	· Gases III: Kinetic Theory Diffusion	· Liquids: Intermolecular interactions Visualizing liquids	· Homework questions · Careers in Chemistry	· Solids I: Simple solids Structures	· Student Mini-Lesson · Activity: Gas Laws
Material Due				Problem Set 6	
Reading Assigned	For Tues – 11.1-11.5	For Thurs – 12.1-12.5		For Mon – 12.6-12.7 12.9	
Important Deadlines					

<i>Week 7</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
	Oct 4	Oct 5	Oct 6	Oct 7	Oct 8
Topics Covered	· Solids II: Complex solids Metallic bonding	· Changes of State · Phase Diagrams · Work problems	· Homework questions	· Exam Q&A	[Exam Day]
Material Due				Problem Set 7	
Reading Assigned	For Tues – 11.6-11.8				For Oct 18 – 4.9-4.12 7.1-7.4
Important Deadlines					Exam II (Covers through Oct 6)

<i>Week 8</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
	Oct 11	Oct 12	Oct 13	Oct 14	Oct 15
Topics Covered	Fall Break – No Class	Fall Break – No Class	Fall Break – No Class	Fall Break – No Class	Fall Break – No Class
Material Due					
Reading Assigned					
Important Deadlines					

<i>Week 9</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
Unit III – Chemical Transformations	Oct 18	Oct 19	Oct 20	Oct 21	Oct 22
Topics Covered	· Stoichiometry I: Formulae and composition of compounds, Balancing equations	· Stoichiometry II: Limiting Reagents and calculations	· Exam post-mortem	· Chemical Energy · Basics of enthalpy · Hess's Law · Modern energy concepts	· Student Mini-Lesson · Activity: Stoichiometry & Limiting Reagents
Material Due				Problem Set 8	
Reading Assigned	For Tues – 7.5-7.6		For Thurs – 9.1-9.6	For Fri – 9.7-9.11	For Mon – 8.1-8.4
Important Deadlines					



<i>Week 10</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
	Oct 25	Oct 26	Oct 27	Oct 28	Oct 29
Topics Covered	· Solutions What are they? Solubility Vapor pressures Colligative properties	· Solution Reactions I: Approach to reactions in solution Precipitation reactions	· Homework questions · Careers in Chemistry	· Solution Reactions II: Acid-Base Reactions	· Student Mini-Lesson Activity: Calorimetry
Material Due				Problem Set 9	
Reading Assigned	For Tues – 8.5-8.6	For Thurs – 8.7		For Mon – 8.8-8.9	
Important Deadlines					

<i>Week 11</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
	Nov 1	Nov 2	Nov 3	Nov 4	Nov 5
Topics Covered	· Solution Reactions III: Oxidation-Reduction reactions	· Homework questions	· Exam Q&A	[Exam Day]	Exam post-mortem
Material Due				Problem Set 10	
Reading Assigned					For Mon – 14.1-14.4
Important Deadlines				Exam III (Covers through Nov 1)	

<i>Week 12</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
Unit IV – Kinetics & Advanced Topics	Nov 8	Nov 9	Nov 10	Nov 11	Nov 12
Topics Covered	· Kinetics I: Rate laws Meaning of a rate	· Kinetics II: Integrated rate laws	· Homework Questions Careers in Chemistry	· Kinetics III: Reaction mechanisms · Transition State The- ory Dynamics vs Kinetics Molecular dynamics simulations	· Student Mini-Lesson · Activity: Rates
Material Due				Problem Set 11	
Reading Assigned	For Tues – 14.5	For Thurs – 14.6-14.7		For Mon – 14.8	
Important Deadlines					Withdraw Deadline

<i>Week 13</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
	Nov 15	Nov 16	Nov 17	Nov 18	Nov 19
Topics Covered	· Kinetics IV: Catalysis	· Radioactivity I	· Homework questions	· Radioactivity II: Nuclear reactions Medical applications of radioactivity	· Student Mini-Lesson · Radioactivity activity
Material Due				Problem Set 12	
Reading Assigned	For Tues – 20.1-20.3	For Thurs – 20.4-20.12			
Important Deadlines					

<i>Week 14</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
	Nov 22	Nov 23	Nov 24	Nov 25	Nov 26
Topics Covered	· A brief interlude regarding entropy	· Homework questions	· Modern Topics: Photochemistry	Thanksgiving Break – No Class	Thanksgiving Break – No Class
Material Due			Problem Set 13 *Note Wed Submission!		
Reading Assigned	For Wed – (Separate Notes)				
Important Deadlines					

<i>Week 15</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
	Nov 29	Nov 30	Dec 1	Dec 2	Dec 3
Topics Covered	· [Exam Day]	· Exam post-mortem	· Modern Topics III: Biomolecules DNA Protein folding	· Flex review day	· Student Mini-Lesson · Flex review day
Material Due			Problem Set 14		
Reading Assigned					
Important Deadlines	Exam IV (Covers through Nov 22)				

<i>Week 16</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
	Dec 6	Dec 7	Dec 8	Dec 9	Dec 10
Topics Covered	· Practice problems	· Homework questions	· Wrap-up Activity: Real-world (research) case study	· Review activity	[No class] *Outside review TBA
Material Due				Problem Set 15	
Reading Assigned					
Important Deadlines				*Last day of class *Seminar requirement deadline *Cutoff for regrade requests	

<i>Week 17</i>	Monday (Lecture)	Tuesday (Lecture)	Wednesday (Discussion)	Thursday (Lecture)	Friday (Discussion)
	Dec 13	Dec 14	Dec 15	Dec 16	Dec 17
Topics Covered	[Final Exam Day]	[Final Exam Day]			
Material Due					
Reading Assigned					
Important Deadlines	FINAL EXAM 8:00-10:00am CSC 205	CHEM DEPT ACS EXAM 3:30-5:30pm CSC 205			

*All dates and content are subject to change with reasonable notice.