



Chemistry 109: Advanced General Chemistry

Meeting Time and Location:

Lecture 1: MWF 12:05-12:55PM B10 Ingraham Hall

Lecture 2: MWF 2:25-3:15PM B10 Ingraham Hall

Course Credit Information:

This 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 a discussion section (50 minutes per week). Over the course of the fall semester, students are expected to do a total of about 225 hours learning activities which includes class/lab/discussion attendance, reading, studying, pre-class/pre-lab/pre-discussion preparation, problem sets, and other learning activities.

Instructors

Lecture 1: Prof. Etienne Garand (egarand109@chem.wisc.edu)

Office Hours: Mondays 2-3pm and Fridays 10-11am in Chem 4319

Lecture 2: Dr. Stephen Block (sblock@chem.wisc.edu)

Office Hours: Tuesdays and Thursdays from 2:00-3:00PM in Chem 1321C

You are encouraged to contact your professors by email if you have questions related to the operation of the course. If you have content-related questions, you need to post them on **Piazza** (see link in Canvas). As a reminder, a professional email contains a proper salutation, a concise description of the background and a well-articulated question. Emails that do not follow these criteria may not be answered.

Course Description

Chemistry 109 is a one-semester, accelerated introductory university course in chemistry that is designed for students with good chemistry and mathematics background preparation who desire a one-semester coverage of general chemistry. It is recommended for students intending to major in chemistry or related fields. Throughout this course, emphasis will be placed on understanding chemistry and learning to think effectively in solving problems. Successful problem-solving requires a basic knowledge of principles, facts, and terms: a vocabulary of chemistry. This course is designed to help you to learn as much chemistry as possible and to perform at the highest level possible. The pace will be fast; you should prepare yourself to work considerably harder than in high school. You will need to devote significant outside-of-class time to studying chemistry.

Official Course Description (as published in the catalog)

A modern introduction to chemical principles that draws on current research themes. For students with good chemistry and mathematics background preparation who desire a one-semester coverage of general chemistry. Recommended for students intending majors in chemistry or allied fields. Lecture, lab, and discussion.

Official Requisites

MATH 113, 114, or 171; not open to students who have taken CHEM 104 or CHEM 115

Course Designations and Attributes

Elementary level; physical science breadth; counts as L&S credit; satisfies General Education Quantitative Reasoning Part B

TAs

For up-to-date Chem 109 Help Desk hours, see

<https://canvas.wisc.edu/courses/105353/pages/getting-help-summary>

Chem 109-1			Chem 109-2		
801 802	Brandon Mehlenbacher	bmehlenbache@wisc.edu	841	Daniel Salgueiro	salgueiro@wisc.edu
803 804	Megan Tracy	megan.tracy@wisc.edu	842	Jia Zhou	jia.zhou@wisc.edu
805 806	Catherine Kruszynski	ckruszynski@wisc.edu	843 844	Diana Wang	djwang@wisc.edu
807 808	Samantha Gavin	sjgavin2@wisc.edu	845 846	Grace Lutovsky	lutovsky@wisc.edu
809 810	Mary Hawgood	hawgood@wisc.edu	847 848	Rachel Tritt	rtritt@wisc.edu
811 812	Kathleen Nickson	knickson@wisc.edu	849 850	Rebecca Schultz	rlschultz3@wisc.edu
813 814	Kelson Oram	koram@wisc.edu	851 852	Tae Wook Kim	tkim334@wisc.edu
815 816	Jason Scheeler	jscheeler@wisc.edu	853 854	Dylan Tabang	tabang@wisc.edu
817	Matt Dalphin	dalphin@wisc.edu	855 856	Christopher Roy	crroy@wisc.edu
			857 858	Dominic Ross	rdross@wisc.edu
			859 860	Erdong Lu	elu4@wisc.edu

Learning Outcomes

By completing this course, you will learn how to:

1. Describe fundamental chemical concepts and principles, including structure and properties of atoms, models for bonding and molecular geometry, intermolecular forces, organic molecules and functional groups, biomolecules and polymers, kinetics and reaction mechanisms, equilibria and thermodynamics, acid-base chemistry, and electrochemistry.
2. Invoke models of atoms, molecules, and their interactions to qualitatively explain observed macroscopic phenomena, including: the organization of the periodic table, chemical and physical characteristics of organic compounds, the rates of chemical reactions, equilibrium concentrations, and electrical currents generated by electrochemical cells.
3. Apply quantitative chemical models to predict thermodynamics, equilibrium concentrations, rates of reaction, and voltages of electrochemical cells.
4. Design, conduct and analyze experiments pertaining to the covered chemical concepts while developing fundamental skills in safe laboratory practices, accurate chemical measurements, sample isolation and analysis techniques.
5. Demonstrate abilities as reflective, self-directed learners who can assess their work, identify their misconceptions, and critically evaluate information from a variety of sources.
6. Articulate the rationale behind experimental observations and the answers to conceptual problems using clear, concise, and scientifically appropriate language.
7. Solve a wide variety of integrative chemistry problems that connect ideas across the covered concepts and their applications to real world situations.

Face-to-Face Instructional Modes:

1) Whole Class Meeting

In class, your instructor will provide organizational frameworks, discuss principles, and present illustrations and demonstrations. You should do the assigned pre-class activities prior to each whole class session. You should take notes during class; note taking should be an active, thinking process. Your notes should reflect your understanding of what you heard and saw. If there are particular concepts or ideas that are not clear to you, you may ask your professor or your TA about them during class, after class using Piazza, or in office hours. Soon after each class, work the related homework questions to build your problem solving skills. Please do not expect to learn everything you need to know in the classroom; you will learn far better by working problems on your own or with a group of other students outside of class.

2) Discussion Session

Your TA will lead discussions for a group of ~22 students. For each discussion (except the first week) there will be a Pre-Discussion Worksheet posted in Canvas. **You must turn in your completed worksheet at the beginning of your discussion class period.** After evaluating the

pre-class worksheets with the class, your TA will guide you in structured problem-solving activities. Discussions will be most valuable if you come prepared. Bring specific questions to ask, and be sure you understand the questions asked by others and the answers given by your TA and fellow students. Your active participation will help you and your fellow students learn.

3) Laboratory Session

The laboratory exercises are designed to illustrate the principles described in class, and the exams will include questions based on the laboratory materials. **To receive a passing grade in Chem 109, you must successfully complete all laboratory assignments and achieve an overall lab score of at least 60%.** If you are unable to attend a specific lab session due to an unavoidable scheduling conflict or if you are ill, contact your TA as soon as possible to reschedule. Make-up lab times can only be accommodated during the same week the missed lab exercise.

It is essential that you come to lab well prepared and strictly follow all safety instructions given by your TA. When in the laboratory, you must act in a safe and professional manner. During the lab period, you will carry out the experiment, take notes, and complete your data analysis. You will be evaluated on your pre-lab preparation, your in-lab experimental technique and data analysis, and on your ability to observe chemical phenomena and record your observations in your notebook. **The lab report sheet and lab notebook carbon copy are due at the end of each lab session.**

If you have specific accessibility needs or a condition that that might endanger your safety or the safety of others in the laboratory, please inform your instructor and TA.

Required Texts & Materials

You need to purchase each item listed below. These are the only required items for this course.

Textbook: *Chemistry: The Molecular Science* 5th ed. Moore, Stanitski + OWLv2 with 24 Months MindTap eReader

Lab Manual: *Chemistry 109 Laboratory Manual, Fall 2018*, Chemistry Department, UW-Madison. Lab manuals will be sold Tuesday, September 4 through Friday, September 14 in the Undergrad Computer Lab (Room 1375) of the Chemistry Bldg. The cost is \$20 and **payment is by WiscCard only.**

Lab Notebook: Carbonless laboratory notebook with duplicate pages: available from Alpha Chi Sigma or local bookstores (where it is more expensive)

Safety Goggles: Industrial quality eye protection—goggles that completely seal around your eyes, have indirect venting, and fit over regular glasses—is required at all times when you are in the lab. Purchase from Alpha Chi Sigma or local bookstores.

Calculator: A calculator is required. It should have capabilities for square roots, logarithms and exponentiation (antilogarithms), and exponential (scientific) notation operations. You may use programmable calculators in this course as long as they do not have communication capabilities.

Podia: CHEM109 will use Podia for in-class polling. During class, your instructor will ask questions on Podia that may require numerical, a few sentences, and/or image-based responses. Podia allows you to sketch structures online and/or take pictures of sketches drawn on paper with your mobile device. To sign into Podia, follow these instructions:

- 1) Go to wisc.podiaapp.com
- 2) Click "Sign up / Sign in" at the top.
- 3) Enter your full name as it appears on Canvas.
- 4) Enter your instructor's community name:

Dr. Etienne Garand's community is: **109-1**

Dr. Stephen Block's community is: **109-2**

5) Your cellphone number functions like a password. If you don't have good cell service, make sure WiFi is enabled on your phone so you can receive a 4-digit authentication code.

Assessments:

1) OWLv2 Homework

Each week you will have a homework assignment in OWLv2. **Homework is due every Sunday at 11:55 PM.** You may attempt each question up to three times and your highest score will count. You will not get the same questions as other students do, although most of the questions on your homework will be on the same topics as those for other students. It is possible to save your homework assignment and come back to it later using the "Save and Exit" button. Each question in an assignment has a "Submit Answer" button. You have not completed a question until you click "Submit Answer". Until you click "Finish Assignment" you have not completed an assignment; don't forget to click "Finish Assignment" before you close your browser. **Don't wait until the last minute before the deadline to do your homework!** In Canvas you will find directions for registering for OWLv2. **When you register for the first time in OWLv2, use your @wisc email for your email address and use your NetID (i.e., **bbadger25**, not **9074321964**) as your "Student ID".**

If you have technical problems, please email Dr. Rachel Bain at rbain@chem.wisc.edu. Include your name, this course number (Chem 109), and a clear description of the problem.

2) Canvas Quizzes:

You must achieve a perfect score on the **Module 0 Quizzes** in order to access the course material. In addition, there are four Biomolecules Tutorials and four **Biomolecules Quizzes** that you will need to complete. Links to the Biomolecules Tutorials and Quizzes will appear in Canvas for the week in which they are due. Each Biomolecules Tutorial has an accompanying quiz that you must complete successfully to receive credit for the tutorial. These quizzes are listed under the 2nd week's assignment. If you read the orange safety pages in your lab manual before taking the Safety Quiz, you should have no difficulty getting a perfect score.

3) Exams:

There will be three 50-minute midterm exams and a 2-hour final exam. Please note the exam dates on your calendar and avoid scheduling anything at those times. If you have an unavoidable conflict, contact your professor well in advance. Learning objectives for each exam, a selected set of study questions keyed to the learning objectives, and two practice exams may be found in the Exam Preparation modules on the Canvas page.

Midterm Exams:	Mon. Sept. 24	during class
	Mon. Oct. 22	during class
	Mon. Nov. 19	during class
Final Exam:	Fri. Dec. 14	5:05 PM – 7:05 PM

Grades

Your grade will be based on a maximum of 500 points divided as follows:

Module 0 Quizzes (4 @ 1 points each)	4 points
Biomolecules Tutorials and Quizzes (4 @ 5 points each)	20 points
OWLv2 Homework (Best 16 of 17 @ 5 points each)	80 points
Pre-Discussion Worksheets (12 @ 3 points each)	36 points
Laboratory Exercises (11 @ 10 points each)	110 points
Midterm Exams (3 @ 50 points each)	150 points
Final Exam (1 @ 100 points)	100 points

Course Total 500 points

Final grades will be based on the absolute scale shown below. If you score the number of points indicated, then you will receive the letter grade indicated, regardless of how many other students achieve the same grade. There is no curve (forced grading distribution), therefore it is to your benefit (and to your friends' benefit) that you help other students learn and they help you learn. After each midterm exam, you will be able to determine your probable grade by totaling your earned points, dividing by the total points possible at that time, multiplying by 500, and comparing with this list. If necessary, minor adjustments will be made at the end of the semester, but these adjustments will never lower your final letter grade, only raise it. Past experience in Chem 109 shows that the class average is about 3.2 on a four-point scale—slightly above a B average.

A	445-500 points
AB	425-444 points
B	400-424 points
BC	375-399 points
C	340-374 points
D	275-339 points
F	< 275 points

Other Information

Rules, Rights & Responsibilities

See the Guide's Rules, Rights and Responsibilities
(<http://guide.wisc.edu/undergraduate/#rulesrightsandresponsibilitiestext>)

Academic Integrity

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to <https://conduct.students.wisc.edu/academic-integrity/>.

Academic misconduct includes and is not limited to acts in which a student seeks to claim credit for the work or efforts of another without authorization or citation, uses unauthorized materials or fabricated data in any academic exercise, forges or falsifies academic documents or records, intentionally impedes or damages the academic work of others, engages in conduct aimed at making false representation of a student's academic performance, or assists other students in any of these acts. Examples include but are not limited to: cutting and pasting text from the web without quotation marks or proper citation; paraphrasing from the web without crediting the source; using notes when such use is not allowed; using another person's ideas, words, or research and presenting it as one's own by not properly crediting the originator; stealing examinations or course materials; changing or creating data in a lab experiment; altering a transcript; hiding a book knowing that another student needs it to prepare an assignment; altering an exam and submitting it to be regraded; collaboration that is contrary to the stated rules of the course, or tampering with a lab experiment or computer program of another student. Each student in this course is expected to work entirely on her/his own while taking any exam, to complete assignments on her/his own effort without the assistance of others unless directed otherwise by the professor or TA. If you have any questions about an assignment, please ask. Academic misconduct either in lab or lecture will result in a penalty consistent with university policy.

Accommodations for Students With 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. You are expected to inform your professor of your 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.”

Diversity & Inclusion

Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world.

CHEM 109 Schedule - Fall 2018

Unit	W	L	Date	Subject	Textbook	Assignments	Laboratory
1	1	1	W 9/5	Intro	Ch. 1-3 Appendix A&B	Intro to OWL Assignment (due 9/9@11:55pm) OWL Review Homework 1 (due 9/9@11:55pm)	No lab this week
		2	F 9/7	Atomic Structure	Ch. 5 Sec. 1-4		
	2	3	M 9/10	Atomic Orbitals	Ch. 5 Sec. 5-6	Pre-discussion worksheet 2 (due in discussion) Safety&Acad. Honesty Quizzes (due 9/16@11:55pm) OWL Review Homework 2 (due 9/16@11:55pm) OWL Homework 1 (due 9/16@11:55pm)	Lab check-in Citizenship in the Lab
		4	W 9/12	Electronic configurations	Ch. 5 Sec. 7-9		
		5	F 9/14	Ionic bonds and compounds	Ch. 5 Sec. 10-13 Ch. 2 Sec. 4-6		
	3	6	9/17	Covalent bonds	Ch. 6 Sec. 1,12	Pre-discussion worksheet 3 (due in discussion) OWL Homework 2 (due 9/23@11:55pm)	Reaction of Zinc and Iodine
		7	9/19	Molecular compounds Lewis dot structure	Ch. 2 Sec. 7,8 Ch. 9 Sec. 7 Ch. 6 Sec. 2-4		
		8	F 9/21	Hydrocarbons	Ch. 6 Sec. 5		
2	4	9	M 9/24	Exam #1	Weeks 1-3		
		10	W 9/26	Bond properties	Ch. 6 Sec. 6-8	Pre-discussion worksheet 4 (due in discussion) OWL Homework 3 (due 9/30@11:55pm)	Redox Titration
		11	F 9/28	Resonance and VSEPR	Ch. 6 Sec. 9-11 Ch. 7 Sec. 1-2		
	5	12	M 10/1	Valence bond theory	Ch. 7 Sec. 3-4	Pre-discussion worksheet 5 (due in discussion) OWL Homework 4 (due 10/7@11:55pm)	Molecular Structures
		13	W 10/3	Noncovalent interactions	Ch. 7 Sec. 5-6 Ch. 9 Sec 1-3a, 5		
		14	F 10/5	Petrochemistry/Alcohols	Ch. 10 Sec. 1-4		
	6	15	M 10/8	Functional groups Addition Polymers	Ch. 10 Sec 5-6a	Pre-discussion worksheet 6 (due in discussion) Biomolecules Tutorials: Proteins 1&2 Biomolecules Tutorials: Lipids &Carbohydrates Proteins 1&2 Canvas Quiz (due 10/14@11:55pm) Lipids &Carb. Canvas Quiz (due 10/14@11:55pm) OWL Homework 5 (due 10/14@11:55pm)	Synthesis of Biodiesel
		16	W 10/10	Condensation Polymers Biopolymers	Ch. 10 Sec. 6b, 7d-e		
		17	F 10/12	Biomolecules	Ch. 10 Sec. 5c, 7b-c Ch. 7 Sec. 7		
	7	18	M 10/15	Rate of Reactions	Ch. 11 Sec. 1-2	Pre-discussion worksheet 7 (due in discussion) Biomolecules Tutorials: DNA 1&2 DNA 1&2 Canvas Quiz (due 10/21@11:55pm)	Esters and Amides
19		W 10/17	Rate of Reactions Radioactive decay	Ch. 11 Sec. 3 Ch. 18 Sec 1-2			

		20	F 10/19	Nuclear chemistry	Ch. 18 Sec 3-9	OWL Homework 6 (due 10/21@11:55pm)	
3	8	21	M 10/22	Exam #2	Weeks 4-7	Pre-discussion worksheet 8 (due in discussion)	Neutron Activation of Silver
		22	W 10/24	Elementary Reactions	Ch. 11 Sec. 4, 6	Biomolecules Tutorials: Enzymes	
		23	F 10/26	Effect of Temperature	Ch. 11 Sec. 5, 7	Enzymes Canvas Quiz (due 10/28@11:55pm) OWL Homework 7 (due 10/28@11:55pm)	
	9	24	M 10/29	Reaction Mechanisms	Ch. 11 Sec. 7-8	Pre-discussion worksheet 9 (due in discussion)	Kinetics of Erioglaucine with Sodium Hypochlorite
		25	W 10/31	Catalysis and Enzymes	Ch. 11 Sec. 9-10	OWL Review Homework 3 (due 11/4@11:55pm)	
		26	F 11/2	Thermochemistry	Ch. 4	OWL Homework 8 (due 11/4@11:55pm)	
	10	27	M 11/5	Entropy	Ch. 16 Sec. 1-5	Pre-discussion worksheet 10 (due in discussion) OWL Homework 9 (due 11/11@11:55pm)	Enzyme Kinetics
		28	W 11/7	Gibbs free energy Chemical Equilibrium	Ch. 16 Sec. 6 Ch. 12 Sec. 1-2		
		29	F 11/9	Chemical Equilibrium	Ch. 12 Sec. 3-5		
	11	30	M 11/12	Le Chatelier's principle	Ch. 12 Sec. 6-7	Pre-discussion worksheet 11 (due in discussion) OWL Homework 10 (due 11/18@11:55pm)	Chemical Equilibrium
		31	W 11/14	Equilibrium and free energy	Ch. 16 Sec. 7		
32		R 11/16	Kinetic Stability	Ch. 16 Sec. 8-11 Ch. 12 Sec. 8			
4	12	33	M 11/19	Exam #3	Weeks 8-11	No discussion this week No Homework this week	No Lab this week
		34	W 11/21	Acids and Bases	Ch. 3 Sec. 4 Ch. 14 Sec. 1-5		
	13	35	M 11/26	Acids and Bases	Ch. 14 Sec. 6-8	Pre-discussion worksheet 13 (due in discussion) OWL Homework 11 (due 12/2@11:55pm)	Acid-Base Titration
		36	W 11/28	Buffers	Ch. 15 Sec. 1		
		37	F 11/30	Acid-Base Titrations	Ch. 15 Sec. 2		
	14	38	M 12/3	Redox Reactions	Ch. 3 Sec. 5, Appendix F Ch. 17 Sec. 1-2	Pre-discussion worksheet 14 (due in discussion) OWL Homework 12 (due 12/9@11:55pm)	Electrochemical Cells Lab check out
		39	W 12/5	Cell potential	Ch. 17 Sec. 3-5		
		40	F 12/7	Electrochemical Cells	Ch. 17 Sec. 6-7		
	15	41	M 12/10	Electrochemical Cells	Ch. 17 Sec. 8-9	No discussion this week OWL Homework 13 (due 12/12@11:55pm)	No Lab this week
		42	W 12/12	Electrochemistry	Ch. 17 Sec. 10-12		
			F 12/14	FINAL EXAM	Week 1-15	5:05-7:05 PM, Location TBD	