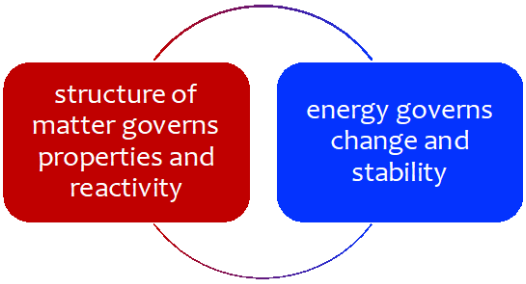
WISCONSIN
UNIVERSITY OF WISCONSIN–MADISON

Advanced General Chemistry

CHEMISTRY 109

Information for Students

What is Chemistry 109?



Chemistry 109 is an accelerated introductory chemistry course for students with a strong chemistry background (1–2 years of high school chemistry). First and foremost, this course will introduce you to chemistry as not just a body of facts, but an incredibly useful and interesting way of thinking about the world. This course will also shape your understanding of the fundamental ideas upon which chemical reasoning is built: (1) the nanoscale structure of matter governs a substance's properties and reactivity; and (2) whether a chemical system changes or remains stable depends on differences in energy and energy dispersal. Lastly this course will build your skills in a variety of practices related to science, including analyzing and interpreting data, constructing explanations, engaging in argument from evidence, developing and using models, and planning and carrying out investigations. **By the end of the course, your Chemistry instructors will expect you to begin "thinking like a chemist"** by generating submicroscopic models using chemistry's core ideas and using these models to explain/predict chemical phenomena, plan experiments, make correct inferences and deduce conclusions from data, and interpret whether conclusions are warranted based on given data. Thus, if you are planning to pursue a major in the materials and molecular sciences (biochemistry, chemistry, chemical engineering, materials science and engineering, molecular and cell biology, etc.), you are encouraged to enroll in Chemistry 109.

There is an Honors section of Chemistry 109 (109H), which has the same course structure as non-honors Chemistry 109. The main goal in pursuing honors credit in this course is not to master material in addition to that presented in Chemistry 109. Rather, the goal of Chemistry 109H is to master a portion of the course material more deeply by engaging in a creative activity relevant to the material. In this course, students explore the landscape of undergraduate research related to the materials and molecular sciences at UW–Madison by working collaboratively to propose, construct, and peer-review creative artifacts that connect Chemistry 109 core ideas and science practices to the research of fellow undergraduates.

What are the requirements and expectations for Chemistry 109?

- All sections of Chemistry 109 have the same math requisite: completion of MATH 113, 114, or 171 (algebra, trigonometry, and precalculus) or placement into MATH 221 (first-semester calculus).
- Chemistry 109 students are expected to have taken at least one year of high school chemistry, and many Chemistry 109 students have had two years.
- If you have never taken a chemistry course or if it has been some time since your last chemistry course, it is recommended that you consider enrolling in Chemistry 103 and 104.
- Chemistry 109 is a five-credit course. The credit standard for the course is met by an expectation of a total of 225 hours of student engagement with course learning activities (~15 hr per week). These activities include regularly scheduled whole-class (2.5 hr per week) and discussion/laboratory meeting times (4 hr per week), as well as completing pre-class activities, homework, preparing for exams, preparing for laboratory activities, and completing post-laboratory assignments.

How much prior experience is needed for Chemistry 109?

Chemistry 109 covers the breadth of the material from Chemistry 103/104 but assumes familiarity with some introductory content so that students can focus more on using chemistry's core ideas to build models that explain and predict phenomena. Chemistry 109 students tend to be familiar with the following concepts and skills when they begin the course; they are comfortable using these ideas after some reminders and review. (The expectation is <u>not</u> that a student can pass an exam on these topics on Day 1 of the course!) Even though Chemistry 109 refrains from direct instruction on these topics, the course provides brief reminders in most cases where students are expected to use these ideas.

- **physical properties**: states of matter, temperature, mass, volume, density
- **measurements**: SI units, unit conversions, significant digits
- **chemical elements**: the periodic table, atomic symbols, nuclear model of the atom, subatomic particles (electrons, protons, neutrons), atomic number, isotopes, weighted average atomic mass
- **chemical compounds**: empirical and molecular formulas, molar mass, mass-amount (gram-mole) conversions
- **gases**: partial pressures, "ideal" behavior as described by gas laws, the gas constant "R"
- **molecular structure**: Lewis structures
- **chemical equations**: balancing chemical equations, stoichiometry, limiting and excess reagents, percent yield computations
- **solutions**: solution concentration (in molarity), dilutions ($M_1V_1 = M_2V_2$), stoichiometry in solutions
- **acids and bases**: pH definition, computing pH from $[H^+]$ (and visa versa)
- **energy:** differences between kinetic (energy related to motion) and potential energy (energy related to position), concept of energy conservation

How did Chemistry 109 students perform in Fall of 2022?

- 538 students began Chemistry 109 and 521 students completed the course. The distribution of letter grades in Fall 2022 is provided at right.
- The DFW rate (i.e., students who earned a letter grade of D or F, and those who withdrew) for Fall 2022 was 6%.
- Of the 538 students who began the course, 338 (63%) reported scores from the AP Chemistry exam. The grade distribution for students who reported AP Chemistry scores was not markedly different than that for students who did not.