Chemistry 124 

Instructor: Dr. Greg Scott 
Email: gscott02@calpoly.edu 
Office Hours: Mon 1-2pm, Tue 1-2pm, Wed 1-3pm, Fri 12-1pm, and by appointment.

You are strongly encouraged to take advantage of office hours and other opportunities for remediation, advancement, and enrichment. You will get the most benefit from attending office hours if you have first rolled up your sleeves and put some effort into working your way through the material.

Course Meetings Classes are held Tuesdays and Thursdays from 8:10am-11:00am in 180-334. The course is run in an integrated studio format wherein lecture, lab, and practice opportunities are combined into a single experience. We will regularly transition between direct instruction and hands-on activities, and you will find it much easier to succeed in the course through regular, active attendance.

Course Website Course materials and important announcements will be posted on PolyLearn, accessible through the Cal Poly portal (my.calpoly.edu). You should regularly refer to the course website, which will be updated on an ongoing basis with information relevant to the course.

Reading The text for the course is Chemistry from OpenStax College. Electronic copies are available at no cost at https://openstaxcollege.org/textbooks/chemistry/get. You should complete the assigned reading before lecture. You are also responsible for watching assigned videos posted on the course website prior to class. Specific assignments will be posted on an ongoing basis on the course website.

Homework Suggested practice from multiple sources will be provided and posted online after each class. Sources for practice will include problems from the textbook and “Mastery Questions” provided by the instructor. Quiz material will closely reflect these practice problems.

Quizzes There will be a short quiz nearly every week in class. Through thorough reading, active attendance in lecture, and diligent practice of homework problems from the previous week, you will be well prepared for these quizzes. Quiz topics will include material from all types of class activities.

Exams Exams provide the most significant opportunity for you to demonstrate your mastery of the course material. There will be two exams during the quarter and a comprehensive final exam. The best way to prepare for exams is to be consistent with your study and work throughout the quarter.

Graded Activities The course will contain many hands-on activities that are designed to help you master the course material. Some of the class activities will be evaluated for part of the course grade and to provide you with feedback. Many of these activities will require you to contribute outside of the classroom and may contain an online component.

Course Policies
- Proper attire and personal protective equipment must be worn for all potentially hazardous experiments as outlined in the department safety documents. Wear closed shoes every day.
- Only non-programmable calculators may be used and may not be shared during assessments.
- There are no make-up exams. For conflicts, requests to reschedule quizzes should be made at least one week in advance; requests for exams should be made at least two weeks in advance.
- If you have a documented disability and wish to discuss academic accommodations, please contact the instructor as soon as possible.
- This is an inclusive learning environment. Be respectful and strive for success together.
- Maintain a high standard of academic integrity. Breaches of academic integrity may result in immediate failure in the course.
**Schedule**  This schedule is tentative. Dates are subject to change.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
<th>Notes</th>
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<tbody>
<tr>
<td>1</td>
<td>Atomic Structure</td>
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<tr>
<td>2</td>
<td>Interactions with Light</td>
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<tr>
<td>3</td>
<td>Quantum Mechanics</td>
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<tr>
<td>4</td>
<td>Electronic Structure</td>
<td>Exam 1: Thurs., Oct 15</td>
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<td>5</td>
<td>Bonding and Structure</td>
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<tr>
<td>6</td>
<td>Molecular Structure</td>
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<tr>
<td>7</td>
<td>Structure and Properties</td>
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<tr>
<td>8</td>
<td>Intermolecular Forces</td>
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<tr>
<td>9</td>
<td>Reactions / Stoichiometry</td>
<td>Exam 2: Thurs., Nov 12</td>
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<tr>
<td>10</td>
<td>Stoichiometry</td>
<td>No class Thursday</td>
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<tr>
<td>11</td>
<td>Stoichiometry</td>
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*The Final Exam will take place Thursday, December 10 at 7:10am.*

**Strategies for Success**  This course serves as an introduction to the underlying principles of the broad field of chemistry. You should strive for a level of understanding that will allow you to ask insightful questions, solve novel problems, and relate the course content to a broad range of your interdisciplinary interests.

Learning how to work and study effectively can be daunting, particularly in the transition to college, but with hard work, you will succeed! Because this course moves quickly and covers a lot of material, good time-management will be critical to your success and it is important that you do not let yourself get behind. Below are some specific suggestions that you may find useful as you hold yourself to high expectations in this course.

**On-Going**
- Treat your mind and body well: get plenty of sleep, eat well, and exercise.
- Use a calendar and schedule your time.
- Continually review material from the early parts of the course as the quarter progresses.
- Don’t be embarrassed by things you don’t know; seek out understanding!

**Reading**
- Complete assigned reading before classes.
- Read actively.
  - Write down important ideas and questions that you have.
  - Work example problems along with the text.
- Re-read difficult sections.

**In-Class**
- Attend every class. Be on time.
- Take excellent notes.
  - Keep your notes well-organized.
  - Review your notes soon after class and again before the next class.
- Actively participate in class discussions and ask questions.
- Think critically during activities.

**Practice and Study**
- Study a minimum of 8-10 hours per week.
- Study thoughtfully and with purpose.
- Schedule study time so that you don’t have to cram.
- Do the Mastery Questions.
- Do suggested problems from the text.
- Work online problems.

**Use Additional Resources**
- Come to Office Hours with questions.
- Use open Office Hours of other instructors.
- Use online resources.
- Join a Supplemental Workshop.
- Utilize tutoring through the department.
- Join a Study Session and attend regularly.
- Engage in Piazza discussions.
- Make your own study-group, but be sure to practice alone sometimes too.
- Utilize your Learning Assistants.

**Grades**  Cutoffs may be lowered, but will not be raised.

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
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<tbody>
<tr>
<td>Graded Activities</td>
<td>15%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>25%</td>
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<tr>
<td>Exams (2)</td>
<td>35%</td>
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<tr>
<td>Final Exam</td>
<td>25%</td>
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<tr>
<td>Total</td>
<td>100%</td>
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<table>
<thead>
<tr>
<th>Grade</th>
<th>Cutoff</th>
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<tr>
<td>A (A-, A)</td>
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<tr>
<td>B (B-, B, B+)</td>
<td>80%</td>
</tr>
<tr>
<td>C (C-, C, C+)</td>
<td>70%</td>
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<tr>
<td>D</td>
<td>60%</td>
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Course Learning Objectives
You should be able to:

Module 1: Atoms
- Correctly predict the relative ordering for ionization energy, electron affinity, atomic radius, and ionic radius of a series of elements using effective nuclear charge and atomic shell arguments
- Correctly determine ground state electron configurations for elements
- Identify different isotopes and correctly determine the number of protons, neutrons, and electrons
- Determine the average molar mass of an element from isotopic abundances
- Correctly identify quantum numbers associated with an electron in a particular atomic orbital
- Explain why atoms emit light at only specific wavelengths in terms of quantized electron energies
- Use the Rydberg equation to determine the energy associated with a particular electron transition in a hydrogen atom
- Use the relationships between the wavelength, frequency, and energy of a photon to determine the energy, wavelength, or frequency of a photon emitted or absorbed by a hydrogen atom
- Associate increases and decreases of electron energy with absorption and emission processes
- Use their understanding of the wave nature of light to describe electromagnetic radiation in terms of its wavelength, frequency, and color (if visible).
- Use their understanding of the particle nature of light and light quanta or photons to relate the energy of a photon of light to its wavelength or frequency
- Explain why some materials (solutions, solids, colored glass, etc.) possess color and how absorption and reflection of light result in the perception of colored materials
- Use an absorption spectrum to determine the wavelength of maximum absorbance and predict the color of the material absorbing light
- Explain how absorbance, concentration, and molar absorptivity are related

Module 2: Molecules
- Relate atomic radii and material density using basic metallic and ionic crystal structures.
- Describe metals, semiconductors, and insulators in terms of basic band theory.
- Use physical properties of atomic periodic trends to describe trends in semiconductor properties.
- Predict bonding behaviors of Hydrogen, Carbon, Nitrogen and Oxygen using valence electrons
- Build simple molecular models from chemical formulae using Atomic Tiles
- Recognize and explain bonding patterns for simple molecules
- Describe the Octet Rule
- Sketch good Lewis Structures from chemical formulae with and without Atomic Tiles
- Create multiple good Lewis Structures of different isomers from chemical formulae
- Identify functional groups in a Lewis Structure
- Create good Lewis Structures with specific functional groups from chemical formulae
- Predict Electronic and Molecular Geometry by identifying the number and type of electron groups around a central atom
- Translate chemical formulae into three-dimensional molecular representations using Lewis Structures and VSEPR
- Explain relative strengths of intermolecular forces in molecules based on Lewis structures and 3D models
- Describe the relationships between elution orders (in GC), boiling points, and intermolecular forces
• Explain relative boiling points using intermolecular forces
• Determine the empirical formula of a compound from combustion analysis data
• Determine the molecular formula of a compound from the empirical formula and information that allows determination of the molar mass of the compound

Module 3: Reactions
• Identify common macroscopic signs that a chemical reaction has occurred
• Use patterns in chemical reactivity to predict the products and write balanced chemical equations
• Use stoichiometry to determine the concentration of an unknown solute in an aqueous solution via titration
• Use stoichiometry to determine the empirical and molecular formulae of an unknown
• Perform acid-base titrations
• Use reaction stoichiometry and quantitative measurements to determine the composition of a metal carbonate/metal bicarbonate mixture
• Apply algebraic concepts to reaction stoichiometry in cases where there are multiple unknown quantities
• Use the ideal gas law to quantitatively track reactions that involve gases

Technical Skills
• Use a linear calibration curve to determine unknown values from known values
• Create a linear graph from nonlinear data by choosing appropriate axes given a formula
• Interpret a graph and extract physical information from a linear fit equation
• Create a standard curve by making solutions of known dye concentration and measuring their absorbances
• Use a Vernier SpectroVis Plus spectrometer to collect a visible absorption spectrum of an aqueous solution
• Use volumetric glassware to prepare solutions of known dye concentration
• Operate a gas chromatograph and interpret resulting chromatograms
• Use online chemical databases and digital modeling tools
• Make and record careful observations
• Use an electronic balance and volumetric glassware
• Validate an experimental method via a control experiment
• Define and correctly use units central to chemistry such as: density, molarity, moles, molar mass, joules, pressure (atm, torr, mmHg, Pa)