

CHEMISTRY 6087 –Advanced Chemistry Knowledge for Educators: Bonding Models and States of Matter.

4 Credit Hours.

Available: May 12-July 30; May 12- July 2; June 8- July 30

Instructor Information

Instructor:	Dr. Ted M. Clark	Office:	N/A
Email:	Clark.789@osu.edu	Office Hours:	By arrangement

Course Description: For professionals and educators seeking an advanced understanding of General Chemistry content knowledge with consideration of how this understanding informs teaching and learning in College Credit Plus Chemistry courses. Topics typically found in the second-half of the first semester of General Chemistry will be investigated including the electronic structure of atoms, periodic properties of atoms, bonding models ranging from Lewis structures to valence bond theory to molecular orbital theory, intermolecular forces, and ideal gases, real gases, liquids, and solids.

Prerequisites: Chemistry 6086.

Suggested General Chemistry Textbooks

- Chemistry, The Central Science (14th Ed.) Brown, LeMay, Bursten, Murphy, Woodward, & Stoltzfus.
- Chemical Principles: The Quest for Insight. Atkins, Jones, Laverman.

How This Course Works

Mode of delivery: This course is 100% online. There are not required sessions when you must be logged in to Carmen at a scheduled time. Meetings with the instructor are optional and flexibly arranged on a weekly basis.

Pace of online activities: The course is divided into modules which are completed in order. The student is expected to distribute their time approximately equally across the different modules. Within a given module there is considerable flexibility and the student can select resources they find most interesting and useful for completing the assignments.

Credit hours and work expectations: This is a 4-credit-hour course. According to OSU guidelines, expect to spend 12-15 hours on coursework to receive an average grade. In this graduate course an average grade is a B+.

Attendance and participation: During most weeks you will probably log in to the course in Carmen multiple times. Office hours and any live sessions are optional.

Discussion forum: We will use a program (called Perusall) to annotate and discuss class readings. This is a place where you can share ideas, comments, and questions with the instructor and your classmates. This is an essential resource in class for asynchronous learning.



Module Overview

Module	Topic	Sub-Topics
0	Introduction	Assignments Find and using information
1	Quantum mechanics and electronic structure.	Quantum mechanics and wavefunctions. Electron configurations. Pauli exclusion principle and Hund's rule.
2	Periodic properties of atoms.	Periodic table- historical. Scientific explanations, arguments, predictions. Effective nuclear charge. Ionization energy, electron affinity, atomic size. Group trends and descriptive chemistry.
3	Introduction to covalent and ionic bonding.	Overview of bonding models. Ionic bonding. Covalent bonding. Octets. Drawing Lewis structures. Resonance Electronegativity
4	VSEPR theory, valence bond theory, molecular orbital theory	VSEPR theory. The role of orbitals. Polarity and dipole moment. Valence bond theory. Molecular orbital theory. Application of bonding models.
5	Gases	Historical description of gases. Pedagogical implications. Kinetic molecular theory.
6	Intermolecular forces and liquids	Understanding intermolecular forces. Properties and student misconceptions. The structure of liquids.
7	Solids	Bonding models Structure-property relationships Symmetry, order and disorder

Course Objectives

Upon successful completion of this course, you should:

- Synthesize methods, practices, and resources appropriate for teaching undergraduate General Chemistry with a deep understanding of fundamental topics that inform pedagogical decisions.
- Demonstrate an awareness of the range and depth of topics in undergraduate General Chemistry courses, along with mastery of these topics.
- Adapt educational resources to support General Chemistry instruction based on one's learning objectives and the setting in which the resources are to be used.
- Use primary research articles to connect an advanced understanding of scientific ideas with their teaching and learning in General Chemistry.



Assignments & Grading

Assignments: In every module you will select and use content within Perusall to...

- 1) Prepare specific activities for use within a high school classroom that support student learning that are based on pedagogical insights and content knowledge. Activities include things like lesson plans, demonstrations, lectures, polling questions, computer simulations, homework assignments, etc.
- 2) Reflect on your own understanding before and after completing a module and describe how deeper content knowledge will influence future pedagogical decisions. This can be communicated in different ways, including self-reflection papers or presentations.

Students also earn credit for completing tasks within each module, especially contributions within Perusall.

Classroom activities: 20% Self-reflection papers, presentations: 20% Within module tasks: 60%

Grading Scale

A > 92% A- = 90.0 – 91.9%

B+ = 88.0 – 89.9% B = 82.0 – 87.9% B- = 80.0 – 81.9%

C+ = 78.0 – 79.9% C = 75.0 – 77.9%

Course Information & Policies

Title IV Attendance Requirement: Federal policy requires that attendance for all university students be verified during the first week of classes

STANDARDS OF ACADEMIC CONDUCT IN GENERAL CHEMISTRY

Violations of academic standards in General Chemistry will be referred to the University Committee of Academic Misconduct (COAM) as required by Faculty Rules. It is the responsibility of COAM to investigate all reported cases of student academic misconduct; illustrated by, but not limited to, cases of plagiarism and any dishonest practices in connection with examinations, quizzes, and graded assignments. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information see the Code of Student Conduct: studentlife.osu.edu/csc

Student Responsibilities: *Any graded material must represent your own work.* Unauthorized group efforts by students, use of another student's course materials, or assistance from individuals who already have taken the course, could place you in jeopardy of violation of the standards for the course. In some courses, group work is acceptable on certain activities (as explicitly stated by your instructor). In these cases, it is important that you know and understand where authorized collaboration (working in a group) ends and collusion (working together in an unauthorized manner) begins. Identical answers indicate copying or unacceptable group efforts - always answer questions in your own unique words. It is important that you consult with your instructor for clarification on whether or not collaboration is appropriate on an activity. *You should not assist others in violating academic standards.* Students supplying materials for others to "look at" may be charged with academic misconduct.

Commitment to Diversity: The Department of Chemistry and Biochemistry promotes a welcoming and inclusive environment for all students and staff, regardless of race, gender, ethnicity, national origin, disability or sexual orientation. There is no tolerance for hateful speech or actions. All violations of this policy should be reported to the OSU Bias Assessment and Response Team (BART, studentaffairs.osu.edu/bias). The Department encourages diversity at all levels, particularly among the next generation of scientists. Students are encouraged to participate in organizations that provide support specifically for science and engineering students who are African-American, Asian, disabled, Hispanic, LGBTQ or women. These organizations are listed on the Colleges of Arts and Sciences (artsandsciences.osu.edu/stem-organizations) and Engineering (engineering.osu.edu/studentorgs) websites.



Disability Services: The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), reasonable accommodations can be established. Students should first register with Student Life Disability Services, then meet with the General Chemistry SLDS Coordinator in the Undergraduate Studies Office (Holly Wheaton) who will assist you in establishing your accommodations in the course.

Contact SLDS

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