



Advanced Chemistry Knowledge for Educators

This online graduate certificate program has been created to serve teachers seeking to improve their pedagogical content knowledge to support their teaching of College Credit Plus (CCP) courses. This program consists of four graduate courses, totaling 18 graduate credit hours, that are entirely online, asynchronous, and scheduled throughout the year in half or full semester offerings. These courses examine content found in General Chemistry courses, but at a much deeper level. All courses are flexible, interactive, and supportive, but also demanding. Participants will be able to choose from diverse resources to support their learning and will share ideas with classmates and the instructor. Participants will succeed in these courses, but it is important to realize these courses require a high level of commitment and dedication. Like other learning environments, the learner's motivation and purpose for taking a course are important factors that influence their experiences in the course. Participants eager to improve their own instruction, find resources to use with their students, and deepen their content knowledge, will find this program especially rewarding.

Program Overview:

- Courses are entirely online and available every semester in half or full-semester versions.
- Courses are asynchronous, self-paced, and highly interactive with many opportunities to share ideas.
- Focus is on deepening the pedagogical content knowledge of teachers for use in their own courses.
- Resources from an undergraduate General Chemistry course will be shared and can be adapted for use elsewhere.
- Supportive environment that builds on the prior knowledge and experiences of the participants.
- Highly flexible structure with many resources gathered from chemical education and STEM education research, chemistry research, historical readings, upper-level textbooks, the research of OSU faculty, etc. The participant chooses their own path among provided resources to complete course modules, prepare lesson plans, and write reflection papers.

Course Sequence

Chemistry 6086: Atomic Structure, Energy, and Quantum Mechanics. 5 Credit-hours	Topics from the first-half of the first semester of General Chemistry: <ul style="list-style-type: none">• Scientific measurement and error analysis.• The historical underpinnings of atomic structure leading to a quantum mechanical model.• Thermodynamics and student conceptions, and misconceptions, of energy.
Chemistry 6087: States of Matter and Bonding Models. 4 Credit-hours	Topics from the second-half of the first semester of General Chemistry: <ul style="list-style-type: none">• Electronic structure and periodic properties of atoms.• Bonding models, including Lewis structures, valence bond theory, and molecular orbital theory• Intermolecular forces, ideal and gases, liquids, and solids.
Chemistry 6088: Kinetics, Thermodynamics, and Equilibrium. 4 Credit hours	Content from the second semester of General Chemistry: <ul style="list-style-type: none">• Topics pertaining to equilibrium, such as solubility and acid-base chemistry will be investigated and described using kinetic and thermodynamic-based explanations.
Chemistry 6089: Modern Applications and Instrumental Analysis. 5 Credit hours	Content from the second semester of General Chemistry, including lab: <ul style="list-style-type: none">• Topics are discussed with emphasis on modern applications, including electrochemistry and energy storage, nuclear chemistry, materials, and leading approaches involving instrumental analysis.• Connections are made between these topics and potential laboratory experiments.

Contact Dr. Ted Clark (Clark.789@osu.edu) with questions.