

CHEMISTRY

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www.mcla.edu/chem (<http://www.mcla.edu/chem/>)

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Chemistry Major

The Department of Chemistry offers a four-year program leading to a Bachelor of Science in Chemistry. Exploration of the composition, structure, properties, and reactions of matter is achieved through lectures coupled with hands-on laboratory work, with opportunities for independent research. Using both classic and modern instrumentation, students will also learn synthetic skills, lab techniques, data reporting, and chemical safety. Equally important are skills in analysis, critical thinking, and problem-solving that students will gain and can apply to a wide range of careers. In addition to the general Chemistry major and minor, students may choose one of two concentrations. The Biochemistry concentration focuses on the structure-function relationship and reactions of molecules in living organisms, which is a great fit for students interested in graduate school, pharmaceutical research, and medicine. The Formulation Chemistry concentration prepares students for immediate jobs in manufacturing and quality control in biotech, pharmaceutical, industry, and cosmetic companies.

Students graduating with a major in Chemistry will be able to:

- Demonstrate knowledge of basic principles and theories in analytical, organic, physical chemistry, inorganic chemistry, and biochemistry
- Apply chemical principles through problem-solving and laboratory experimentation
- Demonstrate competency in the use of sophisticated laboratory instruments
- Students with a Concentration in Biochemistry will also design, implement, and analyze biochemical experiments involving nucleic acids and proteins
- Students with a Concentration in Formulation Chemistry will also troubleshoot quality control issues and communicate protocols and data according to technical standards

Chemistry Minor

Students graduating with a minor in Chemistry will be able to:

- Demonstrate knowledge of basic principles and theories in analytical, organic, and one of the following sub-areas: inorganic, biochemistry, or physical chemistry
- Apply chemical principles through problem-solving and laboratory experimentation
- Demonstrate competency in the use of basic laboratory instruments.

Chemistry Programs

- Chemistry - Biochemistry Concentration, B.S. (<https://catalog.mcla.edu/undergraduate/academic-programs-study/chemistry/chemistry-biochemistry-concentration-bs/>)
- Chemistry - Formulation Chemistry Concentration, B.S. (<https://catalog.mcla.edu/undergraduate/academic-programs-study/chemistry/formulation-chemistry-concentration-bs/>)
- Chemistry Minor (<https://catalog.mcla.edu/undergraduate/academic-programs-study/chemistry/chemistry-minor/>)

- Chemistry, B.S. (<https://catalog.mcla.edu/undergraduate/academic-programs-study/chemistry/chemistry-bs/>)

Chemistry Courses

CHEM 150 Introduction to Chemistry I

4 cr

Studies chemical principles, theories, laws and their applications. Topics include electronic and nuclear behavior, periodicity, stoichiometry, structure and bonding. Teaches laboratory techniques through the performance of experiments related to the above topics.

Corequisite: CHEM 150L

Attributes: Core Science & Tech w/lab (CSTL), Environmental Studies (ENVI)

CHEM 152 Introduction to Chemistry II

4 cr

Studies chemical principles, theories, laws and their applications. Topics include oxidation and reduction, kinetics, thermodynamics, equilibrium and descriptive inorganic chemistry. Teaches laboratory techniques through the performance of experiments related to the above topics.

Prerequisite: CHEM 150

Corequisite: CHEM 152L

Attributes: Core Science & Tech w/lab (CSTL), Environmental Studies (ENVI)

CHEM 201 Organic Chemistry I

4 cr

Studies the structure, properties and synthesis of organic compound and the mechanisms of their reactions. Topics include bonding, molecular orbitals, stereochemistry, resonance, acid-based chemistry, nomenclature, infrared spectroscopy, conformational analysis and substitution and elimination reactions.

Prerequisite: CHEM 152

Corequisite: CHEM 201L

CHEM 202 Organic Chemistry II

4 cr

Builds on the concepts introduced in CHEM 201 by studying the reactivity of other classes of compounds including aromatic, unsaturated, alcohols, ethers, carbonyl derivatives and nitrogen-containing compounds. Nuclear magnetic resonance (NMR) will be studied. Basic total synthesis will be covered throughout the semester as new reactions are introduced.

Prerequisite: CHEM 201

Corequisite: CHEM 202L

CHEM 250 Inorganic Chemistry

3 cr

Explores the structures, properties and chemical reactivity of the elements and of many compounds. This course builds upon the principles that have been introduced in general chemistry and will enhance understanding of atomic structure and bonding models, periodic trends and molecular symmetry, including molecular orbitals. These concepts are directly applicable to organic and biochemistry and environmental science.

Prerequisite: CHEM 152

CHEM 301 Physical Chemistry I

3 cr

Studies the concepts and methods of classical thermodynamics and their application to chemical systems including: chemical reactions, phase changes, solubility, equilibrium, kinetics and electrochemistry.

Prerequisite: CHEM 152, MATH 320

CHEM 302 Physical Chemistry II

3 cr

Develops the mathematical and conceptual foundations of quantum mechanics. Includes applications of quantum theory to atomic and molecular spectroscopy. Group theory will be introduced and then applied to atomic and molecular structure and motion, rotational, vibrational and electronic spectra.

Prerequisite: CHEM 301

CHEM 310 Analytical Chemistry**4 cr**

Examines classical and modern methods of chemical analysis. Emphasis is placed on chemical equilibrium, titrimetry and selected analytical applications of instrumental methods, including visible, infrared, fluorescence spectroscopy, gas chromatography and electro-chemistry. Required laboratory focuses on analytical techniques.

Prerequisite: CHEM 152**Corequisite:** CHEM 310L**CHEM 311 Instrumental Analysis in Chemistry****4 cr**

Explores the role of instruments in both research and industry. The theory and hands-on experience of a variety of analytical instruments will be covered. In addition, the student will learn the roles of quality control and quality assurance when processing data. The student will become familiar with the operation of ultraviolet, visible, fluorescence and infrared spectroscopic instrumentation as well as high pressure liquid chromatography (HPLC) and gas chromatography (GC). Required Laboratory.

Prerequisite: CHEM 310**Corequisite:** CHEM 311L**CHEM 395 Special Topics in Chemistry****1-4 cr**

Covers current topics in chemistry including: bioinorganic chemistry, bioorganic chemistry, forensic chemistry and physical chemistry. Depending on the topic, laboratory exercises could be conducted as part of the course content. This course does not require an independent project.

Prerequisite: Junior/senior status**Repeatable:** Unlimited Credits**CHEM 401 Advanced Laboratory****3 cr**

Exposes students to best practices in industrial chemistry using project-based methodology. The student will use instruments to analyze a variety of samples. There is an emphasis on record keeping, data analysis and report writing. In addition, the student will be exposed to standard operating procedure (SOP) writing and root cause analysis. Instruments the student become proficient in operating may include: ultraviolet/visible, fluorescence, infrared, atomic absorption/emission, and mass spectrometers; high pressure liquid chromatography and gas chromatography systems; osmometer and differential scanning calorimeter; and quantitative real-time polymerase chain reaction systems.

Prerequisite: CHEM 311**CHEM 420 Special Topics in Chemistry****1-4 cr**

Covers current topics in chemistry including: bioinorganic chemistry, bioorganic chemistry, forensic chemistry and physical chemistry. Depending on the topic, laboratory exercises could be conducted as part of the course content. This course requires an independent project.

Prerequisite: Junior/senior status**Repeatable:** Unlimited Credits**CHEM 440 Advanced Organic Chemistry****3 cr**

Provides the student with a deeper understanding of some of the concepts and reactions that are discussed in CHEM 201 and CHEM 202. The course also introduces new reactions such as the Aldol, Claisen Rearrangement and Ene reactions. The role of these reactions in the total synthesis of natural products is also explored. Current topics in organic chemistry will be discussed.

Prerequisite: CHEM 202**CHEM 490 Chemistry Seminar****1 cr**

Presents current topics in chemistry. Primary literature articles will be assigned and discussed in class. Enrolled students will present topics of their choice. Attendance at academic lectures at other colleges/universities is possible.

Prerequisite: Senior status**Repeatable:** Unlimited Credits**CHEM 500 Independent Study in Chemistry****1-3 cr**

For chemistry majors who wish to conduct an independent project on a specific topic in chemistry. The project will be supervised by a faculty member. The course requires a final scholarly report detailing the finding of the project. This course may be taken more than once for lengthy projects.

Prerequisite: Junior/senior status, department approval**Repeatable:** Maximum of 12 credits**CHEM 540 Internship in Chemistry****1-15 cr**

Offers the upper-level chemistry major an opportunity to practice chemistry in an appropriate professional situation. The student will work with a faculty sponsor and an off-campus supervisor in gaining experience significant to the major.

Prerequisite: Junior/senior status, department approval**Repeatable:** Maximum of 15 credits**CHEMISTRY: TEACHER LICENSURE**

Students majoring in Chemistry may opt to pursue initial licensure as an early childhood teacher, or elementary teacher. Also, Chemistry majors may pursue initial licensure as a teacher of Chemistry at the secondary level. These students will complete a Chemistry major and a licensure program in Education. Please see the Education major for more details.