

CHEMISTRY

Chemistry deals with the study of matter and its interactions. The chemistry major at USAO receives theoretical instruction and laboratory experiences in each of the major disciplines of chemistry. The laboratory experience covers standard bench chemistry and instrumental methods using the computerized instrumentation found in the industrial laboratory.

Students are prepared for careers in a broad range of chemical enterprises or for further study in graduate school.

Bachelor of Science in Chemistry

Required Chemistry Core (41 hours):

<i>Course</i>	<i>Title</i>	<i>Hours Required</i>
CHEM 1111	General Chemistry Lab I	1
CHEM 1113	General Chemistry I	3
CHEM 1121	General Chemistry Lab II	1
CHEM 1123	General Chemistry II	3
CHEM 3011	Analytical Laboratory	1
CHEM 3013	Analytical Chemistry	3
CHEM 3021	Instrumental Laboratory	1
CHEM 3023	Instrumental Chemistry	3
CHEM 3302	Organic Chemistry I Laboratory	2
CHEM 3303	Organic Chemistry I	3
CHEM 3312	Organic Chemistry II Laboratory	2
CHEM 3313	Organic Chemistry II	3
CHEM 3321	Biochemistry Laboratory	1
CHEM 3323	Biochemistry	3
CHEM 4411	Physical Chemistry I lab	1
CHEM 4413	Physical Chemistry I	3
CHEM 4421	Physical Chemistry II Lab	1
CHEM 4423	Advanced Inorganic Chemistry	3
CHEM 4433	Physical Chemistry II	3

Supporting Courses (23 hours)

PHYS 1301	General Physics Lab I	1
PHYS 1401	General Physics Lab II	1
PHYS 2114	General Physics I	4
PHYS 2124	General Physics II	4
<i>and</i>		
MATH 1145	Calculus I	5
MATH 2225	Calculus II	5
MATH 3243	Calculus III	3

Recommended Science Electives:

MATH 2203	Elementary Statistics	3
CSCI 2143	Programming in "C/C++"	3
CHEM 4450	Research in Chemistry	1-3

Exit requirement:

- The chemistry degree requires an exit portfolio completed in conjunction with enrollment in colloquium (NSCI 2700 or NSCI 2701) each fall and spring trimester.
- Completion of exam (see item "d" under general graduation requirements, pg. 18)

Minor in Chemistry

20 hours to be selected with the approval of a chemistry advisor

COURSE LISTINGS in CHEMISTRY

- 1111 GENERAL CHEMISTRY LABORATORY I
A study of the general principles of chemistry. 1 hour. Co-requisite: Chemistry 1113.
- 1113 GENERAL CHEMISTRY I
Study of general principles of chemistry, including atomic structure, bonding, states of matter, equilibrium, kinetics, thermochemistry, acids and bases, Lewis Structures and oxidation / reduction 3 hours. Prerequisite: No math deficiency. Co-requisite: CHEM 1111.
- 1121 GENERAL CHEMISTRY LABORATORY II
Continuation of CHEM 1111. 1 hour. Prerequisites: CHEM 1111 *and* CHEM 1113. Co-requisite: CHEM 1123.
- 1123 GENERAL CHEMISTRY II
Study of the general principles of chemistry, including kinetics, equilibrium, acids and bases, complex ions, spontaneity of reaction, electrochemistry, nuclear reactions and organic chemistry . 3 hours. Prerequisites: CHEM111, CHEM1113, and MATH 1513. Co-requisite: CHEM 1121.
- 2880 SPECIAL TOPICS
Special topics in chemistry. 1-4 hours (may be repeated for total of 6 hours).
- 2900 WORKSHOP
Guided study in chemistry under faculty supervision; various topics and methods. 1-4 hours (may be repeated for total of 6 hours with change in title and topic).
- 2990 TUTORIAL
Independent study in chemistry under faculty supervision. 1-4 hours (may be repeated for total of 9 hours with change in title and content).
- 3011 ANALYTICAL LABORATORY
Laboratory experiments in quantitative analysis, including gravimetric and volumetric techniques. Volumetric analysis includes precipitation, acid-base, complexometric, and redox titrations. Preparation of samples and statistical treatment of results are included. 1 hour.
- 3013 ANALYTICAL CHEMISTRY
Study of modern theories of solutions, separation techniques and methods of analysis. 3 hours. Prerequisite: CHEM 1123. Co-requisite: CHEM 3011.
- 3021 INSTRUMENTAL LABORATORY
Laboratory experiments using instrumentation, including UV-visible spectroscopy, AA spectroscopy, IR spectroscopy, gas chromatography, high performance liquid chromatography, and ion-selective electrodes. Analysis of NMR and mass spectra are also included. 1 hour.
- 3023 INSTRUMENTAL ANALYSIS
Introduction to instrumental methods of analysis, with emphasis on spectrophotometric methods and gas and high-performance liquid chromatography. 3 hours. Prerequisite: CHEM 3013. Co-requisite: CHEM 3021.
- 3301 SEMINAR
Topic to be selected according to student and instructor interests. 1 hour. Prerequisite: permission of instructor.
- 3302 ORGANIC CHEMISTRY I LABORATORY
The first part of the course is to teach basic organic laboratory principles, techniques of compound isolation/purification, and other operations. The remaining part of the course is to provide the students with some basic organic synthetic skills. 2 hours. Co-requisite: CHEM 3303.

- 3303 ORGANIC CHEMISTRY I
Study of principles of organic chemistry. 3 hours. Co-requisite: CHEM 3302.
- 3312 ORGANIC CHEMISTRY II LABORATORY
The first part of the course emphasized organic compound syntheses and analyses using modern spectroscopic techniques: UV, IR, MS, ^1H - and ^{13}C -NMR. The last part of the course provides the students the opportunity to carry out experiments on qualitative organic analysis. 2 hours. Co-requisite: CHEM 3313.
- 3313 ORGANIC CHEMISTRY II
Continuation of CHEM 3303. 3 hours. Prerequisite: CHEM 3303. Co-requisite: CHEM 3312.
- 3321 BIOCHEMISTRY LABORATORY
Laboratory experiments involving qualitative and quantitative identification of biomolecules including sugars, proteins, electrolytes, nucleic acids, fatty acids and enzymes using spectrophotometric, GC, and HPLC techniques. 1 hour.
- 3323 BIOCHEMISTRY
Introduction to broad field of biochemistry, includes a study of proteins, nucleic acids, carbohydrates, lipids, enzymes, and intermediary metabolism. 3 hours. Prerequisite: CHEM 3313.
- 4411 PHYSICAL CHEMISTRY LABORATORY I
Theory of errors and selected experiments in physical phenomena. 1 hour. Co-requisite: CHEM 4413.
- 4413 PHYSICAL CHEMISTRY I
Study of thermodynamics, equilibria, quantum theory, spectroscopy, kinetics, and solution processes. 3 hours. Prerequisites: PHYS 2124 *and* MATH 3243. Co-requisite: CHEM 4411.
- 4421 PHYSICAL CHEMISTRY LABORATORY II
Measurement of fundamental constants and selected experiments in physical phenomena. 1 hour. Prerequisite: CHEM 4411.
- 4423 ADVANCED INORGANIC CHEMISTRY
Study of topics of inorganic chemistry, molecular structure, acids and bases, coordination chemistry. 3 hours. Prerequisite: CHEM 4413.
- 4433 PHYSICAL CHEMISTRY II
Continuation of CHEM 4413. 3 hours. Prerequisite: CHEM 4413. Co-requisites: CHEM 4421 *and* MATH 3243.
- 4450 RESEARCH
Research in various topics and problems in chemistry; chosen in consultation with advisor. 1-3 hours.
- 4880 SPECIAL TOPICS
Special topics in chemistry. 1-4 hours (may be repeated for total of 6 hours).
- 4900 WORKSHOP
Related topics and problems in chemistry. 1-6 hours (may be repeated for total of 9 hours with change in title and content).
- 4990 TUTORIAL
Independent study in chemistry under faculty supervision. 1-4 hours (may be repeated for total of 9 hours with change in title and content).