

Chemistry and Biochemistry

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The Department of Chemistry and Biochemistry provides high-quality training in chemistry and biochemistry while providing opportunities for meaningful spiritual and interpersonal experiences that will enable students to move successfully into the next phase of their professional training or the career of their choice. Chemistry is an excellent starting point for careers in research within the physical and life sciences, medicine, veterinary medicine, dentistry, pharmacy, environmental science, forensic science, education, industry, food science, and many others.

Biochemistry (BS)

The Bachelor of Science degree with a major in Biochemistry requires 70-72 hours. This program prepares students for a career in biochemistry, medicine, molecular biology, and other related fields. *All major courses must be completed with a grade of C- or better and are included in the major GPA.*

During their sophomore year, students interested in medicine should check out the medical school admissions requirements for the school(s) to which they plan to apply. The Medical School Admission Requirements guide published annually by AAMC is the best resource for this information. It is important to meet the specific entrance requirements of the medical school(s) chosen.

Maintaining at least an A- average and scoring well on the MCAT test (usually taken in the Spring of the junior year) are common prerequisites for acceptance to a medical school. Assistance is available in preparing for the MCAT examinations.

Major Requirements

CHE 211	4	College Chemistry I
CHE 212	4	College Chemistry II
CHE 301	4	Analytical Chemistry I
CHE 302	4	Analytical Chemistry II
CHE 311	4	Organic Chemistry I
CHE 312	4	Organic Chemistry II
CHE 330	4	Advanced Inorganic Chemistry
CHE 411	3	Biochemistry I
CHE 411L	1	Biochemistry I Lab
CHE 412	3	Biochemistry II
CHE 412L	1	Biochemistry II Lab
CHE 420	1	Chemistry Thesis
CHE 431	4	Physical Chemistry I

Select 3 hours of advanced biochemistry or directed research.

Additional Major Requirements

BIO 201	4	Biology I: Foundations of Cell Biology and Genetics
MAT 151	4	Calculus I
MAT 230	4	Calculus II
PHY 211	4-5	University Physics I

Select one of the following:

PHY 204	4	General Physics II
PHY 212	5	University Physics II

Electives

Select two additional upper-division biology courses totaling at least 6 hours. BIO 203 may also count as an elective.

Recommended Biology Courses

BIO 203	4	Principles of Genetics
BIO 462	4	Molecular Genetics
BIO 471	4	Microbiology and Immunology
CHE 320	4	Environmental Pollution and Toxicology

Chemistry (BA)

The Bachelor of Arts degree with a major in Chemistry requires two years of one foreign language and 57-59 hours in the major. This program is suitable for students wishing to enter either graduate school or the chemical industry. *All major courses must be completed with a grade of C- or better and are included in the major GPA.*

Major Requirements

CHE 211	4	College Chemistry I
CHE 212	4	College Chemistry II
CHE 301	4	Analytical Chemistry I
CHE 302	4	Analytical Chemistry II
CHE 311	4	Organic Chemistry I
CHE 312	4	Organic Chemistry II
CHE 330	4	Advanced Inorganic Chemistry
CHE 411	3	Biochemistry I
CHE 411L	1	Biochemistry I Lab
CHE 420	1	Chemistry Thesis
CHE 431	4	Physical Chemistry I
CHE 432	4	Physical Chemistry II

Additional Major Requirements

MAT 151	4	Calculus I
MAT 230	4	Calculus II
PHY 211	4-5	University Physics I

Select one of the following:

PHY 204	4	General Physics II
PHY 212	5	University Physics II

Recommended Courses

CHE 320	4	Environmental Pollution and Toxicology
CHE 412	3	Biochemistry II
CHE 412L	1	Biochemistry II Lab
COS ____	1-4	Any Computer Science course
MAT 240	4	Calculus III
MAT 251	4	Differential Equations
MAT 352	4	Mathematical Statistics

NAS 480 is recommended in the junior or senior year.

Chemistry (BS)

The Bachelor of Science degree with a major in Chemistry requires 67-69 hours in the major. This program is especially attractive to students planning to enter either graduate school or the chemical industry. *All major courses must be completed with a grade of C- or better and are included in the major GPA.*

Major Requirements

CHE 211	4	College Chemistry I
CHE 212	4	College Chemistry II
CHE 301	4	Analytical Chemistry I
CHE 302	4	Analytical Chemistry II
CHE 311	4	Organic Chemistry I
CHE 312	4	Organic Chemistry II
CHE 330	4	Advanced Inorganic Chemistry
CHE 411	3	Biochemistry I
CHE 411L	1	Biochemistry I Lab
CHE 412	3	Biochemistry II
CHE 412L	1	Biochemistry II Lab
CHE 420	1	Chemistry Thesis
CHE 431	4	Physical Chemistry I
CHE 432	4	Physical Chemistry II
CHE 450*	6	Directed Research

*A minimum of 3 credits must be completed on campus

Additional Requirements

MAT 151	4	Calculus I
MAT 230	4	Calculus II
PHY 211	4-5	University Physics I

Select one of the following:

PHY 204	4	General Physics II
PHY 212	5	University Physics II

Recommended Courses

BIO 201	4	Biology I: Foundations of Cell Biology and Genetics
CHE 320	4	Environmental Pollution and Toxicology
MAT 240	4	Calculus III
MAT 251	4	Differential Equations
MAT 352	4	Mathematical Statistics

Chemistry Education (BA/BS)

The Chemistry Education major requires 44-47 hours in addition to education courses. Optional concentrations are available in SpEd Mild-Moderate P-12 Licensure, SpEd Intense P-12 Licensure, and TESOL P-12 Licensure. The Bachelor of Arts degree requires two years of one foreign language. *All major courses, including education curriculum courses, must be completed with a grade of C- or better and are included in the major GPA.*

Chemistry Courses

CHE 211	4	College Chemistry I
CHE 212	4	College Chemistry II
CHE 301	4	Analytical Chemistry I
CHE 302	4	Analytical Chemistry II
CHE 311	4	Organic Chemistry I
CHE 420	1	Chemistry Thesis
CHE 431	4	Physical Chemistry I

Select at least one course from:

CHE 312	4	Organic Chemistry II
CHE 320	4	Environmental Pollution and Toxicology
CHE 330	4	Advanced Inorganic Chemistry
CHE 411	3	Biochemistry I

Additional Major Requirements

MAT 151	4	Calculus I
MAT 230	4	Calculus II
PHY 211	4-5	University Physics I

Select one of the following:

PHY 204	4	General Physics II
PHY 212	5	University Physics II

Professional Education

EDU 150	3	Education in America
EDU 222	2	Reading in the Content Area for Secondary Teachers
EDU 260	3	Educational Psychology
EDU 307	2	Discipline and Classroom Management for Secondary Teachers
EDU 309	1	Methods of Instruction and Assessment in Secondary Education
EDU 332	2	The Junior High/Middle School
EDU 344	1	Educational Technology in Secondary Education
EDU 384	1	Perspectives on Diversity
EDU 431	17	Supervised Internship in Secondary Schools
NAS 309	2	Science Education Methods
SED 220	3	Exceptional Children

Additional Education Requirements

ENG 110	3	College Composition
PSY 340	3	Adolescent Psychology

Select one course from the following:

CAC 160	3	Integrative Communication
COM 210	3	Public Speaking

Chemistry-Environmental Science (BS)

This integrated major has a strong emphasis on the physical aspects of environmental studies. It is appropriate for students planning careers in environmental research or industrial or municipal environmental monitoring and control. The Bachelor of Science degree with a major in Chemistry-Environmental Science requires 91 major hours. *All major courses must be completed with a grade of C- or better and are included in the major GPA.*

Chemistry Requirements

CHE 211	4	College Chemistry I
CHE 212	4	College Chemistry II
CHE 301	4	Analytical Chemistry I
CHE 302	4	Analytical Chemistry II
CHE 311	4	Organic Chemistry I
CHE 312	4	Organic Chemistry II
CHE 330	4	Advanced Inorganic Chemistry
CHE 411	3	Biochemistry I
CHE 411L	1	Biochemistry I Lab
CHE 420	1	Chemistry Thesis
CHE 431	4	Physical Chemistry I
CHE 432	4	Physical Chemistry II

Physics Requirements

PHY 211	4-5	University Physics I
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Select one of the following:

PHY 204	4	General Physics II
PHY 212	5	University Physics II

Environmental Science Requirements

CHE 320	4	Environmental Pollution and Toxicology
CHE 450	3	Directed Research
ENS 204	4	Principles of Ecology
ENS 302	4	Environmental Law and Policy
ENS 383	4	Environmental Ethics
SUS 231	4	Environmental Science, Society, and Sustainability

Mathematics Requirements

MAT 151	4	Calculus I
MAT 230	4	Calculus II

Electives (to complete a minimum of 91 major hours)

CHE 412	3	Biochemistry II
CHE 412L	1	Biochemistry II Lab
ENS 241	4	Physical Geology
MAT 210	4	Introductory Statistics

Chemistry/Pre-Medicine Concentration (BA)

The Bachelor of Arts degree with a major in Chemistry and a pre-professional concentration in Pre-Medicine requires two years, sequential study of one foreign language and 65-67 major hours.

Students interested in the pre-medicine curriculum should check out during their sophomore year the medical school admissions requirements for the school(s) to which they plan to apply. The Medical School Admission Requirements guide published annually by AAMC is the best resource for this information. It is important to meet the specific entrance requirements of the medical school(s) chosen.

Maintaining at least an A- average and scoring well on the MCAT test (usually taken in the Spring of the junior year) are common prerequisites for acceptance to a medical school. Assistance is available in preparing for the MCAT examinations. *All major courses, including those in the concentration, must be completed with a grade of C- or better and are included in the major GPA.*

Major Requirements

CHE 211	4	College Chemistry I
CHE 212	4	College Chemistry II
CHE 301	4	Analytical Chemistry I
CHE 302	4	Analytical Chemistry II
CHE 311	4	Organic Chemistry I
CHE 312	4	Organic Chemistry II
CHE 330	4	Advanced Inorganic Chemistry
CHE 411	3	Biochemistry I
CHE 411L	1	Biochemistry I Lab
CHE 420	1	Chemistry Thesis
CHE 431	4	Physical Chemistry I

Additional Major Requirements

MAT 151	4	Calculus I
MAT 230	4	Calculus II
PHY 211	4-5	University Physics I

Select one of the following:

PHY 204	4	General Physics II
PHY 212	5	University Physics II

Select three biology courses from the following:

BIO 201*	4	Biology I: Foundations of Cell Biology and Genetics
BIO 202	4	Biology II: Organisms and Diversity
BIO 203*	4	Principles of Genetics
BIO 310	4	Human Anatomy and Physiology I
BIO 311	4	Human Anatomy and Physiology II
BIO 312	4	Cellular and Molecular Biology
BIO 331	4	Comparative Anatomy
BIO 432	4	Developmental Biology
BIO 452	4	Animal Physiology
BIO 471	4	Microbiology and Immunology

*BIO 201, 203, 310, and 311 are highly recommended.

Recommended Courses

CHE 320	4	Environmental Pollution and Toxicology
CHE 412	3	Biochemistry II
CHE 412L	1	Biochemistry II Lab
PSY ____	__	Any Psychology course
SOC ____	__	Any Sociology course

Chemistry Minor

The Chemistry minor requires a minimum of 22-24 hours and includes at least four semesters of core chemistry lab courses. *All minor courses must be completed with a grade of C- or better and are included in the minor GPA.*

Minor Requirements

CHE 211	4	College Chemistry I
CHE 212	4	College Chemistry II
CHE 301	4	Analytical Chemistry I
CHE 311	4	Organic Chemistry I

Electives

Select at least two additional, 3-4 credit hour upper-division (300/400-level) chemistry courses.

Chemistry Courses

CHE 100 4 hours

Chemistry for Living

A course designed for students who have little or no background in chemistry. Basic principles of chemistry are applied in a social context. Three hours of lecture and one two-hour lab per week. *Meets foundational core physical science requirement. No prerequisite, although high school algebra is recommended.*

CHE 120 4 hours

Forensic Science

This course is a one semester introduction to forensic science which will focus on the application of physical and life sciences to criminal investigation. Topics include the crime scene, physical evidence, fingerprints, forensic toxicology, forensic serology, as well as many others. *There are no prerequisites. Based upon the course section selected, will meet either a life or physical science foundational core requirement.*

CHE 170 1-4 hours

Selected Topics

A course offered on a subject of interest but not listed as a regular course offering.

CHE 201 4 hours

General, Organic, and Biochemistry I

This is the first semester of a two-semester sequence designed for students with minimal backgrounds in chemistry yet need a solid foundation in chemistry for their major. These students do not typically take other chemistry courses beyond this sequence. The two semesters are a comprehensive overview of general chemistry, organic chemistry, and biochemistry. The first semester focuses on general chemistry with an introduction to organic chemistry. *Three hours of lecture and three hours of lab per week. Meets foundational core physical science requirement. No college level prerequisites, but high school algebra and chemistry are strongly recommended.*

CHE 202 4 hours

General, Organic, and Biochemistry II

This is the continuation of CHE 201 (see CHE 201 description). The second semester continues with the introduction to organic chemistry and includes an overview of biochemistry. *Three hours of lecture and three hours of lab per week. Prerequisite: CHE 201.*

CHE 211 College Chemistry I	4 hours		CHE 370 Selected Topics	1-4 hours	
This is a general chemistry course for those intending to take later coursework in chemistry, such as organic, inorganic, analytical, or environmental chemistries. The course thoroughly explores the basic concepts and theories of chemistry, using quantitative skills to predict and characterize chemical properties and changes. The nature of atomic structure and chemical bonding and the properties of solids, liquids, and gases are all presented and studied using lectures, demonstrations, and computer-assisted teaching and testing methods. Chemical change is studied in terms of reaction classes, energy flows, and kinetic theories. <i>Three hours of lecture and three hours of lab per week. Meets the foundational core physical science requirement. High school algebra and chemistry are strongly recommended.</i>			A course offered on a subject of interest but not listed as a regular course offering.		
CHE 212 College Chemistry II	4 hours		CHE 393 Practicum	1-4 hours	
The second general chemistry course for those intending to take later coursework in chemistry, such as organic, inorganic, analytical, or environmental chemistries. This course thoroughly explores the basic concepts and theories of chemistry using quantitative skills to predict and characterize chemical properties and changes. The nature of organic chemistry, complexes, equilibria, electrochemistry, and advanced acid-base properties are all presented and studied using lectures, demonstrations, and computer-assisted teaching and testing methods. Chemical change is studied in terms of entropy, free energy, and kinetic theories. <i>Three hours of lecture and three hours of lab per week. Prerequisite: CHE 211.</i>			Supervised learning involving a first-hand field experience or a project. Generally, one hour of credit is awarded for a minimum of 40 hours of practicum experience. <i>Offered primarily during Summer.</i>		
CHE 270 Selected Topics	1-4 hours		CHE 411 Biochemistry I	3 hours	
A course offered on a subject of interest but not listed as a regular course offering.			An introduction to the fundamental principles of biochemistry focusing on the structure and function of biomolecules such as carbohydrates, lipids, proteins, and nucleic acids. The relation between structure and function is explored in such topics as enzyme kinetics, the chemistry of major metabolic pathways, and their regulation. This course is designed for chemistry, biology, and Pre-Med related majors with a background in organic chemistry. <i>Prerequisite: CHE 311. BIO 201 and CHE 312 are strongly recommended.</i>		
CHE 301 Analytical Chemistry I	4 hours		CHE 411L Biochemistry I Lab	1 hour	
Introduction to modern theories and methods used in separations and quantitative determinations. Topics include basic statistics and treatment of data, gravimetry, titrations, and spectroscopy. Topics correlate with the lab. Lab includes gravimetric, titrations, and spectroscopy. Some instrumentation is used including AA and GCMS. <i>Three hours of lecture and three hours of lab per week. Prerequisite: CHE 212 or permission of instructor.</i>			This project-based laboratory class is designed for Biochemistry I (CHE 411) students. The students will utilize science fundamentals to participate in a broad research topic. Students will employ various biochemical investigative tools, including but not limited to molecular modeling, protein expression, chromatography, DNA manipulation, spectroscopy, and enzyme assays, to study structure-function relationships in major biomolecules. <i>This course is designed for chemistry and biology majors with a background in organic chemistry. Prerequisite: CHE 311. Corequisite: CHE 411. BIO 201 is strongly recommended.</i>		
CHE 302 Analytical Chemistry II	4 hours		CHE 412 Biochemistry II	3 hours	
A continuation of CHE 301 in which instrumental methods of analysis are emphasized. A survey of instrumental methods used in modern analytical chemistry. Topics include the general principles of basic instrument components and their integration into the wide variety of modern instrumentation. Students will gain hands-on experience with a variety of spectroscopic (UV, VIS, AA), spectrometric (MS), electrochemical, chromatographic (HPLC, GC, IC), and hybrid (GC/MS, LC/MS) analytical instrumentations. <i>Three hours of lecture and three hours of lab per week. Prerequisite: CHE 301 or permission of instructor.</i>			This course is a continuation of CHE 411 with emphasis on metabolism of major biomolecules (i.e., carbohydrates, lipids, proteins, and nucleic acid). Example topics include synthesis and degradation of glycogen and nitrogen-containing (e.g., amino acids, DNA and RNA bases) compounds, protein synthesis, and metabolic integration. <i>Prerequisite: CHE 411. BIO 201 is strongly recommended.</i>		
CHE 311 Organic Chemistry I	4 hours		CHE 412L Biochemistry II Lab	1 hour	
The study of covalent carbon compounds. Nomenclature, properties, and reactions (including reaction mechanisms) of all classes of hydrocarbons, alcohols, ethers, halides, and organometallic substances are studied. NMR, IR, and MS spectroscopic methods are learned and applied. The lab includes development of advanced lab skills and study of the kinetics and properties of organic substances in reactions. <i>Three hours of lecture and three hours of lab per week. Prerequisite: CHE 212.</i>			This project-based laboratory class is designed for Biochemistry II (CHE 412) students. The students will utilize science fundamentals to participate in a broad research topic. Students will employ various biochemical investigative tools, including but not limited to molecular modeling, protein expression, chromatography, DNA manipulation, spectroscopy, and enzyme assays, to study structure-function relationships in major biomolecules. <i>This course is designed for chemistry and biology majors with a background in organic chemistry. Prerequisite: CHE 411 and CHE 411L. Corequisite: CHE 412. BIO 201 is strongly recommended.</i>		
CHE 312 Organic Chemistry II	4 hours		CHE 420 Chemistry Thesis	1 hour	
Continuation of CHE 311. Focuses on carbonyl and carboxylate compounds and their derivatives, amines, and polyfunctional compounds, including biomolecules. Lab work includes study of the properties of aromatic compounds, qualitative organic analysis, and small group original research projects. <i>Three hours of lecture and three hours of lab per week. Prerequisite: CHE 311.</i>			Students write a major paper, receive coaching and feedback, modify their paper if necessary, and give an oral presentation. <i>Prerequisite: Successful completion of Fall term paper writing workshop. Required of all chemistry seniors.</i>		
CHE 320 Environmental Pollution and Toxicology	4 hours		CHE 431 Physical Chemistry I	4 hours	
A course that emphasizes principles and analysis of pollution sources, movement, distribution, and toxic effects in natural and biological environments. The principles of toxicology related to industry and the environment, including dose response, mechanisms of toxicity, hazard evaluation will be explored. The laboratory work will provide experience in sampling and analysis of water, as well as common toxicology techniques. <i>Three hours of lecture and three hours of lab per week. One year of general chemistry is recommended.</i>			An introduction to the principles of thermodynamics, kinetic-molecular theory of gases, and chemical kinetics. The lab includes vacuum techniques, calorimetry, electrochemistry, physical characterization of solutions, and optical techniques. <i>Three hours of lecture and three hours of lab per week. Prerequisites: CHE 211; CHE 212; PHY 211; PHY 204 or PHY 212; MAT 151; and MAT 230.</i>		
CHE 330 Advanced Inorganic Chemistry	4 hours		CHE 432 Physical Chemistry II	4 hours	
Coverage of the bonding and properties of the main group and especially transition metal elements with a focus on their coordination and solid-state chemistry. Molecular symmetry principles, spectroscopy, materials science and catalytic applications of these substances are discussed in lecture and studied in lab. <i>Three hours of lecture and three hours of lab per week. Prerequisite: CHE 311.</i>			Emphasis on elementary principles of quantum mechanics, molecular structure, spectroscopy, and photochemistry. The lab focuses on computational chemistry, mathematical modeling, and spectroscopy. <i>Three hours of lecture and three hours of lab per week. Prerequisites: CHE 211; CHE 212; PHY 211; PHY 204 or PHY 212; MAT 151; and MAT 230.</i>		
CHE 360 Independent Study	1-4 hours		CHE 450 Directed Research	1-4 hours	
An individualized, directed study involving a specified topic.			Investigative learning involving closely directed research and the use of such facilities as the library or laboratory.		
			CHE 480 Seminar	1-4 hours	
			A limited-enrollment course designed especially for upper-class majors with emphasis on directed readings and discussion.		
			CHE 490 Honors	1-2 hours	
			Individualized study or research of an advanced topic within a student's major. <i>Open to students with at least a 3.00 GPA in the major field.</i>		