Chemistry (CHEM)

The Department of Chemistry offers a BA in Chemistry, a BA in Chemistry with a Concentration in Biochemistry, and a BS in Chemistry. The Bachelor of Arts degree provides students with a foundation in multiple areas of chemistry while permitting the freedom to explore other areas of interest. The problem solving emphasized in this preparation is particularly well suited for students interested in pursuing a career in business, education, law, medicine, and other health-related professions. Students completing the concentration in biochemistry will be prepared for post-graduate study in chemistry, biochemistry, medicine, dentistry, pharmacy, biomedical research, or health-related professions.

The Bachelor of Science degree is an in-depth curriculum focused on preparing students for post-graduate work in chemistry and chemistry-related careers. With coursework from each of the traditional sub-disciplines of chemistry, students completing this degree will think critically about complex issues facing chemists from many facets.

Students majoring in chemistry may obtain an Emphasis in Computational Science (http://catalog.wofford.edu/courses-programs-departments/computer-science/). The interdisciplinary field of Computational Science applies computer science and mathematics to chemistry and the other sciences. For requirements, see the Computer Science (http://catalog.wofford.edu/courses-programs-departments/computer-science/) section of the *Catalog*.

Honors Courses and Research

Students majoring in Chemistry are encouraged to participate in the honors programs and research opportunities available in the department. For further information, see CHEM 250 (http://catalog.wofford.edu/search/?P=CHEM%20250) Introduction to Research and CHEM 450 (http://catalog.wofford.edu/search/?P=CHEM%20450) Senior Research in the course descriptions and the section on Honors Courses (http://catalog.wofford.edu/academics/academic-honors/honors-courses/)in this *Catalog* or consult the department chair.

Chair

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Professors

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In preparation to enroll in upper-level chemistry courses, students need to successfully complete MATH 181 and 182 as well as a Physics sequence (PHY 121/122 or PHY 141/142).

Requirements for the Bachelor of Arts with a Major in Chemistry

Course	Title	Hours
Foundational Math Courses		**6**
MATH 181	Calculus I	
MATH 182	Calculus II	
Foundational Physics Courses		**8**
Select one of the following:		
PHY 121 & PHY 122	General Physics I (with lab) and General Physics II (with lab)	
PHY 141 & PHY 142	Physics for Science & Engineering I (with lab) and Physics for Science & Engineering II (with lab)	
Required Major Courses		**29**
CHEM 123	General Chemistry I (with lab)	
CHEM 124	General Chemistry II (with lab)	
CHEM 203	Organic Chemistry I (with lab)	
CHEM 204	Organic Chemistry II (with lab)	
CHEM 214	Introductory Analytical Chemistry (with lab)	
CHEM 309	Biochemistry (with lab)	
CHEM 313	Physical Chemistry I (with lab)	
CHEM 360	Chemical Information & Seminar	
Chemistry Elective, 300-level		**4**
Select one of the following:		
CHEM 308	Biotechnology (with lab)	
CHEM 314	Physical Chemistry II (with lab)	
CHEM 323	Inorganic Chemistry (with lab)	
Chemistry Elective, 400-level		**4**
Select 4 credit hours in Chemistry (CHEM) at the 400-level		
Biology Elective		**4**
Select one 3-4 credit hour Biology (BIO) course (excluding BIO 104)		
Total Hours		**55**

Requirements for the Bachelor of Arts with a Major in Chemistry and Concentration in Biochemistry

Course	Title	Hours
Foundational Math Courses		**6**
MATH 181	Calculus I	
MATH 182	Calculus II	
Foundational Physics Courses		**8**
Select one of the following:		
PHY 121 & PHY 122	General Physics I (with lab) and General Physics II (with lab)	
PHY 141 & PHY 142	Physics for Science & Engineering I (with lab) and Physics for Science & Engineering II (with lab)	
Required Major Courses		**25**

CHEM 123	General Chemistry I (with lab)	
CHEM 124	General Chemistry II (with lab)	
CHEM 203	Organic Chemistry I (with lab)	
CHEM 204	Organic Chemistry II (with lab)	
CHEM 214	Introductory Analytical Chemistry (with lab)	
CHEM 313	Physical Chemistry I (with lab)	
CHEM 360	Chemical Information & Seminar	
Biochemistry Concentration		**17**
CHEM 251	Introduction to Biochemical Research	
CHEM 308	Biotechnology (with lab)	
CHEM 309	Biochemistry (with lab)	
CHEM 409	Advanced Biochemistry	
BIO 213	Introduction to Genetics & Molecular Biology	
BIO 215	Introduction to Cellular Biology	
Chemistry Elective		**2 to 4**
Select 2-4 credit hours in Chemistry (CHEM) at the 400-level		
Total Hours		**58-60**

Requirements for the Bachelor of Science with a Major in Chemistry

Course	Title	Hours
Foundational Math Courses		**6**
MATH 181	Calculus I	
MATH 182	Calculus II	
Foundational Physics Courses		**8**
PHY 141 & PHY 142	Physics for Science & Engineering I (with lab) and Physics for Science & Engineering II (with lab)	
Required Major Courses		**33**
CHEM 123	General Chemistry I (with lab)	
CHEM 124	General Chemistry II (with lab)	
CHEM 203	Organic Chemistry I (with lab)	
CHEM 204	Organic Chemistry II (with lab)	
CHEM 214	Introductory Analytical Chemistry (with lab)	
CHEM 313	Physical Chemistry I (with lab)	
CHEM 314	Physical Chemistry II (with lab)	
CHEM 323	Inorganic Chemistry (with lab)	
CHEM 360	Chemical Information & Seminar	
Chemistry Elective		**4**
Select 4 credit hours from the following:		
CHEM 250	Introduction to Research	
CHEM 308	Biotechnology (with lab)	
CHEM 309	Biochemistry (with lab)	
CHEM 450	Senior Research	
Chemistry Electives, 400-level		**8**
Select 8 credit hours of 400-level Chemistry (CHEM) courses		
Total Hours		**59**

Requirements for the Minor in Chemistry

The Chemistry minor requires the completion of 28 credit hours with at least 8 of those hours being at the 300-level or above.

Course	Title	Hours
Required Minor Courses		**20**
CHEM 123	General Chemistry I (with lab)	
CHEM 124	General Chemistry II (with lab)	
CHEM 203	Organic Chemistry I (with lab)	
CHEM 204	Organic Chemistry II (with lab)	
CHEM 214	Introductory Analytical Chemistry (with lab)	
or CHEM 324	Environmental Chemistry (with lab)	
Electives		**8**
Select 8 credit hours at the 300-level or above (except CHEM 360)		
Total Hours		**28**

CHEM 103. Chemistry: Science in Context. 3 Hours.
Students will explore the features that make science an important way of understanding the natural world. This exploration will focus on science-based topics and issues important in our contemporary world.

CHEM 104. Chemistry: Concepts & Methods (with lab). 4 Hours.
A study of topics selected to introduce students to basic concepts in chemistry and to the scientific method. Does not count toward a major in Chemistry.

CHEM 123. General Chemistry I (with lab). 4 Hours.
A study of the nature of matter and the changes it undergoes from a molecular perspective. The first of a two-semester sequence, this courses focuses on atomic structure, molecular bonding, reaction stoichiometry, energy related to chemical change, gases, and quantitative and proportional reasoning. The laboratory portion examines chemical techniques and measurements, laboratory safety, data collection, and interpretation of data using chemical and mathematical models.

CHEM 124. General Chemistry II (with lab). 4 Hours.
The second of the two-semester sequence that continues the study of matter and the changes it undergoes. The focus is on chemical equilibrium, acid-based equilibria, phase equilibria, chemical kinetics, thermodynamics, electrochemistry, and quantitative reasoning. The laboratory portion examines chemical techniques and measurements, laboratory safety, data collection, and interpretation of data using chemical and mathematical models.
Prerequisite: CHEM 123 with a minimum grade of C.

CHEM 203. Organic Chemistry I (with lab). 1 or 3 Hours.
A study of the major classes of organic compounds, with emphasis on structure and mechanisms. The lab portion will emphasize laboratory set-ups, distillation, extraction, recrystallization, chromatographic separations, and spectroscopic analysis (particular attention will be paid to simple IR and NMR analysis).
Prerequisite: CHEM 124 with a minimum grade of C.

CHEM 204. Organic Chemistry II (with lab). 1 or 3 Hours.
A continuation of CHEM 203 in studying the major classes of organic compounds, with emphasis on structure and mechanisms. The lab portion will emphasize laboratory set-ups, distillation, extraction, recrystallization, chromatographic separations, and spectroscopic analysis (particular attention will be paid to simple IR and NMR analysis).
Prerequisite: CHEM 203 with a minimum grade of C.

CHEM 214. Introductory Analytical Chemistry (with lab). 1 or 3 Hours.
Fundamental theories and techniques of quantitative chemical analysis. The lab portion focuses on the application of classical procedures for specific determinations. It includes volumetric, gravimetric, and common electroanalytical chemistry techniques.
Prerequisite: CHEM 124 with a minimum grade of C.

CHEM 250. Introduction to Research. 1 Hour.
Elementary investigations in chemistry for students who wish to begin research early in their undergraduate studies. A student may earn a maximum of 4 semester hours in Chemistry 250.
Prerequisite: CHEM 124 with a minimum grade of C.

CHEM 251. Introduction to Biochemical Research. 1 Hour.
Students undertake a laboratory research project in biochemistry. From the project, students practice chemical safety, learn the operation of modern biochemical instrumentation and data analysis, and develop information literacy and scientific communication skills.

CHEM 280. Selected Topics in Chemistry. 1 to 4 Hours.
Group or individual study of selected topics in chemistry at an intermediate level. Intended for non-chemists as well as students majoring in Chemistry. Specific topics vary with student interest and are announced one semester in advance.

CHEM 308. Biotechnology (with lab). 1 or 3 Hours.
This course is designed to provide knowledge and skills of biochemical processes and their application to industrial chemistry and microbiology. The lab exercises in this course have been selected to provide practical experience in biochemical processes and their application to industrial chemistry, microbiology, and use of microorganisms for biological synthesis.
Prerequisite: CHEM 204 with a minimum grade of D.

CHEM 309. Biochemistry (with lab). 1 or 3 Hours.
A rigorous introduction to modern biochemistry with an emphasis on the molecular basis of cellular structure and biological function. A thorough treatment of physicochemical properties of informational macromolecules is employed to provide a sound basis for the study of bioenergetics and metabolic organization. The lab exercises provide experience in protien chemistry and in chromatographic and electrophoretic separation, and emphasizes the basic principles of biochemistry.
Prerequisite: CHEM 204 with a minimum grade of D.

CHEM 313. Physical Chemistry I (with lab). 1 or 3 Hours.
A study of the laws and theories of thermodynamics applied to chemical systems presented from a modern perspective. Theories describe the behavior of energy, heat, work; entropy; reaction spontaneity and equilibrium; equations of state; and phase diagrams. The lab portion studies chemical kinetics using both modern experimental techniques and computer-aided calculations and simulations. Also emphasized is understanding the measurements of chemical reaction rates, from both theoritical and experimental perspectives, while focusing on methods for statistical treatment of experimental data.
Prerequisite: CHEM 214 with a minimum grade of D and (PHY 122 with a minimum grade of D or PHY 142 with a minimum grade of D) and MATH 182 with a minimum grade of D.

CHEM 314. Physical Chemistry II (with lab). 1 or 3 Hours.
An introduction to quantum chemistry focusing on the postulates and models of quantum mechanics as they apply to atoms and molecules. The laboratory engages in an experimental study of selected aspects of physical chemistry, with emphasis on experimentation relevant to the field of quantum chemistry. Topics include laser operation, optical spectroscopy, and quantum computational methods.
Prerequisite: MATH 182 with a minimum grade of D and CHEM 313 with a minimum grade of D and (PHY 142 with a minimum grade of D or PHY 122 with a minimum grade of D).

CHEM 323. Inorganic Chemistry (with lab). 1 or 3 Hours.
A survey of inorganic chemistry with emphasis on the periodicity of the elements and development of the modern theories of the relationships of chemical behavior and structure. This laboratory component focuses on the synthesis and characterization of organometallic, coordination, bioorganic, and solid state compounds, including inert atmosphere techniques, vibrational spectroscopy, NMR spectroscopy, and electrochemistry.
Prerequisite: CHEM 124 with a minimum grade of C.

CHEM 324. Environmental Chemistry (with lab). 1 or 3 Hours.
This course provides an introduction to aquatic, soil and atmospheric chemistry processes that effect local and global ecology, with an emphasis on the effects on humans.
Prerequisite: CHEM 203 with a minimum grade of C.

CHEM 360. Chemical Information & Seminar. 1 Hour.
Both an introduction to the retrieval of information from on-line databases in chemistry and a seminar course discussing current topics in chemistry through the examination of the primary literature of chemistry in combination with seminars presented by outside speakers and students enrolled in the course. The goal of the course is to provide students with the tools, including the computer skills, necessary to conduct independent literature searches for courses and research and to also learn how to make effective computer-assisted presentations.
Prerequisite: CHEM 204 with a minimum grade of D.

CHEM 361. Chemistry Seminar I. 1 Hour.
A seminar course discussing current topics in chemistry through the examination of the primary literature of chemistry in combination with seminars presented by outside speakers and students enrolled in the course. This course is designed to be taken in the junior or senior year after the completion of General Chemistry, Organic Chemistry, and while enrolled in upper level chemistry courses.
Prerequisite: CHEM 204 with a minimum grade of D.

CHEM 409. Advanced Biochemistry. 2 Hours.
This course is designed to provide detailed and in-depth study of selected topics in biochemistry. The emphasis is to familiarize students with specific metabolic pathways and their regulations, hormones, nutrients, abnormal biochemical reactions in human disease and the theory and practice of X-ray crystallography as it applies to studying the 3D structure of macromolecules.
Prerequisite: CHEM 309 with a minimum grade of C.

CHEM 411. Instrumental Analysis (with lab). 1 or 3 Hours.
A study of the theories employed in analytical instrumentation. The application of instruments for methods in absorption and emission spectroscopy, gas chromatography, mass spectroscopy, radioisotopes, electrometric measurements, and separations will be emphasized. The lab is the practical application of instrumental procedures for specific determinations. It includes gas chromatography, mass spectroscopy, UV-Vis spectroscopy, IR spectroscopy, electrometric measurements, and thermal analysis.
Prerequisite: CHEM 214 with a minimum grade of C or CHEM 224 with a minimum grade of C.

CHEM 420. Advanced Organic Chemistry Laboratory. 1 Hour.
Utilize techniques to process organic chemical reactions and assess their progress and side reactions applying advanced analytical techniques. This course is designed for students planning to pursue a career in industrial chemistry or an advanced degree in chemistry.
Prerequisite: CHEM 204 with a minimum grade of C.

CHEM 421. Advanced Organic Chemistry: Reactions & Synthesis. 3 Hours.
Advanced topics in synthetic organic chemistry. Topics include carbon-carbon bond forming reactions and functional group interchanges and their application to the synthesis of complex structures.
Prerequisite: CHEM 204 with a minimum grade of C.

CHEM 422. Organic Spectroscopy. 2 or 3 Hours.
Designed for students that wish to pursue a graduate degree in chemistry, topics will focus on spectroscopic techniques that are used in the field of organic chemistry, including learning the underlying quantum mechanical systems that describe energy levels in organic molecules and the mathematical description of light as it interacts with molecules.
Prerequisite: CHEM 204 with a minimum grade of C.

CHEM 423. Advanced Organic Chemistry: Kinetics, Mechanisms & Heterocycles. 3 Hours.
A survey of specific topics within organic chemistry. Topics include an introduction to the kinetics of organic reactions and how the application of kinetic studies relates to the elucidation of organic mechanisms. The fundamentals of organic mechanisms are then used as the foundation to introduce concepts in heterocyclic chemistry.
Prerequisite: CHEM 204 with a minimum grade of C.

CHEM 425. Industrial Chemistry. 2 Hours.
Designed for students that are pursuing a career in industrial chemistry, this course will teach students about scale-up techniques to take viable products from the laboratory scale to the industrial manufacturing scale. Students will visit local companies to learn about plant equipment and design.
Prerequisite: CHEM 204 with a minimum grade of C and (CHEM 421 with a minimum grade of D or CHEM 423 with a minimum grade of D).

CHEM 427. Introduction to Polymer Chemistry. 2 Hours.
An introductory study of polymers and their properties. Topics covered will include polymerization mechanisms, polymer syntheses, and the characterization and application of various polymers.
Prerequisite: CHEM 204 with a minimum grade of C.

CHEM 450. Senior Research. 1 to 4 Hours.
Guided original research in the field of a student's interest. Introduction to basic principles of library and laboratory research leading to a solution of the problem and a written report. A student may earn a maximum of four semester hours in Chemistry 450. Permission of instructor and Department Chair required.

CHEM 480. Advanced Topics in Chemistry. 1 to 4 Hours.
Group or individual study of special topics in chemistry at an advanced level. Topics vary with student interest, but are selected from an advanced area of analytical, organic, inorganic, physical, or biochemistry, and are announced one semester in advance.

CHEM 500. Honors Course. 3 Hours.
At the discretion of the faculty, students may undertake a six-hour independent course of study in the senior year in order to broaden their educational experience within their major area of study. Students must meet specific GPA standards and arrange a faculty sponsor. The honors course criteria are outlined in the Academic Honors portion of the catalog.