

CHEMISTRY

Chemistry Major

The Chemistry curriculum is designed to provide a comprehensive background in the fundamentals of the science, and to contribute to the general education of the student. Graduates with a B.S. degree may find industrial or government employment or continue advanced studies in a graduate or professional school.

The B.A. degree is available for students who desire additional flexibility to prepare for a career in secondary education, the health professions (such as medicine or dentistry), law, business, engineering, computer science, or other related fields. The B.A. program in Chemistry includes specific concentrations that allow students to have a solid, fundamental background in Chemistry in combination with disciplines such as Art, Business, Computer Science, Education, Environmental Sciences, Forensic Science, Mathematics, Pharmaceutical Sciences, and Pre-Medical Studies. The ultimate goal is to create a curriculum that is easily adapted to the ever-changing challenges of modern society and of multidisciplinary academic endeavors.

The Wilkes Chemistry program is approved by the American Chemical Society for the professional training of chemists. Students who complete the B.S. program are certified for membership eligibility in the Society at graduation. The B.A. program in Chemistry may be approved, dependent upon the student's choice of chemistry courses. In all cases, students will choose specific courses in a concentration after consultation with departmental advisers.

Chemistry Major (B.S. Degree) - Required Courses and Recommended Course Sequence

First Semester	Credits
[[CHM-113]] – Elements & Compounds Lab	1
[[CHM-115]] – Elements & Compounds	3
[[ENG-101]] – Composition or Distribution Requirement	4
[[FYF-101]] – First-Year Foundations	3
[[MTH-111]] – Calculus I	4
Total Credits	15

Second Semester	Credits
[[CHM-114]] – The Chemical Reaction Lab	1
[[CHM-116]] – The Chemical Reaction	3
[[CHM-190]] – Freshmen Seminar	1
[[MTH-112]] – Calculus II	4

[[CS-125]] – Computer Science I	4
[[HST-101]] – Historical Foundations of the Modern World	3
Total Credits	16

Third Semester	Credits
[[CHM-231]] – Organic Chemistry I	3
[[CHM-233]] – Organic Chemistry Lab I	1
[[PHY-201]] – General Physics I	3
[[PHY-204]] – General Physics I Lab	1
[[MTH-212]] – Multivariable Calculus	4
[[PHL-101]] – Introduction to Philosophy or Foreign Language	3
Total Credits	15

Fourth Semester	Credits
[[CHM-232]] – Organic Chemistry II	3
[[CHM-234]] – Organic Chemistry Lab II	1
[[CHM-246]] – Analytical Chemistry Lab	1
[[CHM-248]] – Analytical Chemistry	3
[[CHM-291]] – Ethical Resp. in Mod. Sci.	1
[[PHY-202]] – General Physics II	3
[[PHY-205]] – General Physics II Lab	1
Area III requirement or free elective	3
Total Credits	16

Fifth Semester	Credits
[[CHM-341]] – Instrumental Methods	3
[[CHM-343]] – Instrumental Methods Lab	1
[[CHM-351]] – Physical Chem: Quantum & Spectro	3
[[CHM-353]] – Physical Chem: Quantum & Spectro Lab	1
[[MTH-211]] – Introduction to Ordinary Differential Equations	3

Chemistry

Area III or Area IV requirement	3
Total Credits	14

Sixth Semester	
[[CHM-322]] – Inorganic Chemistry	3
[[CHM-352]] – Physical Chem: Kinetics & Thermo	3
[[CHM-354]] – Physical Chem: Kinetics & Thermo Lab	1
[[CHM-365]] – Medical Biochemistry	4
[[CHM-390]] – Chemistry Junior Seminar	1
[[ENG-120]] – Introduction to Literature and Culture	3
Total Credits	15

Seventh Semester	
[[CHM-363]] – Biochemistry Lab	1
[[CHM-391]] – Senior Research I	2
Major Elective *	3
Area III or Area IV requirement	3
Free Electives	6
Total Credits	15

Eighth Semester	
[[CHM-323]] – Advanced Inorganic Chemistry Lab	1
[[CHM-392]] – Senior Research	2
Major Elective *	3
Area III requirement or free elective	3
Free Electives	6
Total Credits	15

**All B.S. chemistry majors must also complete two 300 level major elective courses in addition to the specifically required 300 level courses listed above.*

**MTH-211 is not a degree requirement but students are strongly encouraged to complete this course.*

Chemistry Major (B.A. Degree) - Concentrations and Minor Areas of Study

Art

Recommended courses for the B.A. degree in Chemistry with a concentration in Art:

ART 113 – Drawing I 3 cr.
ART 123 – Ceramics 3 cr.
ART 120 – Painting I 3 cr.
ART 122 – Sculpture 3 cr.
ART 140 - History of Art I 3 cr.
ART 141 - History of Art II 3 cr.

Recommended Area IV Distribution course

ART 101 – Experiencing Art 3 cr.

Recommended Free Elective

ART 121 – Printmaking 3 cr.

Business (Minor)

Chemistry majors may pursue a minor in one of the areas in Business. For details of minor degree programs in Business, see Accounting Minor, Business Administration Minor, Marketing Minor, and Entrepreneurship Minor.

Computer Science

Recommended courses for the B.A. degree in Chemistry with a concentration in Computer Science:

CS 126 – Computer Science II 4 cr.
CS 225 – Computer Science III 3 cr.
CS 324 – Systems Analysis 3 cr.
CS 325 – Database Management 3 cr.
CS 328 – Algorithms 3 cr.
CS 334 – Software Engineering 3 cr.
Free Elective: MTH 231 – Discrete Mathematics 3 cr.

Students pursuing a concentration in Computer Science must satisfy all prerequisites for recommended concentration courses.

Secondary Education (Major or Minor)

Students interested in becoming secondary teachers in Chemistry should make an appointment with the chairperson of the Education Department or the Coordinator of the Secondary Education Program as early as possible in their course of study, to plan their professional studies. These students will declare a major in Chemistry and as well as a major or minor in Secondary Education. The major in Secondary Education must be taken in conjunction with an approved major; it is not a stand alone major. Upon successful completion of the secondary education program, students may become certified in Pennsylvania to teach in grades 7-12 in their chosen field.

Students interested in pursuing either the major or the minor in Secondary Education should refer to the Education Department section of this bulletin for complete details of the curriculum and other degree requirements. Students

should also consult carefully with their Education program and Chemistry program advisors in planning their course of studies.

Total credits required for Secondary Education minor - 40 credits

Total credits required for Secondary Education major - 47 credits

Required courses for the major(*) or minor in Secondary Education are as follows:

- ED 180 Educational Psychology 3 cr.
- ED 190 Effective Teaching with Field Experience 3 cr.
- ED 191 Integrating Technology into the Classroom 3 cr.
- EDSP 210 Teaching Students with Special Needs 3 cr.
- ED 220 Teaching Culturally and Linguistically Diverse Learners 3 cr.
- EDSP 225 Special Education Methods I with Field Experience 3 cr.
- * ED 345 Assessment 3 cr.
- * ED 375 Middle Level/Secondary School Methods with Field Exp. 4 cr.
- ED 371 Teaching Methods in Science with Field Experience 4 cr.
- ED 380 Content Area Literacy 3 cr.
- EDSP 388 Inclusionary Practices (taken concurrently with ED 390) 3 cr.
- ED 390 Student Teaching with Seminar 12 cr.
- * These additional courses required in order to complete the major in Secondary Education.

- All Teacher Education candidates must apply for admission to the Teacher Education Program in the sophomore or junior year.
- To be admitted into the Teacher Education Program, candidates must
 - Attain a 3.0 GPA
 - Complete 48 credits including six credits in both Mathematics and English
 - Pass a test of basic skills
 - Submit required clearances showing 'no record'
- To remain in the Teacher Education Program, candidates must
 - Maintain a 3.0 GPA
 - Adhere to the Code of Professionalism and Academic Honesty
- To be certified as a teacher in Pennsylvania in grades 7-12, candidates must
 - Successfully complete all required Education courses, including student teaching
 - Graduate with a 3.0 cumulative GPA
 - Pass the appropriate exit test(s) in their content area
 - Apply for certification through the Pennsylvania Teacher Information Management System (TIMS).

Forensic Science

Recommended courses for the B.A. degree in Chemistry with a concentration in Forensic Science:

- BIO 121 – Principles of Modern Biology I 4 cr.
- CHM 398 – Forensic Chemistry 3 cr.
- PS 232 – Criminal Law 3 cr.
- PSY 242 – Personality 3 cr.
- PSY 355 – Forensic Psychology 3 cr.

SOC 222 – Criminology 3 cr.

Recommended Distribution Courses:

- EC 102 – Principles of Economics II 3 cr.
- PSY 101 – General Psychology 3 cr.
- SOC 101 – Introduction to Sociology 3 cr.

Recommended Free Electives:

- BIO 226 – Cellular and Molecular Biology 4 cr.
- BIO 345 – Genetics 4 cr.
- MTH 150 – Elementary Statistics 3 cr.

Students pursuing a concentration in Forensic Science must satisfy all prerequisites for recommended concentration courses.

Pre-Medical Studies

Recommended and required courses for the B.A. degree in Chemistry with a concentration in Pre-Medical Studies:

CHM 361 and 362 is recommended in place of CHM 365.

Required Courses:

- BIO 121 – Principles of Modern Biology I 4 cr.
- BIO 122 – Principles of Modern Biology II 4 cr.
- CS 265 – Medical Informatics 3 cr.

Recommended Courses (select 18 credits from the following list of courses):

- BIO 321 – Mammalian Physiology 4 cr.
- BIO 323 – Functional Histology 4 cr.
- BIO 326 – Immunology and Immunochemistry 4 cr.
- BIO 327 – Medical Microbiology 4 cr.
- BIO 328 – Developmental Biology 4 cr.
- BIO 329 – Virology 3 cr.
- BIO 345 – Genetics 4 cr.
- BIO 368 – Medical Botany 3 cr.
- BIO 398 – Medical Ethics 3 cr.
- CHM 398 – Brain Chemistry 3 cr.
- CHM 398 – Medicinal Chemistry 3 cr.
- MTH 150 – Elementary Statistics 3 cr.
- SP 210 – Medical Spanish 3 cr.

Students pursuing a concentration in Pre-Med Studies must satisfy all prerequisites for recommended concentration courses.

Sustainability

Recommended course for the B.A. degree in Chemistry with a concentration in Sustainability:

CHM 398 – Environmental Chemistry 3 cr.

The B.A. degree in Chemistry with a concentration in Sustainability requires a minimum of 29 credits in the concentration area. Students should select courses from the following content areas:

- Content Area I: Writing Perspective (3 cr.) Credits
 - ENG 202 – Technical and Professional Writing 3
 - ENG 228 – Professional and Workplace Writing 3
- Content Area II: Political and Legal Perspective (6 cr.) Credits

Chemistry

BA 335 – Law and Business 3
 PS 224 – Public Policy Analysis 3
 PS 260 – Introduction to Political Thinking 3
 Content Area III: Ethical Perspective (3 cr.) Credits
 PHL 218 – Environmental Ethics 3
 PHL 350 – Philosophy of Science 3
 Content Area IV: Environmental Perspective (17 cr.) Credits
 EES 210 – Global Climatic Change 3
 EES 240 – Principles of Environmental Science 3
 EES 261 – Regional Geography 3
 EES 271 – Environmental Mapping I: The Global Positioning System 3
 EES 272 – Environmental Mapping II: Geographic Information Systems 3
 EES 304 – Environmental Data Analysis 3
 EES 330 – Water Quality 3
 EES 332 – Air Quality 3
 EES 344 – Ecology 3
 EES 341 – Freshwater Ecosystems 3
 EES 343 – Marine Ecology 3
 EES 398 – Topics in EES 3
 ENV 305 – Solid Waste Management 3
 ENV 315 – Soils 3
 ENV 321 – Hydrology 4
 ENV 351 – Water and Wastewater Treatment 4
 ENV 353 – Air Pollution Control 3
 ENV 354 – Hazardous Waste Management 3
 ENV 398 – Topics in Engineering 3
 ME 322 – Engineering Thermodynamics 3

Students pursuing a concentration in Sustainability must satisfy all prerequisites for recommended concentration courses.

Chemistry Major (B.A. Degree) - Required Courses and Recommended Course Sequence

First Semester	Credits
[[CHM-113]] – Elements & Compounds Lab	1
[[CHM-115]] – Elements & Compounds	3
[[ENG-101]] – Composition	4
[[FYF-101]] – First-Year Foundations	3
[[MTH-111]] – Calculus I	4
Total Credits	15

Second Semester	Credits
[[CHM-114]] – The Chemical Reaction Lab	1
[[CHM-116]] – The Chemical Reaction	3
[[CHM-190]] – Freshmen Seminar	1
[[CS125]] – Computer Science I	4
[[MTH-112]] – Calculus II	4

[[HST-101]] – Historical Foundations of the Modern World	3
Total Credits	16

Third Semester	Credits
[[CHM-231]] – Organic Chemistry I	3
[[CHM-233]] – Organic Chemistry Lab I	1
[[PHY-201]] – General Physics I	3
[[PHY-204]] – General Physics I Lab	1
Area III requirement	3
[[PHL-101]] – Introduction to Philosophy or Foreign Language	3
Concentration Area or Minor Course	3
Total Credits	17

Fourth Semester	Credits
[[CHM-232]] – Organic Chemistry II	3
[[CHM-234]] – Organic Chemistry Lab II	1
[[CHM-246]] – Analytical Chemistry Lab	1
[[CHM-248]] – Analytical Chemistry	3
[[CHM-291]] – Ethical Resp. in Mod. Sci.	1
[[PHY-202]] – General Physics II	3
[[PHY-204]] – General Physics II Lab	1
Total Credits	13

Fifth Semester	Credits
[[CHM-341]] – Instrumental Methods	3
[[CHM-343]] – Instrumental Methods Lab	1
Concentration Area or Minor Course	3
Concentration Area or Minor Course	3
[[ENG-120]] - Introduction to Literature and Culture	3
Area III or Area IV requirement	3

Total Credits	16
----------------------	-----------

Sixth Semester	
[[CHM-322]] – Inorganic Chemistry	3
[[CHM-355]] – Physical Chemistry for the Life Sciences	4
[[CHM-357]] – Physical Chemistry for the Life Sci. Lab	1
[[CHM-365]] – Medical Biochemistry	4
[[CHM-390]] – Chemistry Junior Seminar	1
Concentration Area or Minor Courses	3
Total Credits	16

Seventh Semester	
[[CHM-363]] – Biochemistry Laboratory	1
[[CHM-391]] – Senior Research	2
Major Elective ⁺	3
Concentration Area or Minor Course	3
Area III or Area IV requirement	3
Free Elective [*]	3
Total Credits	15

Eighth Semester	
[[CHM-323]] – Advanced Inorganic Laboratory	1
[[CHM-392]] – Senior Research	2
Major Elective ⁺	3
Concentration Area or Minor Courses	3
Concentration Area or Minor Courses	3
Free elective [*]	3
Total Credits	15

^{*} All B.A. chemistry majors must also complete the required courses for their specific concentration or minor area of study which include: Art, Business, Computer Science, Education, Forensic Science, Pre-Medical Studies, and Sustainability. Students must work with their advisors to

verify completion of the requirements. ⁺B.A. students may, with the selection of the correct major electives have their degree certified by the American Chemical Society.

CHM. CHEMISTRY

CHM-105. CHEMISTRY AND MODERN SOCIETY

Credits: 3

This course will emphasize consumer applications of chemistry with some emphasis on environmental consequences of the use of various forms of energy (nuclear, coal, petroleum, natural gas) and everyday chemicals (foods, drugs, agricultural chemicals, and chemicals used in pest control).

CHM-111. FUNDAMENTALS OF CHEMISTRY

Credits: 4

Designed for students who do not intend to major in science or engineering, this one-semester course presents principles of chemistry. Topics include atomic structure, chemical bonding, gas laws, solutions, acid/base chemistry and an introduction to organic and biochemistry. A laboratory component is required as part of this course, in which students will develop basic principles of laboratory technique. Students may not receive credit for both CHM 111 and CHM 113/115. Three hours of class, one hour of problem session, and two hours of lab per week.

[Click here for course fee.](#)

Pre-Requisites

Departmental placement criteria are met.

CHM-113. ELEMENTS AND COMPOUNDS LAB

Credits: 1

This is the first chemistry laboratory course in the two-semester general chemistry sequence. Experiments are performed to reinforce the concepts learned in CHM-115. One three-hour laboratory per week.

[Click here for course fee.](#)

Pre-Requisites

Departmental placement criteria are met

Co-Requisites

[[CHM-115]]

CHM-114. THE CHEMICAL REACTION LAB

Credits: 1

This is the second chemistry laboratory course in the two-semester general chemistry sequence. Experiments are performed to reinforce the concepts learned in CHM-116. One three-hour laboratory per week.

[Click here for course fee.](#)

Pre-Requisites

[[CHM-113]] with a grade of 2.0 or better and [[CHM-115]] with a grade of 2.0 or better

Co-Requisites

[[CHM-116]]

Chemistry

CHM-115. ELEMENTS AND COMPOUNDS

Credits: 3

Emphasis is placed on the periodic table and stoichiometry, including chemical properties, physical states, and structure. Three hours of class and a one-hour problem session per week.

Corequisite: [[CHM-113]].

Pre-Requisites

Departmental placement criteria are met.

CHM-116. THE CHEMICAL REACTION

Credits: 3

A detailed study of chemical equilibria in aqueous solution. Three hours of class and a one-hour problem session per week.

Pre-Requisites

[[CHM-113]] with a grade of 2.0 or better and [[CHM-115]] with a grade of 2.0 or better

Co-Requisites

[[CHM-114]]

CHM-117. INTRODUCTORY CHEMISTRY LAB FOR ENGINEERS

Credits: 1

This is a one-semester introductory chemistry laboratory course for engineering students. Experiments are performed to reinforce the concepts learned in [[CHM-118]]. One three-hour lab per week.

[Click here for course fee.](#)

Pre-Requisites

Departmental placement criteria are met.

Co-Requisites

[[CHM-118]]

CHM-118. CHEMISTRY FOR ENGINEERS

Credits: 3

This course covers the foundations of chemistry, matter and measurements, periodicity, atomic and molecular structure, stoichiometry, states of matter, phase changes, kinetics, equilibrium, thermochemistry and electrochemistry. Four hours of lecture per week.

Pre-Requisites

Departmental placement criteria are met

Co-Requisites

[[CHM-117]]

CHM-190. FRESHMEN SEMINAR

Credits: 1

Terms Offered: Spring

Students will be introduced to important skills and content area in our major programs. Students will gain familiarity with the various subdisciplines of chemistry, tools & technologies utilized by chemists, potential career pathways and applications of chemistry in everyday settings. Students will also discuss chemistry and its subdisciplines in the news and modern society.

Pre-Requisites

Successful completion of [[CHM-115]] / [[CHM-113]] with grades of 2.00 or higher or instructor permission.

Co-Requisites

[[CHM-116]] / [[CHM-114]] or instructor permission.

CHM-231. ORGANIC CHEMISTRY I

Credits: 3

Terms Offered: Summer

An introduction to the chemistry of carbon compounds, this course develops the interconnected relationship between bonding, structure, properties and reactivity in organic compounds. Instrumental methods will be presented as a means to determine structure. Three hours of class and a one-hour problem session per week.

Pre-Requisites

[[CHM-114]] with a grade of 2.0 or better and [[CHM-116]] with a grade of 2.0 or better

Co-Requisites

[[CHM-233]]

CHM-232. ORGANIC CHEMISTRY II

Credits: 3

This course continues [[CHM-231]], with emphasis on organic synthesis. Three hours of class and a one-hour problem session per week.

Pre-Requisites

[[CHM-231]] with a grade of 2.0 or better and [[CHM-233]] with a grade of 2.0 or better

Co-Requisites

[[CHM-234]]

CHM-233. ORGANIC CHEMISTRY I LAB

Credits: 1

After an introduction to standard organic reaction, purification, physical characterization, and spectroscopic techniques, students will investigate concepts discussed in [[CHM-231]]. One three-hour laboratory per week.

[Click here for course fee.](#)

Pre-Requisites

[[CHM-114]] with a grade of 2.0 or better and [[CHM-116]] with a grade of 2.0 or better

Co-Requisites

[[CHM-231]]

CHM-234. ORGANIC CHEMISTRY II LAB**Credits:** 1

Weekly labs that parallel the lecture topics in [[CHM-232]] and emphasize organic synthesis and characterization, including multistep synthesis. Three hours per week.

[Click here for course fee.](#)

Pre-Requisites

[[CHM-231]] with a grade of 2.0 or better and [[CHM-233]] with a grade of 2.0 or better

Co-Requisites

[[CHM-232]]

CHM-235. ESSENTIALS OF ORGANIC CHEMISTRY**Credits:** 3

A one semester course covering the fundamentals of carbon chemistry. Nomenclature, stereochemistry, functional groups, spectroscopy, and reactions and mechanisms of alcohols, ethers, amines, alkyl halides, carbonyl compounds, and benzene are covered. Four hours of lecture per week.

Pre-Requisites

[[CHM-114]] with a grade of 2.0 or better and [[CHM-116]] with a grade of 2.0 or better.

Co-Requisites

[[CHM-237]]

CHM-237. ESSENTIALS OF ORGANIC CHEMISTRY LAB**Credits:** 1

A one semester fundamental organic chemistry laboratory course that introduces organic reactions, purification, physical characterization and spectroscopic techniques.

[Click here for course fee.](#)

Pre-Requisites

[[CHM-114]] with a grade of 2.0 or better and [[CHM-116]] with a grade of 2.0 or better.

Co-Requisites

[[CHM-235]]

CHM-246. ANALYTICAL CHEMISTRY LAB**Credits:** 1

Weekly labs that parallel the lecture topics in [[CHM-248]]. One three-hour laboratory per week.

[Click here for course fee.](#)

Pre-Requisites

[[CHM-114]] with a grade of 2.0 or better and [[CHM-116]] with a grade of 2.0 or better

Co-Requisites

[[CHM-248]]

CHM-248. ANALYTICAL CHEMISTRY**Credits:** 3

A course in the application of the principles of chemical equilibria to obtain the qualitative and quantitative information about the composition and structure of matter. An introduction to the importance of sampling is included along with methods for the statistical treatment of data. The course focuses primarily on the analyses of elemental and ionic species using electrochemical, spectroscopic, and chromatographic techniques. Three hours of lecture per week.

Pre-Requisites

[[CHM-114]] with a grade of 2.0 or better and [[CHM-116]] with a grade of 2.0 or better

Co-Requisites

[[CHM-246]]

CHM-256. POLYMER CHEMISTRY**Credits:** 3

This course covers topics in polymer composition and structure, polymerization mechanisms, stereochemistry of polymerization and reaction of polymers. Three hours of lecture per week.

Pre-Requisites

[[CHM-117]] with a grade of 2.0 or better and [[CHM-118]] with a grade of 2.0 or better

CHM-258. POLYMER CHEMISTRY LABORATORY**Credits:** 1

Experiments are conducted to emphasize the concepts learned in the Polymer Chemistry lecture course, [[CHM-256]].

Students will collect and process experimental data and develop laboratory skills. One three-hour laboratory per week.

[Click here for course fee.](#)

Pre-Requisites

[[CHM-117]], [[CHM-118]]

Co-Requisites

[[CHM-256]]

CHM-261. PLANT SAMPLE PREPARATION FOR CHEMICAL ANALYSIS**Credits:** 2

This is course in plant preparation for analytical chemical analysis, covering plant dehydration, digestion, and extraction of pertinent organic and inorganic chemical analytes for analysis on modern chemical instrumentation. One (1.0) hour per week of lecture/discussion and three (3.0) hours per week of laboratory.

[Click here for course fee.](#)

Pre-Requisites

[[CHM-231]] or instructor permission.

Co-Requisites

[[CHM-231]] or instructor permission.

Chemistry

CHM-291. ETHICAL RESPONSIBILITIES IN MODERN SCIENCE

Credits: 1

Terms Offered: Spring

Students will become familiar with ethical issues facing modern scientists, their role in maintaining an ethical environment, and learn to behave in an ethical fashion when conducting research as an undergraduate and moving forward. Students will also evaluate the role of scientists in society, and their responsibility to ensure the proper dissemination of scientific knowledge. Topics include: what is misconduct, roles in a lab setting and how they affect power dynamics, scientific communication, data ownership, human subjects and the IRB, and the societal responsibilities of scientists. Assignments will be tailored to the major program (including: biochemistry, cannabis chemistry, and other specific chemistry tracks) of the registered students.

Pre-Requisites

30 (or more) credits completed

CHM-322. INORGANIC CHEMISTRY

Credits: 3

[[CHM-322]] presents a survey of current topics in Inorganic Chemistry. The first half of the course offers a survey of main group chemistry, including individual group trends. The second half of the course covers Crystal Field Theory, Ligand Field Theory, reaction mechanisms, and organometallic compounds. Three hours of lecture per week.

Pre-Requisites

[[CHM-114]] with a grade of 2.0 or better & [[CHM-116]] with a grade of 2.0 or better

CHM-323. ADVANCED INORGANIC CHEMISTRY LAB

Credits: 1

Advanced Inorganic Chemistry Laboratory is the complimentary laboratory to CHM-322 Inorganic Chemistry. Students will build upon the foundational concepts first explored in CHM-322. An emphasis will be placed on the synthesis and characterization of transition metal complexes. Coordination chemistry reactions and mechanisms will be introduced as well as the chemistry of lanthanides. Students will gain experience in the handling of air-sensitive materials. Laboratory, three hours per week.

[Click here for course fee.](#)

Pre-Requisites

[[CHM-322]]

CHM-341. INSTRUMENTAL METHODS FOR CHEMICAL ANALYSIS

Credits: 3

A course in the fundamental principles that provide the basis for the design and fabrication of chemical instrumentation. The underlying physical basis for each method is introduced through an exploration of the capabilities, limitations, and applications of a wide range of separations, spectroscopic, and electrochemical methods. Three hours of lecture per week.

Pre-Requisites

[[CHM-246]] with a grade of 2.0 or better, [[CHM-248]] with a grade of 2.0 or better, [[MTH-112]], [[PHY-202]]

Co-Requisites

[[CHM-343]]

CHM-343. INSTRUMENTAL METHODS FOR CHEMICAL ANALYSIS LAB

Credits: 1

Weekly lab that corresponds to the lecture topics in [[CHM-341]]. One three-hour laboratory per week.

[Click here for course fee.](#)

Co-Requisites

[[CHM-341]]

CHM-346. ADVANCED SEPARATIONS CHEMISTRY

Credits: 2

Terms Offered: Spring

An analytical chemistry laboratory course in separations chemistry. The course will cover chromatography, including GC-MS, LC, and LC-MS with a focus on their application to cannabis and natural products analysis. The course will also cover the operation and maintenance of the modern chemical chromatography instrumentation. Meets for two-laboratory sessions per week.

[Click here for course fee.](#)

Pre-Requisites

[[CHM-341]] , [[CHM-343]] and [[CHM-261]] or instructor permission.

CHM-351. PHYSICAL CHEMISTRY: QUANTUM AND SPECTROSCOPY

Credits: 3

This course emphasizes the molecular approach to physical chemistry. It begins discussing the principles of quantum mechanics and their applications in chemistry, leading to atomic and molecular structure, and chemical bonding. These concepts are then used in the development of atomic and molecular spectroscopy. Photochemistry is introduced. Three hours of lecture per week.

Pre-Requisites

[[CHM-114]] with a grade of 2.0 or better, [[CHM-116]] with a grade of 2.0 or better, [[MTH-212]] and [[PHY-202]]

CHM-352. PHYSICAL CHEMISTRY: KINETICS AND THERMODYNAMICS**Credits:** 3

Statistical mechanics is used to formulate thermodynamics in terms of atomic and molecular properties, allowing a molecular interpretation of the laws of thermodynamics. Three hours of lecture a week.

Pre-Requisites

[[CHM-114]] with a grade of 2.0 or better, [[CHM-116]] with a grade of 2.0 or better, [[MTH-212]], and [[PHY-202]]

CHM-353. PHYSICAL CHEMISTRY: QUANTUM AND SPECTROSCOPY LAB**Credits:** 1

Laboratory experiments are performed in order to reinforce concepts in [[CHM-351]]. Bench as well as computational experiments will explore the photoelectric effect, resonance states of a particle in a one-dimensional box, applications of molecular orbital theory, and molecular spectroscopy. Three hours per week.

[Click here for course fee.](#)

Co-Requisites

[[CHM-351]]

CHM-354. PHYSICAL CHEMISTRY: KINETICS AND THERMODYNAMICS LAB**Credits:** 1

Laboratory experiments are performed in order to reinforce concepts in [[CHM-352]]. Bench as well as computational experiments explore calorimetry, phase equilibria, colligative properties, kinetics, and applications of the Monte Carlo method to chemical kinetics. One three-hour lab per week.

Co-Requisites

[[CHM-352]]

CHM-355. PHYSICAL CHEMISTRY FOR LIFE SCIENCES**Credits:** 4

An introduction to traditional physical chemistry topics, including additional topics related to life sciences. Laws of thermodynamics, equilibria, kinetics, and spectroscopy will be discussed in terms of their application to life sciences. Four hours of lecture per week.

Pre-Requisites

[[CHM-114]] with a grade of 2.0 or better, [[CHM-116]] with a grade of 2.0 or better, and [[PHY-202]]

Co-Requisites

[[CHM-357]]

CHM-357. PHYSICAL CHEMISTRY FOR LIFE SCIENCES LAB**Credits:** 1

The laboratory experiments emphasize concepts presented in [[CHM-355]]. Course includes experimental work, analysis of a research article, and computer simulations relevant to life sciences. One three-hour laboratory pre week.

Co-Requisites

[[CHM-355]]

CHM-361. BIOCHEMISTRY: STRUCTURE AND FUNCTION**Credits:** 3

This course presents a study of the physical and chemical properties of proteins, nucleic acid, fatty acids, and carbohydrates, emphasizing the relationship between the chemical structure and the biological function. The course includes the physical methods of biochemistry, enzyme kinetics, bioenergetics, and nucleic acid transcription and translation. Three hours of lecture per week.

Pre-Requisites

[[CHM-232]] with a grade of 2.0 or better

CHM-362. BIOCHEMISTRY: METABOLISM**Credits:** 3

This course presents a study of the catabolism and anabolism of carbohydrates, fatty acids, and amino acids. The course emphasizes the regulation and integration of major metabolic pathways, including glycolysis, the Krebs cycle, electron transport, gluconeogenesis, pentose phosphate pathway, fatty acid metabolism, and amino acid metabolism. Three hours of lecture per week.

Pre-Requisites

[[CHM-232]] with a grade of 2.0 or better

CHM-363. BIOCHEMISTRY LABORATORY**Credits:** 1

Laboratory experiments, which emphasize biochemical techniques used in isolation and characterization of macromolecules. Included in the course are various chromatographic techniques, electrophoresis, spectrophotometry, and classic biochemical methods. Laboratory, three hours a week.

[Click here for course fee.](#)

Pre-Requisites

Prerequisite or Corequisite: [[CHM-361]] or permission of instructor.

CHM-365. MEDICAL BIOCHEMISTRY**Credits:** 4

Introduction to basic biochemistry concepts, focusing on the structure and function of vitamins, proteins, and lipids, as well as bioenergetics and major catabolic pathways. The catabolism of carbohydrates, fats and amino acids, including reactions and regulation, will be discussed. Common metabolic pathways of drugs, enzyme induction and metabolism down regulation will also be presented. Four hours of lecture per week. Cross-listed with [[PHA-365]] and [[BEGR-465]].

Pre-Requisites

[[CHM-232]] or [[CHM-235]] with a grade of 2.0 or better, or permission of the instructor

Chemistry

CHM-370. CHM 371, CHM 372 INTEGRATED LABORATORIES I, II, III

Credits: 1-2 each

Laboratory experiments related to the five major areas of chemistry. Labs will be chosen in order that students might demonstrate proficiency in each of the required areas. Labs will include synthesis, isolation, and characterization of chemical compounds, spectroscopy, kinetics, calorimetry, chromatography, electrophoresis, and other chemical and biochemical methods. Three hours of laboratory per week per credit hour.

[Click here for course fee.](#)

Pre-Requisites

[[CHM-232]] with a grade of 2.0 or better, [[CHM-234]] with a grade of 2.0 or better and [[CHM-341]] with a grade of 2.0 or better

CHM-377. INTRODUCTION TO TOXICOLOGY

Credits: 3

Terms Offered: Fall

An introduction to toxicology, including its history, types of poisons, their mode of operation and the biochemistry of detoxification. Environmental problems caused by toxic contaminants will be discussed.

This course is offered in the fall semester of even numbered years.

Pre-Requisites

[[CHM-232]] , [[CHM-234]] and [[BIO-226]] or instructor permission.

CHM-379. MEDICINAL CHEMISTRY

Credits: 3

Terms Offered: Fall

The course provides an introduction to drugs, their action and discovery. Topics covered include drug structure & solubility, structure-activity & quantitative structure relationships, drugs from natural sources, the role of biological membranes in drug delivery, the role of receptors & messengers, enzymes, and an introduction to drug and analogue synthesis.

This course is offered in the fall semester of odd numbered years.

Pre-Requisites

[[CHM-232]] , [[CHM-234]] and [[BIO-226]] or instructor permission.

CHM-380. NMR SPECTROSCOPY

Credits: 3

This course explores the capabilities of the Chemistry Department's NMR spectrometer, and provides a groundwork in NMR theory beyond the level covered in the sophomore organic course. Topics covered include hardware, data processing, chemical shifts and coupling, one- and two-dimensional pulse sequences, dynamic NMR, the NOE effect, and gradient methods. Offered in alternate years.

CHM-390. JUNIOR SEMINAR

Credits: 1

CHM-390 is a one-hour course offered during the spring semester. It is designed to prepare chemistry and biochemistry majors for their careers after graduation and for their capstone research projects, undertaken in the fourth year. The course will cover topics such as résumé preparation, communication of scientific information, internships, job searches, and preparation for graduate school. Students will prepare a topical literature review on their chosen project in conjunction with their selection of a research advisor.

Pre-Requisites

45 hours of service to the Chemistry Department. Requirements; Junior standing and declared major in Chemistry or Biochemistry.

CHM-391. SENIOR RESEARCH I

Credits: 2

Students will plan and execute a chemistry research project under the direction of a faculty member. It is expected that this will be a laboratory research project. Students will also learn how to search the chemical literature. Students are required to attend weekly Department seminars and present at least one seminar. Requirements: Senior standing in a Chemistry curriculum.

[Click here for course fee.](#)

Pre-Requisites

[[CHM-352]] with a grade of 2.0 or better or [[CHM-355]] with a grade of 2.0 or better

CHM-392. SENIOR RESEARCH II

Credits: 2

Students will carry out a chemistry research project under the direction of a faculty member. It is expected that the project will be a laboratory research project. The project must culminate in a written report and the results must be presented at a Department poster event. Students are also required to attend any seminars hosted by the Department. Six hours of laboratory / research work per week.

[Click here for course fee.](#)

Pre-Requisites

[[CHM-391]] with a grade of 2.0 or better

CHM-395. INDEPENDENT RESEARCH

Credits: 1-3

Independent study and research for advanced students in the field of the major under the direction of a staff member. A research paper is required.

Requirements: permission of the instructor.

[Click here for course fee.](#)

CHM-396. INDEPENDENT RESEARCH**Credits:** 1-3

Independent study and research for advanced students in the field of the major under the direction of a staff member. A research paper is required.

Requirements: permission of the instructor.[Click here for course fee.](#)**CHM-398. TOPICS****Credits:** 1-3

A study of topics of special interest, such as advanced physical chemistry, advanced analytical chemistry, advanced organic chemistry, surface and colloid chemistry, nuclear chemistry, chemical kinetics, polymer chemistry, or spectroscopy.

Pre-Requisites

Will vary according to the specific topics course.

CHM-399. COOPERATIVE EDUCATION**Credits:** 1-6

Professional cooperative education placement in a private or public organization related to the student's academic objectives and career goals. In addition to their work experience, students are required to submit weekly reaction papers and an academic project to a Faculty Coordinator in the student's discipline. See the Cooperative Education section of this bulletin for placement procedures. Requirements: Sophomore standing; minimum 2.0 cumulative GPA; consent of the academic advisor; and approval of placement by the department chairperson. Students without the indicated prerequisites for 200 and 300-level chemistry courses may enroll after written permission of the instructor has been approved by the department chair.