

# CHEMISTRY

## Courses

### CHM 101. Introductory General, Organic, and Biochemistry I. 3 Hours

The first semester of a two-semester course covering fundamentals of general, organic and biochemistry as they relates to the health sciences, human medicine, or science education. The topics include states of matter, scientific measurements, balancing chemical equations, acid-base properties of aqueous reactions, pH-scale, buffers, and intramolecular and intermolecular chemical bonding. Foundational general chemistry topics essential to understanding biological systems and health sciences are emphasized.

### CHM 101L. Introductory General, Organic, and Biochemistry Laboratory I. 1 Hour

Laboratory course to complement CHM 101. Laboratory procedures reinforce concepts covered in lecture with an emphasis on relating chemistry to the health sciences and human medicine. One three-hour laboratory session each week. Corequisite(s): CHM 101.

### CHM 102. Introductory General, Organic, and Biochemistry II. 3 Hours

The second part of a two-semester course that covers the fundamentals of general, organic and biochemistry subject areas. Topics include an introduction to chemical nomenclature, structure, and function of biologically relevant organic compounds including function and reactivity of chemical groups commonly encountered in living systems. This course will also cover fundamental components of cell structure, transcription and translation, and metabolism as it relates to chemical principles and reactivity. Several aspects of organic chemistry relevant to living organisms will be emphasized. Prerequisite(s): CHM 101.

### CHM 102L. Introductory General, Organic, and Biochemistry Laboratory Course II. 1 Hour

Laboratory course to complement CHM 102, a lecture course which covers the fundamentals of general, organic and biochemistry as it relates to the health sciences or human medicine. One three-hour laboratory session each week. Prerequisites: CHM 101L. Corequisites: CHM 102.

### CHM 115. College Preparatory Chemistry. 3 Hours

One-term course for students desiring to enter a science or engineering program but whose background is insufficient for CHM 123 and CHM 124. Unacceptable for credit toward chemistry requirements in any chemistry program.

### CHM 115L. College Preparatory Chemistry Laboratory. 1 Hour

Course to accompany CHM 115 or to be elected by students in CHM 200 who lack previous chemistry laboratory experience. One three-hour laboratory each week.

### CHM 123. General Chemistry. 3 Hours

Comprehensive treatment of the fundamentals of general chemistry. Prerequisite(s): One year of high school chemistry or equivalent.

### CHM 123L. General Chemistry Laboratory. 1 Hour

Laboratory course to complement CHM 123. One three-hour laboratory session each week. Corequisite(s): CHM 123.

### CHM 124. General Chemistry. 3 Hours

Comprehensive treatment of the fundamentals of general chemistry. Prerequisite(s): CHM 123.

### CHM 124L. General Chemistry Laboratory. 1 Hour

Laboratory course to complement CHM 124. One three-hour laboratory session each week. Prerequisites: CHM 123L and CHM 123 and CHM 124 (can be taken concurrently).

### CHM 190. Seminar I. 0 Hours

Overview of methods of scientific oral presentation and formal conversation within the molecular sciences professional community.

### CHM 200. Chemistry & Society. 3 Hours

Examination of issues such as environmental quality, disease, hunger, synthetic materials, and law enforcement by the application of chemical principles. Course is for non-science majors. Depending upon background and experience, a student needing a laboratory course may enroll in SCI220L. Prerequisite(s): One year of high school chemistry or equivalent.

### CHM 201. Quantitative Analysis. 3 Hours

Application of the principles of chemical equilibrium to the theory and techniques of gravimetric, volumetric, spectrophotometric, and electroanalytical methods of chemical analysis. Prerequisite(s): CHM 124, CHM 124L.

### CHM 201L. Quantitative Analysis Laboratory. 1 Hour

Course to accompany CHM 201. One three-hour laboratory period each week.

### CHM 234. Energy Resources. 3 Hours

The chemical and geological aspects of formation, production, and benefits/costs (including environmental impacts) of energy derived from fossil fuels (coal and hydrocarbons), biofuels (e.g., ethanol production), radioactive materials (nuclear power), and renewable sources (e.g., geothermal, hydro, wind, and solar power). Prerequisite(s): CHM 123, CHM 124. Corequisite(s): GEO 208.

### CHM 290. Seminar II. 0 Hours

Overview of methods of scientific oral presentation and formal conversation within the molecular sciences professional community.

### CHM 302. Physical Chemistry. 3 Hours

Essential elements of thermodynamics, chemical kinetics, equilibria, and electrochemistry for those with a primary interest in the life sciences. For B.A. chemistry majors and premedical, pre dental, and biology majors. Prerequisite(s): CHM 124.

### CHM 302L. Physical Chemistry Laboratory. 1 Hour

Course to accompany CHM 302. One three-hour laboratory each week. Prerequisite(s): CHM 201, CHM 201L. Corequisite(s): CHM 302.

### CHM 303. Physical Chemistry. 3 Hours

Fundamentals of thermodynamics, chemical kinetics, electrochemistry, and spectroscopy with a mathematics format. For B.S. chemistry and biochemistry majors and chemical engineers. Prerequisite(s): CHM 201 or equivalent. Corequisite(s): MTH 218.

### CHM 303L. Physical Chemistry Laboratory. 1 Hour

Course to accompany CHM 303. One three-hour laboratory each week. Prerequisite(s): MTH 218.

### CHM 304. Physical Chemistry. 3 Hours

Fundamentals of thermodynamics, chemical kinetics, electrochemistry, and spectroscopy with a mathematics format. For B.S. chemistry and biochemistry majors and chemical engineers.

### CHM 304L. Physical Chemistry Laboratory. 1 Hour

Course to accompany CHM 304. One three-hour laboratory each week. Corequisite(s): MTH 218.

### CHM 313. Organic Chemistry. 3 Hours

Major topics in organic chemistry including synthesis, mechanisms, stereochemistry, and spectroscopy. Required of all chemistry majors and students in the life sciences. Prerequisite(s): CHM 124.

**CHM 313L. Organic Chemistry Laboratory. 1 Hour**

Common separation, purification, and analytical techniques including chromatography and spectroscopy. One three-hour laboratory each week. Prerequisite(s): CHM 124, 124L Corequisite(s): CHM 313.

**CHM 314. Organic Chemistry. 3 Hours**

Major topics in organic chemistry including synthesis, mechanisms, stereochemistry, and spectroscopy. Required of all chemistry majors and students in the life sciences. Prerequisite(s): CHM 313.

**CHM 314L. Organic Chemistry Laboratory. 1 Hour**

Synthesis and characterization of organic materials utilizing skills from CHM 313L. One three-hour laboratory each week. Prerequisite(s): CHM 313L. Corequisite(s): CHM 314.

**CHM 317. Spectroscopic Identification of Organic Compounds. 1 Hour**

The use of nuclear magnetic resonance, infrared, and mass spectrometry in elucidating structures. Emphasis on interpretation and integration of spectral data in problem solving. Prerequisite(s): (CHM 314, CHM 314L) or equivalent.

**CHM 319L. Advanced Organic Synthesis Laboratory. 1 Hour**

Preparation of organic compounds by single and multi-step synthetic sequences. Basic techniques in synthesis including use of organometallics, inert atmosphere, temperature control, extraction, vacuum distillation, column chromatography, recrystallization, and spectroscopic characterization methods. One four-hour laboratory each week. Prerequisite(s): CHM 314, CHM 314L.

**CHM 341. Environmental Chemistry. 3 Hours**

An introduction to the chemical processes in the environment. Topics include chemical equilibrium in aqueous solution, reaction mechanisms as applied to atmospheric chemistry, and analytical methods commonly applied to environmental samples. Prerequisite(s): CHM 314 or permission of instructor.

**CHM 341L. Environmental Chemistry Laboratory. 1 Hour**

Laboratory course to accompany CHM 341. Corequisite(s): CHM 341.

**CHM 390. Seminar III. 0 Hours**

Overview of methods of scientific oral presentation and formal conversation within the molecular sciences professional community.

**CHM 404. Special Topics in Physical Chemistry. 3 Hours**

Thorough treatment of topics such as electrochemistry, macromolecules, photochemistry, or spectroscopy. May be repeated as topics change. Prerequisite(s): CHM 302 or CHM 303.

**CHM 410. Biological Inorganic Chemistry. 3 Hours**

An advanced course which considers the role of metal ions in biological and plant systems. For example, alkali and alkaline earth metal ions and their roles in membrane stabilization, nerve signals, and electrical gradients. Transition metal ions in metalloenzymes (superoxidized dismutase, carbonic anhydrase, hemoglobin, hemocyanin) and their role in redox processes, transport, and catalysis. Metal complexes as therapeutics and imaging agents. Prerequisites: CHM 314.

**CHM 412. Intermediate Organic Chemistry. 3 Hours**

Modern theory and practice of organic chemistry. May include structure-reactivity relationships, reaction mechanism, and synthetic topics not normally treated in introductory courses. Prerequisite(s): CHM 302 or equivalent; CHM 313, CHM 314; senior standing.

**CHM 415. Analytical Chemistry. 2 Hours**

Chemical analysis based on modern instrumentation. Chromatographic, electrochemical, and spectroscopic methods. Prerequisite(s): CHM 201, CHM 201L; (CHM 302 or CHM 304).

**CHM 415L. Analytical Chemistry Laboratory. 2 Hours**

Course to accompany CHM 415. Two three-hour laboratory sessions each week. Prerequisite(s): CHM 201L; CHM 302 or equivalent.

**CHM 417. Inorganic Chemistry. 3 Hours**

An advanced course in modern inorganic chemistry. Atomic structure, principles of bonding and structure, acid-base chemistry, periodicity, coordination compounds, nonaqueous solvents, electrochemistry, molecular symmetry, organometallic compounds, and the chemistry of selected representative elements. Prerequisite(s): CHM 314. Corequisite(s): CHM 302 or CHM 304.

**CHM 418L. Inorganic Chemistry Laboratory. 1 Hour**

Laboratory course dealing with the synthesis and characterization of inorganic and organometallic compounds. Topics include vacuum and inert atmosphere techniques, separation and purification, spectroscopic characterization, X-ray diffraction, magnetic moment, and conductance measurements. Prerequisite(s): CHM 201L, CHM 314L. Corequisite(s): CHM 417.

**CHM 420. Biochemistry. 3 Hours**

The fundamental aspects of the chemistry and biochemistry of carbohydrates, lipids, proteins, and nucleic acids. Enzymology, protein purification, bioenergetics, metabolism of carbohydrates, lipids, amino acids, nucleotides and nucleic acids, elementary molecular biology, and control processes are described. Acceptable preparation for medical school. Prerequisite(s): CHM 314.

**CHM 420L. Biochemistry Lab for the Medical Sciences. 1 Hour**

A laboratory course to accompany CHM420, biochemistry. Prerequisite(s): CHM314, CHM314L. Corequisite(s): CHM420.

**CHM 426. Biosynthetic Organic Chemistry. 3 Hours**

Mechanistic fundamentals of the biosynthesis and transformation of organic natural products, with special emphasis on medicinal compounds, toxins, pheromones and other secondary metabolite structures. Prerequisite(s): (CHM 314, CHM 314L) or equivalent.

**CHM 427. Medicinal Chemistry. 3 Hours**

The chemical mechanisms of action of the major drug classes will be surveyed with particular emphasis on the facets of organic chemistry that control drug-receptor interactions, metabolism and mechanisms of toxicity and resistance. First term. Prerequisite(s): CHM 314; (CHM 420 or CHM 451).

**CHM 438. Sustainability and Chemistry. 3 Hours**

Chemical industrial practices drive many sustainability challenges in the near and long term. Many chemical technologies can address the sustainability of these practices as long as the costs (monetary and environmental) of such innovations are accurately presented and evaluated. Sustainability and Chemistry is an advanced 1 semester course describing chemical concepts and principles that underlie the foundations for a more sustainable world. This course analyzes the root chemical and societal causes of unsustainable practices in chemical transformations in our everyday life, and explores techniques to evaluate them. The core technologies discussed will be deeply integrated in the current environmental, economic, and social pillars of modern society. We will specifically address green chemistry principles with learning how to create and manage life cycle assessments (cradle to grave) with computational tools. We will also discuss molecular design to reduce hazards to the environment, and how we can establish practices to quantitatively evaluate the health and safety of core chemical technologies. Prerequisites: CHM 102 or CHM123 or any fundamental chemistry, sustainability, biology, or engineering courses that include sustainability ideas with permission.

**CHM 450. Advanced Organic Synthesis. 3 Hours**

Fundamentals of synthesis and transformations of organic compounds, with emphasis on mechanisms; pericyclic reactions; small and medium ring synthesis; chemoselectivity, regioselectivity, stereoselectivity, retrosynthesis, functional group transformations, carbon-carbon bond forming reactions, oxidations, reductions and protecting groups. Prerequisite: (CHM 314, CHM 314L) or equivalent.

**CHM 451. General Biochemistry I. 3 Hours**

Discussion of the chemistry and biochemistry of carbohydrates, amino acids, proteins, and nucleic acids, including health-science and methodologic aspects. Descriptions of enzymology, protein purification, and carbohydrate metabolism related to such topics as bioenergetics, membranes, and disease processes. Recommended for students desiring entry into graduate and professional schools. Prerequisite(s): CHM 201, CHM 314.

**CHM 452. General Biochemistry II. 3 Hours**

Discussion of selected topics in bioenergetics, and metabolism of lipids, amino acids, porphyrins, nucleic acids, and proteins. Current aspects of nutrition, biochemical genetics, endocrinology, regulation, and genetic engineering addressed and related to health-science topics as time permits. Suitable preparation for medical school. Prerequisite(s): CHM 451.

**CHM 454. Rational Drug Design. 3 Hours**

Introduction to drug target selection, lead compound discovery, and application of structure-activity relationships and computational chemistry towards refinement and optimization of lead compounds and their derivatives. Use of molecular graphics software and publicly available macromolecular structure databases will provide the foundation for evaluating macromolecular models of drug targets and allow a hands-on exploration of the structure/function relationships of proteins that have been successful targets of rational drug design. Prerequisite(s): (CHM 420 or CHM 452) or equivalent.

**CHM 458. Metabolism and Human Disease. 3 Hours**

This course examines the connections between metabolism, human disease and diet with an emphasis placed on current research related to these topics. Prerequisites: Undergraduate biochemistry course that covers metabolism CHM 420, CHM 452, HSS 307 or BIO 403.

**CHM 462L. Biochemistry Laboratory. 1 Hour**

Laboratory course to accompany biochemistry lecture courses. Spectrophotometry, pH and dissociation, enzymologic methodology and analytical techniques, chromatographic techniques. Corequisite(s): CHM 420 or CHM 451.

**CHM 463L. Bioanalytical Chemistry Laboratory. 1 Hour**

Introduction to analytical methods in current use in biochemistry. Course will focus on separations and spectroscopic methods for the analysis of biomolecules. Prerequisite(s): CHM 201, CHM 201L, CHM 302.

**CHM 477. Honors Thesis Project. 3 Hours**

First of two courses leading to the selection, design, investigation, and completion of an independent, original Honors Thesis project under the guidance of a faculty research advisor. Restricted to students in the University Honors Program with permission of the program director and department chairperson. Students pursuing an interdisciplinary thesis topic may register for three semester hours each in two separate disciplines in consultation with the department chairpersons. Prerequisite(s): Approval of University Honors Program.

**CHM 478. Honors Thesis Project. 3 Hours**

Second of two courses leading to the selection, design, investigation, and completion of an independent, original Honors Thesis project under the guidance of a faculty research advisor. Restricted to students in the University Honors Program with permission of the program director and department chairperson. Students pursuing an interdisciplinary thesis topic may register for three semester hours each in two separate disciplines in consultation with the department chairpersons. Prerequisite(s): Approved 477; approval of University Honors Program.

**CHM 480. Professional Practices Seminar. 1 Hour**

Practicum which culminates in the presentation of a technical talk on a topic in chemistry to peers and faculty members. Emphasis on the molecular scale of observation.

**CHM 490. Seminar IV. 1 Hour**

Presentation of a research topic during the weekly seminar series for the Department of Chemistry. Prerequisite(s): CHM 480.

**CHM 495. Introduction to Research Seminar. 0 Hours**

Research topics presented by visiting scientists and faculty, and the results of thesis research by senior students. Required of all junior chemistry and biochemistry majors in the B.S. programs. Grading Option two.

**CHM 496. Professional Practices Seminar. 0 Hours**

After discussions of the chemical literature and information retrieval, resumes, graduate education, and career opportunities, students present technical talks on topics with social, ethical, or historical implications. Required of all chemistry and biochemistry majors, both B.S. and B.A.

**CHM 497. Research Seminar. 0 Hours**

A series of seminars as described under CHM 495. Required of all senior chemistry and biochemistry majors in the B.S. programs.

**CHM 498. Research & Thesis. 3 Hours**

All students in the B.S. programs including co-op students are required to enroll for a minimum of three semester hours in a research course (CHM 498). Students may take additional research semester hours (CHM 499) if the work extends for more than two semesters. Successful completion of research courses requires the submission of a typewritten thesis and the presentation of a seminar. With the prior approval of the department chairperson, B.S. co-op students may substitute work experience for research. Prerequisite(s): Permission of department chairperson.

**CHM 499. Research & Thesis. 1-3 Hours**

All students in the B.S. programs including co-op students are required to enroll for a minimum of three semester hours in a research course (CHM 498). Students may take additional research semester hours (CHM 499) if the work extends for more than two semesters. Successful completion of research courses requires the submission of a typewritten thesis and the presentation of a seminar. With the prior approval of the department chairperson, B.S. co-op students may substitute work experience for research. Prerequisite(s): CHM 498; permission of department chairperson.

**CHM 512. Intermediate Organic Chemistry. 3 Hours**

Modern theory of organic chemistry and reaction mechanisms. Prerequisite(s): CHM 314 or equivalent.

**CHM 515. Analytical Chemistry. 2 Hours**

Methods of analysis based on modern instrumentation including chemical, electrical, and spectral methods. Prerequisite(s): CHM 201 or CHM 302 or CHM 304.

**CHM 515L. Analytical Chemistry Laboratory. 2 Hours**

Laboratory course to accompany CHM 515.

**CHM 517. Inorganic Chemistry. 3 Hours**

An introductory course. The fundamentals of modern inorganic chemistry including atomic structure, principles of structure and bonding, acid-based chemistry, periodicity, coordination compounds, nonaqueous solvents, electrochemistry, molecular symmetry, and the chemistry of representative elements.

**CHM 525. Principles of Organic Chemistry. 3 Hours**

An introduction to the fundamentals of organic chemistry. Prerequisite(s): CHM 124.

**CHM 526. Principles of Organic Chemistry. 3 Hours**

An introduction to the fundamentals of organic chemistry. Prerequisite(s): CHM 124.

**CHM 528. Theoretical Principles of Chemistry. 3 Hours**

No description available. Prerequisite(s): MTH 218.

**CHM 528L. Theoretical Principles of Chemistry Laboratory. 1 Hour**

Laboratory course to accompany CHM 527 - CHM 528. One three-hour laboratory per week.

**CHM 536. Biosynthetic Organic Chemistry. 3 Hours**

Mechanistic fundamentals of the biosynthesis and transformation of organic natural products, with special emphasis on medicinal compounds, toxins, pheromones and other secondary metabolite structures. Prerequisite(s): CHM 314, CHM 314L or equivalent.

**CHM 538. Sustainability and Chemistry. 3 Hours**

Chemical industrial practices drive many sustainability challenges in the near and long term. Many chemical technologies can address the sustainability of these practices as long as the costs (monetary and environmental) of such innovations are accurately presented and evaluated. Sustainability and Chemistry is an advanced one semester course describing chemical concepts and principles that underlie the foundations for a more sustainable world. This course analyzes the root chemical and societal causes of unsustainable practices in chemical transformations in our everyday life, and explores techniques to evaluate them. The core technologies discussed will be deeply integrated in the current environmental, economic, and social pillars of modern society. We will specifically address green chemistry principles with learning how to create and manage life cycle assessments (cradle to grave) with computational tools. We will also discuss molecular design to reduce hazards to the environment, and how we can establish practices to quantitatively evaluate the health and safety of core chemical technologies. Prerequisites: Undergraduates taking this course would need permission to enroll.

**CHM 539. Special Topics in Physical Chemistry. 3 Hours**

Topics of current interest in areas such as chemical instrumentation, electronics, physical biochemistry, macromolecular chemistry, and spectroscopy.

**CHM 541. Topics in Physical Chemistry. 3 Hours**

Modern aspects of physical chemistry, which may include the solid state, electrochemistry, or mathematical methods of physical chemistry.

**CHM 544. Coordination Chemistry. 3 Hours**

Properties of transition metal ions, reaction mechanisms in coordination compounds, bioinorganic systems, electron transfer mechanisms, and the experimental tools common to coordination chemistry.

Prerequisite(s): CHM 517 or equivalent.

**CHM 545. Organometallic Chemistry. 3 Hours**

An advanced one-semester course describing fundamental coordination chemistry to metal ions, the general properties and bonding in organometallic complexes, methods used for structural analysis of organometallic complexes, and core chemical mechanisms surrounding metathesis, polymerization in organic and bioorganometallic chemistry. Prerequisites: CHM 314 or with instructor permission.

**CHM 546. Special Topics in Modern Analytical Chemistry. 3 Hours**

Modern analytical methods. Subject matter may include NMR, EPR, electroanalytical methods, GLC, mass spectrometry, IR and Raman spectroscopies, visible and ultraviolet spectrophotometric methods, X-ray techniques, ESCA and Auger spectroscopies, atomic absorption, and fluorescence.

**CHM 550. Special Topics in Organic Chemistry. 3 Hours**

Modern physical organic chemistry, spectroscopy, photochemistry, molecular rearrangements, stereochemistry, and natural products.

**CHM 551. General Biochemistry I. 3 Hours**

Discussion of the chemistry and biochemistry of carbohydrates, amino acids, proteins, and nucleic acids, including health-science and methodologic aspects. Descriptions of enzymology, protein purification, and carbohydrate metabolism related to such topics as bioenergetics, membranes, and disease processes. prerequisite(s): CHM 201, CHM 314.

**CHM 552. General Biochemistry II. 3 Hours**

Discussion of selected topics in bioenergetics, and metabolism of lipids, amino acids, porphyrins, nucleic acids, and proteins. Current aspects of nutrition, biochemical genetics, endocrinology, regulation, and genetic engineering are addressed and related to health-science topics as time permits. Prerequisite(s): CHM 551.

**CHM 553. Topics in Biochemistry. 1-3 Hours**

Topics of current interest in biochemistry. Prerequisite(s): (CHM 551 or CHM 552) or permission of instructor.

**CHM 554. Directed Readings. 1-3 Hours**

Readings in Chemistry.

**CHM 555. Modern Trends in Chemistry. 3 Hours**

An advanced topics course that offers an up-to-date treatment of new areas of research. Possible subjects to be offered in this course include, but are not limited to, synthetic chemistry of natural and medicinal products, nano-materials/polymer chemistry, and advanced biochemical topics. Prerequisite(s): Graduate standing.

**CHM 557. Biophysical Chemistry. 3 Hours**

No description available.

**CHM 558. Metabolism and Human Disease. 3 Hours**

This course provides a graduate-level understanding of the connections between metabolism, human disease and diet with an emphasis placed on current research related to these topics. Prerequisites: Undergraduate biochemistry course that covers metabolism CHM 420, CHM 452, HSS 307 or BIO 403. Corequisites: BIO 551 or BIO 552.

**CHM 560. Research I. 0-9 Hours**

Research.

**CHM 561. Research II. 0-9 Hours**

Research.