

# Chemistry & Biochemistry (CHM)

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## CHM 109. Chemistry Fundamentals. (1)

Introduction to vocabulary and symbols used in introductory chemistry courses. Enables students to make a smooth transition into CHM 111. A student may not receive credit for graduation for both this course and any chemistry course numbered 141 or above.

## CHM 111. Chemistry in Modern Society. (3)

For non-science majors. Considers both nature of basic chemical processes and ways that chemistry affects our society. Introduction to how scientists approach problems and make decisions. 3 Lec. IVB. PA-2B. CAS-D, CAS-QL.

## CHM 111L. Chemistry in Modern Society Laboratory. (1)

Laboratory course for non-science majors. Students will explore basic chemistry principles that are relevant in everyday life through observation and data analysis. Emphasis will be placed on activities and assessments that develop quantitative reasoning skills and critical thinking with a focus on application to global issues and the development of civic-mindedness. 1 Lab. IVB. PA-2B. CAS-D/LAB, CAS-QL.

## CHM 121. Introduction to Forensic Chemistry. (4)

Integrated lecture and laboratory course for all majors that, by incorporating the exciting theme of forensic science, builds an appreciation for the underlying aspects of chemistry. The topics include paper chromatography of ink, soil analysis, synthetic and natural fibers, fingerprints, ions in urine, drug analysis, fire accelerants, blood alcohol determination, and microscopic hair analysis. Typically taught on the Middletown Campus. IVB. PA-2B. 3 Lec. 1 Lab.

## CHM 131. Chemistry of Life Processes. (4)

Integrated lecture and laboratory course for non-science majors that relate basic inorganic and organic chemical processes to those of biochemistry. Explores the nature of atoms and molecules in terms of simple structures and reactions, and the more complex structures of biochemical molecules and their interactions with living systems. IVB, LAB. CAS-D/LAB. PA-2B.

3 Lec. 1 Lab.

Prerequisite: introductory high school physical science and algebra or CHM 109.

## CHM 141. College Chemistry. (3)

General chemistry lecture course. Examines the fundamentals of atomic and molecular structure, chemical reactions and stoichiometry, properties of solutions, thermochemistry, gases, and chemical bonding. Students also develop ideas, experience, methodology, and skills used in the application of scientific methodology. Credit not given for both CHM 141R and 141. IVB. PA-2B. CAS-D.

Prerequisite: A math ACT score of 22 (or SAT math sub-score 530) or higher, or completion of MTH 025, or MTH 122 or MTH 125 or MTH 151, or Miami Math Placement Test score of 8 or higher, or permission of instructor; high school chemistry is recommended.

## CHM 141H. College Chemistry. (3)

General chemistry lecture course. Examines the fundamentals of atomic and molecular structure, chemical reactions and stoichiometry, properties of solutions, thermochemistry, gases, and chemical bonding. Students also develop ideas, experience, methodology, and skills used in the application of scientific methodology. Credit not given for both CHM 141R and 141. IVB, LAB. PA-2B.

Prerequisite: one year of high school chemistry and a math ACT score of 22 (or a SAT math sub-score 530) or higher or permission of instructor.

Co-requisite: CHM 144.

## CHM 141R. College Chemistry. (4)

Coordinated lecture and recitation to develop ideas, experience, methodology, and skills used in the application of scientific methodology. Framework is consideration of fundamental principles of atomic and molecular structure, chemical bonding, properties of solutions, and chemical reactions. Gain skills in developing hypotheses, observing chemical phenomena, collecting data, and evaluating results critically. Credit not given for both CHM 141 and 141R. IVB. PA-2B. CAS-D/LAB.

Prerequisite: One year of high school chemistry and a math ACT score of 22 (or SAT math sub-score 530) or higher, or completion of MTH 025 or Miami Math Placement Test score of 8 or higher.

Co-requisite: CHM 144.

## CHM 142. College Chemistry. (3)

In this follow-up to CHM 141, students will continue their study of the properties of solutions, thermodynamics, and acids and basis. The course also explores chemical kinetics, chemical equilibrium, coordination chemistry and electrochemistry.

Prerequisite: CHM 141.

Co-requisite: CHM 145.

## CHM 142H. College Chemistry. (3)

In this follow-up to CHM 141, students will continue their study of the properties of solutions, thermodynamics, and acids and basis. The course also explores chemical kinetics, chemical equilibrium, coordination chemistry and electrochemistry.

Prerequisite: CHM 141.

Co-requisite: CHM 145.

## CHM 142M. College Chemistry for Majors. (3)

Covers the same content as CHM 142, but assumes interest in chemistry as a major (See CHM 142). Credit not given for both 142M and 142.

Prerequisite: CHM 141.

Co-requisite: CHM 145M.

## CHM 144. College Chemistry Laboratory. (2)

Presents laboratory exercises to illustrate the fundamental principles of chemistry. An emphasis will be placed on safety, laboratory skills, techniques for simple quantitative measurements and the use of modern instrumentation for data collection and analysis. Students will also gain skills in developing hypotheses, observing chemical phenomena, collecting and sharing data and evaluating results critically. IVB. PA-2B. CAS-D/LAB.

Prerequisite or Co-requisite: CHM 141.

**CHM 144M. College Chemistry Laboratory for Majors. (2)**

Covers content similar to CHM 144. The focus of this laboratory course is for students with an interest in chemistry or biochemistry as a major. IVB. PA-2B. CAS-D/LAB.

Prerequisite: high school chemistry or permission of instructor.

Co-requisite: CHM 141.

**CHM 145. College Chemistry Laboratory. (2)**

Presents laboratory exercises to illustrate the fundamental principles of chemistry. In this follow-up to CHM 144, students will continue working on their laboratory skills, using techniques for quantitative measurements and using modern instrumentation for data collection and analysis. Includes chemical kinetics, equilibrium, acids and bases, and electrochemistry. CAS-D/LAB.

Prerequisite: CHM 144.

Co-requisite: CHM 142 required.

**CHM 145M. College Chemistry Laboratory. (2)**

Covers content similar to CHM 145. The focus of this laboratory course is for students with an interest in chemistry or biochemistry as a major. CAS-D/LAB.

Prerequisite: CHM 144M.

Co-requisite: CHM 142M.

**CHM 147. Introductory Seminar-Chemistry/Biochemistry. (1)**

An introduction to the various Chemistry and Biochemistry programs. Conducted in a seminar/lecture format, the course will include professional orientation, an introduction to undergraduate research opportunities and career options for the various majors.

**CHM 177. Independent Studies. (0-6; maximum 10)****CHM 204. Organic Chemistry I Review. (1)**

Concentrated review of first semester organic chemistry concepts that will be important for understanding second semester organic chemistry material. The course will revisit topics such as: resonance, acid/base chemistry, stereochemistry, and substitution, elimination, and addition reactions and introduce their importance for further course work in chemistry.

Prerequisite: CHM 241 or CHM 251, or permission of instructor.

**CHM 231. Fundamentals of Organic Chemistry. (4)**

One-semester course covering organic structures and reactions with simple examples from living systems. Credit may not be received for both CHM 231 and 241, 242 or 251, 252. CAS-D/LAB.

3 Lec. 1 Lab.

Prerequisite: CHM 142 and 145.

**CHM 241. Organic Chemistry. (3)**

Study of stereochemistry and the reaction mechanisms of various types of organic compounds with examples of chemical reactions in biological systems. For premedical, pre-dental students and science majors including majors in chemistry or biochemistry. Credit may not be received for both CHM 231 and 241, 242 or 251, 252.

Prerequisites: CHM 142 or 142M.

**CHM 242. Organic Chemistry. (3)**

Study of stereochemistry and the reaction mechanisms of various types of organic compounds with examples of chemical reactions in biological systems. For premedical and pre-dental students and science majors including majors in chemistry or biochemistry.

Prerequisite: CHM 241.

**CHM 244. Organic Chemistry Laboratory. (2)**

Introduction to experimental techniques involved in synthesis, purification, and chemical identification of organic molecules. CAS-D/LAB. Prerequisite or co-requisite: CHM 241.

Prerequisite: CHM 145.

**CHM 245. Organic Chemistry Laboratory. (2)**

Introduction to experimental techniques involved in synthesis, purification, and chemical identification of organic molecules. CAS-D/LAB.

Prerequisite: CHM 244.

Prerequisites or Co-requisite: CHM 242.

**CHM 251. Organic Chemistry for Chemistry Majors. (3)**

For those planning a career in chemistry or biochemistry. Modern concepts of molecular structure, mechanisms of organic reactions, and synthetic methods for organic compounds, including natural products.

Prerequisite: CHM 142M.

Co-requisite: CHM 254.

**CHM 252. Organic Chemistry for Chemistry Majors. (3)**

For those planning a career in chemistry or biochemistry. Modern concepts of molecular structure, mechanisms of organic reactions, and synthetic methods for organic compounds, including natural products.

Prerequisite: CHM 251.

Co-requisite: CHM 255.

**CHM 254. Organic Chemistry Laboratory for Chemistry Majors. (2)**

Introduction to modern experimental techniques in organic chemistry as applied to synthesis, purification, and determination of the structure of organic molecules. CAS-D/LAB.

Prerequisite: CHM 145 or equivalent.

Prerequisite or Co-requisite: CHM 241 or CHM 251.

**CHM 255. Organic Chemistry Laboratory for Chemistry Majors. (2)**

Introduction to modern experimental techniques in organic chemistry as applied to synthesis, purification, and determination of the structure of organic molecules. CAS-D/LAB. Prerequisite or co-requisite: CHM 242 or CHM 252.

Prerequisite: CHM 254.

**CHM 277. Independent Studies. (0-6; maximum 10)****CHM 332. Outlines of Biochemistry. (3)**

Overview of the major topics of biochemistry. Topics include: biological functions of proteins, carbohydrates, lipids and nucleic acids, central metabolic pathways and controls, and relevant examples in nutrition and health. 3 Lec. CAS-D.

Prerequisite: CHM 231, CHM 242, or CHM 252.

**CHM 332L. Outlines of Biochemistry Lab. (1)**

Laboratory course designed to enhance the learning experiences in CHM 332. Emphasis on problem solving and data analysis using basic biochemical experiments. Prerequisite/co-requisite: CHM 332.

**CHM 340. Internship. (0-20)****CHM 363. Analytical Chemistry. (3)**

Fundamentals of analytical chemistry including classical and instrumental methods. Typically offered on Middletown Campus.

Prerequisite: CHM 142, CHM 145.

Co-requisite: CHM 364.

**CHM 364. Analytical Chemistry Laboratory. (2)**

Analytical chemistry laboratory including classical and instrumental methods. CAS-D/LAB. Typically offered on Middletown Campus.  
Prerequisites: CHM 142, CHM 145.  
Co-requisite: CHM 363.

**CHM 375. Analytical Chemistry for Majors. (3)**

Instrumental methods of analysis including theory, problem solving, and laboratory experiments applied to real-life samples. Instruction in writing and quantitative literacy. ADVW. PA-1C. CAS-Q. CAS-W.  
1 Lec. 2 Lab.  
Prerequisites: CHM 242 or CHM 252.

**CHM 377. Independent Studies. (0-6; maximum 10)****CHM 411/CHM 511. Learning Theories in Chemistry. (3)**

Students are introduced to the learning theories that inform chemistry education research and the methods therein. Students will focus on how the applications of research findings on how humans learn chemistry can be used to improve teaching and learning. Additionally, the course introduces students to chemistry education research as a field and an essential source of scholarship on learning chemistry.  
Prerequisite: CHM 242 or 252.

**CHM 415/CHM 515. Misconceptions in Chemistry. (3)**

Students explore chemistry education research on common misconceptions about advanced topics in undergraduate chemistry such as thermodynamics, kinetics, and electrochemistry. Students probe learners' prior ideas and consider the role of assessment in emphasizing deeper understanding over memorization while investigating methods that help learners construct scientifically adequate models of chemical behavior. Additionally, the course introduces students to chemistry education research as a field and an essential source of scholarship on learning chemistry.  
Prerequisite: CHM 242 or 252.

**CHM 417/CHM 517. Advanced Inorganic Chemistry. (3)**

Survey of fundamental principles of contemporary inorganic chemistry.  
Prerequisites: CHM 142.

**CHM 419. Synthesis Lab. (2)**

Designed to introduce undergraduate students in chemistry/biochemistry to advanced synthetic methods. Students will synthesize and characterize organic and inorganic molecules, and characterize the products using NMR, EPR, and other modern instrumentation.  
Prerequisites: CHM 242 and CHM 245; or CHM 252 and CHM 255.

**CHM 423/CHM 523. Synthetic and Systems Biology. (3)**

Design principles and applications of microbial cells. Topics include synthetic pathway design, artificial photosynthesis, repurposing genetic codons, genome synthesis and editing, and genetic circuit design among others. CHM 432/CHM 532, MBI 425/MBI 525, and MBI 445/MBI 545 are highly recommended before taking this course. Cross-listed with: MBI 423/MBI 523/523 and BIO 423/BIO 523/523.  
Prerequisite: MBI 201, or equivalent, or permission of instructor.

**CHM 425/CHM 525. Advanced Organic Chemistry. (3)**

Advanced topics in physical and synthetic organic chemistry, including kinetics and mechanism, stereochemistry, orbitals in bonding and reactivity, modern synthetic methods, and multistep synthesis.  
Prerequisite: grade of C- or better in CHM 242 or CHM 252.

**CHM 426/CHM 526. Spectroscopic Identification of Structure. (3)**

Application of infrared, ultraviolet, nuclear magnetic resonance, and mass spectrometry to the solution of structural problems in organic chemistry.  
Prerequisite: CHM 242 or CHM 252.

**CHM 429/CHM 529. Polymer Chemistry. (2)**

Comprehensive overview and examination of the methods used to synthesize and characterize macromolecules. Both descriptive and mechanistic organic chemistry, as it relates to polymer synthesis, is discussed. The relationship between molecular structure and material properties will be another focus of the course.  
Prerequisite: CHM 242 or CHM 252 or Graduate Standing.

**CHM 430. Topics in Biochemistry. (1-3; maximum 8)**

Advanced coverage of selected topics in biochemistry.  
Prerequisite: CHM 432/CHM 532 completed with grade of at least C-

**CHM 432/CHM 532. Fundamentals of Biochemistry. (4)**

Principles of biochemistry with emphasis on structure of biological molecules and metabolic processes.  
Prerequisite: CHM 242 or equivalent.

**CHM 436. Principles in Fermentation. (3)**

Through a combination of lectures from faculty and experts in the fermentation industry, hands-on laboratory experiences, and site visits, students will develop an understanding of the importance of fermentation in the food, beverage, and drug industry. Students will have the opportunity to learn how microbiology, biology, chemistry/biochemistry and engineering are interrelated in the fermentation industry.  
Prerequisites: CHM 332 or CHM 432/CHM 532; or MBI 201; or CPB 204.  
Cross-listed with CPB/MBI.

**CHM 438. Biochemistry Laboratory. (2)**

Laboratory course utilizing modern biochemical techniques. Emphasis on logic, design, and execution of biochemical experimentation.  
Prerequisite: CHM 432/CHM 532 with a grade of C- or higher or permission of instructor.

**CHM 450. Topics in Organic Chemistry. (1-3; maximum 9)**

Advanced coverage of selected topics in organic chemistry.  
Prerequisite: C- or better in CHM 242 or CHM 252.

**CHM 451/CHM 551. Physical Chemistry for Chemistry Majors. (3)**

Fundamentals of physical chemistry including thermodynamics, kinetics, quantum chemistry, statistical thermodynamics, and spectroscopy. Note: Credit may not be received for both CHM 451/CHM 551 and CHM 471/CHM 571.  
Prerequisites: MTH 151 or equivalent and PHY 192 or PHY 162.

**CHM 452/CHM 552. Physical Chemistry for Chemistry Majors. (3)**

Fundamentals of physical chemistry including thermodynamics, kinetics, quantum chemistry, statistical thermodynamics, and spectroscopy. Note: Credit may not be received for both CHM 452/CHM 552 and CHM 472/CHM 572.  
Prerequisite: MTH 251 or equivalent and CHM 451/CHM 551 or equivalent.

**CHM 454/CHM 554. Instrumental Analysis. (3)**

Lecture course emphasizing spectroscopic, electrochemical, and chromatographic methods to determine chemical composition of samples with principles of chemical equilibrium presented to assist in data interpretation.  
Prerequisite or Co-requisite: CHM 375.

**CHM 456. Chemical Measurements II. (2)**

Laboratory course emphasizing instrumental methods of chemical analysis and methods of measuring physical-chemical properties. CAS-D/LAB. Recommended prerequisite: CHM 454/CHM 554. Prerequisite: CHM 452/CHM 552 or CHM 454/CHM 554.

**CHM 460. Topics in Analytical Chemistry. (1-3; maximum 12)**

Advanced coverage of selected topics in the area of analytical chemistry.

**CHM 466/CHM 566. Bioinformatics Computing Skills. (3)**

Study of the core computational and biological concepts in bioinformatics, with programming in Python, MySQL and Ubuntu OS. You will gain hands-on experience in popular bioinformatics applications, including BLAST, sequence alignment, genome browser, and gene annotation, among others. Prerequisites: BIO 256; or CSE 174; or permission of instructor. Cross-listed with BIO/CSE/MBI.

**CHM 471/CHM 571. Biophysical Chemistry I. (3)**

Fundamentals of physical biochemistry including thermodynamics, macromolecular structure, kinetics, enzyme kinetics, quantum chemistry, and biophysical spectroscopy. Note: Credit may not be received for both CHM 451/CHM 551 and CHM 471/CHM 571. Prerequisites: MTH 151 or MTH 249 or equivalent and PHY 182 & 184 or PHY 192 or PHY 162.

**CHM 472/CHM 572. Biophysical Chemistry II. (3)**

Fundamentals of physical biochemistry including thermodynamics, macromolecular structure, kinetics, enzyme kinetics, quantum chemistry, and biophysical spectroscopy. Note: Credit may not be received for both CHM 452/CHM 552 and CHM 472/CHM 572. Prerequisite: MTH 251 or equivalent and CHM 451/CHM 551 or CHM 471/CHM 571.

**CHM 477. Independent Studies. (0-6; maximum 10)****CHM 480. Departmental Honors. (1-6; maximum 6)**

Prerequisite: permission of department chair.

**CHM 491. Chemistry in Societal Issues. (3)**

Chemistry is involved in many of the societal issues facing this nation. In order to protect the environment, create new energy sources, improve health, and increase consumer product safety, understanding chemistry is critical to the problem-solving process. It is important for students in technical fields to understand the interface between the known chemistry and government regulations, public perception, and legal interpretations. Students critically evaluate and form positions on current issues of national interest. SC. Prerequisite: any 300-level chemistry course.

**CHM 492. Independent Research Capstone in Chemistry. (3)**

Students work intensively with instructor to identify a suitable research question; perform research necessary to resolve the question; write a detailed report of the research, results, and the broader scientific and social implications of the overall research project; and communicate the research results to other students and professionals by participation in departmental research presentations and/or participation in a recognized professional meeting. SC. Prerequisite: permission of instructor and department chair, and one semester of CHM 377, 477, 480, or 490 Independent Study.

**CHM 600. Seminar in Chemistry. (1; maximum 12)**

Required of all chemistry graduate students in residence. Prerequisite: graduate standing.

**CHM 641. Organic Principles and Theory. (3)**

Advanced molecular orbital calculations and experimental methods for elucidation of organic reaction mechanisms. Prerequisite: CHM 242 or 252 and 452 or 472.

**CHM 642. Organic Synthetic Methods. (3)**

Scope and limitations of synthetically useful reactions and techniques. Overall strategy and problems in multistep synthesis of natural products emphasized. Prerequisite: CHM 242 or 252.

**CHM 650. Seminar in Molecular Biology. (1; maximum 3)**

Discussion of current literature in molecular biology. Prerequisite: graduate standing. Cross-listed with BIO 650 and MBI 650.

**CHM 655. Theory and Practice of Chemical Laboratory Instruction. (2)**

Evaluation and examination of current practices for the teaching of laboratory components of chemistry courses. Emphasis placed on safety, technique, and evaluation. The proper use of reference material and library search techniques is also emphasized.

**CHM 664. Separation Science. (2)**

Fundamental principles of separation science emphasizing chromatographic theory, gas and liquid chromatography, and capillary electrophoresis. Prerequisite: CHM 554 or permission of instructor.

**CHM 677. Independent Studies. (0-6; maximum 10)****CHM 700. Research for Master's Thesis. (1-12; maximum 30)**

Prerequisite: Graduate Standing.

**CHM 720. Seminar in Organic and Biochemistry. (1; maximum 9)**

Discussion of recent research findings in areas of organic and biochemistry. Prerequisite: permission of instructor.

**CHM 725. Biological Chemistry Seminar. (1; maximum 9)**

Discussion of recent research findings in biological chemistry. Prerequisite: Permission of instructor.

**CHM 730. Seminar in Chemistry Education. (1; maximum 9)**

Discussion of current literature in chemistry education. Prerequisite: Permission of instructor.

**CHM 740. Topics in Organic and Biochemistry. (1-3; maximum 10)**

Advanced coverage of selected topics in organic and biochemistry. Prerequisite: permission of instructor.

**CHM 750. First Year Graduate Seminar. (1)**

Presentation and discussion of research activities being carried out by the research faculty in Chemistry and Biochemistry. Designed to facilitate selection of a research adviser by the end of the term.

**CHM 760. Selected Topics in Inorganic and Analytical Chemistry. (1-3; maximum 10)**

Advanced coverage of selected topics in inorganic and analytical chemistry. Prerequisite: permission of instructor.

**CHM 770. Topics in Physical Chemistry. (1-3; maximum 10)**

Advanced coverage of selected topics in area of physical chemistry. Prerequisite: permission of instructor.

**CHM 780. Seminar in Analytical, Inorganic, and Physical Chemistry. (1; maximum 9)**

Discussion of recent developments in the areas of analytical, inorganic, and physical chemistry.

Prerequisite: permission of instructor.

**CHM 790. Research. (1-15; maximum 20)**

Prerequisite: graduate standing.

**CHM 850. Research for Doctoral Dissertation. (1-16; maximum 60)**

Prerequisite: admission to Ph.D. program.