

CHEMISTRY

Office: 169 Chemistry Building; 313-577-7784

Chairperson: Matthew J. Allen

Associate Chairperson: Jeremy Kodanko

Academic Services Officers: Erin Bachert, Melissa Rochon

<https://clas.wayne.edu/chemistry> (<https://clas.wayne.edu/chemistry/>)

The courses offered by this Department are designed to serve the needs of three distinct groups of students:

1. those majoring in chemistry with the intention of entering the chemical profession,
2. those majoring in chemistry with the intention of entering other professional fields, and
3. those majoring in other subjects who desire to elect chemistry courses as part of their programs. Students intending to major in chemistry should refer to the program tabs for more information.

Students with no prior experience in chemistry may elect CHM 1000 (for non-science majors); CHM 1020 (for non-science majors and certain preprofessional students); CHM 1060 (for non-science majors and certain preprofessional students); or CHM 1040, which is intended for students who need higher-level chemistry work but who fail to qualify for CHM 1100 or CHM 1125 or whose math/science skills are weak.

Students who have had a year or more of high school chemistry or the equivalent may register for CHM 1100 or CHM 1125 (for science and preprofessional majors) provided that they meet the other eligibility requirements outlined below. Election of CHM 1000, CHM 1020, CHM 1100, or CHM 1125, or will satisfy the University General Education Requirement for a physical science.

Terminal Chemistry Courses

CHM 1000 is a terminal survey course designed primarily to acquaint non-science students with the principles of chemistry in a format requiring minimal mathematical skills. When elected for four credits, this course includes a laboratory which satisfies the University General Education Requirement for a laboratory course.

CHM 1020 and CHM 1030 represent a terminal sequence designed to introduce the basic principles of chemistry and survey the various fields of chemistry for non-science majors and certain pre-professional students such as pre-nursing, occupational health, engineering technicians and others.

CHM 1060 is a single terminal course designed to introduce the basic principles of chemistry and survey the various fields of chemistry for non-science majors and certain pre-professional students such as pre-nursing, occupational health and others.

Foundational Chemistry

CHM 1040 is designed as the beginning chemistry course for science majors, pre-professional students, and other students who have had little prior experience in chemistry and/or mathematics. CHM 1100 (or CHM 1125) and CHM 1130 are complementary and corequisite courses which should be taken during the same term. is a classroom-focused course. is a laboratory-focused course. This also describes the succeeding corequisite sets CHM 1140/CHM 1150, CHM 1240/CHM 1250, and CHM 2220/CHM 2230.

General Chemistry

CHM 1100/CHM 1130 are designed as the beginning courses for science majors and preprofessional students who have a good

background in high school chemistry. (CHM 1125/CHM 1130 is the sequence for students in the College of Engineering.) Eligibility for CHM 1100/CHM 1130 must be established by passing a placement examination, covering basic high school material, which is administered by Testing, Evaluation, and Student Life Research, 698 Student Center Building. The qualifying examination is administered several times prior to and during registration.

The sequence of CHM 1100/CHM 1130 and CHM 1140/CHM 1150 are prerequisite to all higher numbered courses in chemistry.

Advanced Placement Credit

Advanced placement college credit in chemistry shall be awarded for scores earned in the chemistry placement examination as follows:

Score of 4 or 5: Credit awarded for CHM 1100/CHM 1130 and CHM 1140 (eight credits); student is eligible to enroll in CHM 1240/CHM 1250.

Score of 3: Credit awarded for CHM 1100/CHM 1130 (five credits); student is eligible to enroll in CHM 1140/CHM 1150.

ALLEN, MATHEW: Ph.D., California Institute of Technology; B.S., Purdue University; Professor and Chair

BHAGWAT, ASHOK S.: Ph.D., Pennsylvania State University; M.S., Indian Institute of Technology; B.A., University of Bombay; Professor

BOUR, JAMES: Ph.D., University of Michigan; B.Sc., Hope College; Assistant Professor

BROCK, STEPHANIE L.: Ph.D., University of California, Davis; B.S., University of Washington; Professor

CHA, JIN K.: Ph.D., University of Oxford; B.S., Seoul National University; Professor

CHEKMENEV, EDUARD: Ph.D., University of Louisville; B.S., Perm State University; Associate Professor

CHERNYAK, VLADIMIR: Ph.D., Russian Academy of Science, Institute of Spectroscopy; M.S., Moscow Physics and Technology Institute; Professor

CHOW, CHRISTINE: Ph.D., California Institute of Technology; M.A., Columbia University; B.A., Bowdoin College; Professor

DENT, MATTHEW: Ph.D., University of Wisconsin-Madison; B.S. James Madison University; Assistant Professor

ENDICOTT, JOHN F.: Ph.D., Johns Hopkins University; B.A., Reed College; Professor Emeritus

FEHL, CHARLIE: Ph.D., University of Kansas; B.S., University of Michigan; Assistant Professor

GROYSMAN, STANISLAV: Ph.D., B.S., Tel Aviv University; Associate Professor

HENDRICKSON, TAMARA: Ph.D., California Institute of Technology; B.A., Wellesley College; Associate Professor

HICKEY, SEAN: Ph.D., B.S., University of New Orleans; M.S., University of Michigan; Assistant Professor of Teaching

KODANKO, JEREMY: Ph.D., University of California at Irvine; B.S., University Wisconsin, Madison; Associate Professor and Associate Chair

KUNTZLEMAN, TOM: Ph.D., University of Michigan-Ann Arbor; M.S., University of North Carolina at Greensboro; B.S.Ed., Bloomsburg University ; Assistant Professor of Teaching

LI, WEN: Ph.D., Stony Brook University; B.S., Peking University; Professor

LINTVEDT, RICHARD L.: Ph.D., University of Nebraska; B.A., Lawrence University; Professor Emeritus

LINZ, THOMAS H.: Ph.D., University of Kansas; B.S., Truman State University; Assistant Professor

LIU, ZHENFEI: Ph.D., University of California at Irvine; B.S., Peking University; Assistant Professor

LONG, LUO: Ph.D., University of Utah; B.S., Beijing University of Aeronautics and Astronautics; Assistant Professor

MATTI, ANDREA: Ph.D., Michigan State University; B.Sc., Madonna University; Assistant Professor of Teaching

NGUYEN, HIEN: Ph.D., University of Illinois at Urbana-Champaign; B.S., Tufts University; Professor

PFLUM, MARY KAY H.: Ph.D., Yale University; B.A., Carleton College; Professor

POOLE, COLIN F.: Ph.D., Keele University; M.Sc., Bristol University; B.Sc., Leeds University; Professor Emeritus

RABUFFETTI, FEDERICO A.: Ph.D., Northwestern University; B.Sc., Universidad de la Republica; Associate Professor

RIGBY, JAMES H.: Ph.D., University of Wisconsin; B.S., Case Western Reserve University; Professor Emeritus

RODGERS, MARY T.: Ph.D., California Institute of Technology; B.S., Illinois State University; Professor

ROMANO, LOUIS J.: Ph.D., B.A., Rutgers University; Professor Emeritus

RORABACHER, DAVID B.: Ph.D., Purdue University; B.S., University of Michigan; Professor Emeritus

RURY, AARON: Ph.D., University of Michigan; B.S., University of Illinois at Urbana-Champaign; Assistant Professor

SANTA LUCIA, JOHN: Ph.D., University of Rochester; B.S., Clarkston University; Professor Emeritus

SCHLEGEL, H. BERNHARD: Ph.D., Queen's University; B.Sc., University of Waterloo; Professor Emeritus

STOCKDILL, JENNIFER L.: Ph.D., California Institute of Technology; B.S., Virginia Polytechnic Institute and State University; Associate Professor

TOMCO, DAJENA: Ph.D., B.S., Wayne State University; Assistant Professor of Teaching

TRIMPIN, SARAH: Doktor der Naturwissenschaften, Max-Planck-Institute for Polymer Research, University of Mainz; Vor-Diplom, Diplom, University of Konstanz; Professor

VERANI, CLAUDIO N.: Ph.D., Max-Planck-Institut für Strahlenchemie and Ruhr-Universität; M.Sc., B.S., Universidade Federal de Santa Catarina; Professor

WALKER, ALICE: Ph.D., University of North Texas; B.S., University of Michigan_Dearborn; Assistant Professor

WINTER, CHARLES H.: Ph.D., University of Minnesota; B.S., Hope College; Professor

WU, NANCY: Ph.D., University of Michigan; B.S., University of California - Los Angeles; Assistant Professor of Teaching

ZIBUCK, REGINA: Ph.D, University of Pennsylvania; M.S., B.S., Bucknell University; Associate Professor of Teaching

- Chemistry (B.A.) (<http://bulletins.wayne.edu/undergraduate/college-liberal-arts-sciences/chemistry/chemistry-ba/>)
- Chemistry (B.S.) (<http://bulletins.wayne.edu/undergraduate/college-liberal-arts-sciences/chemistry/chemistry-bs/>)
- Chemistry Minor (<http://bulletins.wayne.edu/undergraduate/college-liberal-arts-sciences/chemistry/chemistry-minor/>)
- Biochemistry and Chemical Biology (B.S.) (<http://bulletins.wayne.edu/undergraduate/college-liberal-arts-sciences/chemistry/biochemistry-chemical-biology-bs/>)
- Biochemistry and Chemical Biology Minor (<http://bulletins.wayne.edu/undergraduate/college-liberal-arts-sciences/chemistry/biochemistry-chemical-biology-minor/>)
- Cannabis Chemistry (Undergraduate Certificate) (<http://bulletins.wayne.edu/undergraduate/college-liberal-arts-sciences/chemistry/cannabis-chemistry-undergraduate-certificate/>)

CHM 1000 Chemistry and Your World Cr. 4

Satisfies General Education Requirement: Natural Scientific Inquiry, Physical Sciences

Facts and theories from analytical, inorganic, organic, and physical chemistry, and from biochemistry; their consequences in life processes and the environment. Meets General Education Laboratory Requirement when elected for 4 credits. Offered Fall, Winter.

Fees: \$110

CHM 1020 Survey of General Chemistry Cr. 4

Satisfies General Education Requirement: Natural Scientific Inquiry, Physical Sciences

High school chemistry not required. First course in the terminal sequence consisting of CHM 1020 and CHM 1030. Matter and energy in chemistry, chemical symbols and equations, structure and properties of atoms, introduction to chemical bonding; periodicity in chemistry, solids, liquids, gases, solutions, acids and bases, and equilibrium. Meets General Education Laboratory Requirement. Offered Fall, Winter.

Prerequisites: Math Permit to Reg - (L1-L4) with a test score minimum of 2-4, MAT 0993-6XXX with a minimum grade of C, MAT Permit to Reg ACT/SAT with a test score minimum of 2-4, ACT Math with a test score minimum of 18-36, SAT Mathematics with a test score minimum of 490-800, or SAT MATH (POST-2016) with a test score minimum of 490-800

Fees: \$110

CHM 1030 Survey of Organic/Biochemistry Cr. 4

Organic and biological chemistry; brief introduction to organic chemistry, emphasizing classes of compounds important in biochemical processes; survey of biochemistry with applications to nutrition, physiology, and clinical chemistry; protein structure; intermediary metabolism; molecular biology; and metabolic regulation. Offered Winter.

Fees: \$110

CHM 1040 Chemistry Skills and Reasoning Cr. 4

Reasoning and mathematical skills needed for development of a scientific approach in chemistry. No credit if taken after any other chemistry course. Offered Every Term.

Prerequisites: MAT 0993-6XXX with a minimum grade of C-, ACT Math with a test score minimum of 21-36, SAT MATH (POST-2016) with a test score minimum of 530-800, MAT Permit to Reg ACT/SAT with a test score minimum of 2-4, or Math Permit to Reg - (L1-L4) with a test score minimum of 2-4

CHM 1060 General, Organic and Biochemistry Cr. 5

Satisfies General Education Requirement: Natural Scientific Inquiry
Chemistry 1060 is an integrated approach to the study of General Chemistry, Organic Chemistry, and Biochemistry for students pursuing careers in health-related fields. In each area, Health Links and Biochemistry Links will be used to demonstrate key chemistry principles. The laboratory experiments focus on general, organic, and biochemistry. Offered Fall, Winter.

Fees: \$100

CHM 1100 General Chemistry I Cr. 4

Satisfies General Education Requirement: Natural Scientific Inquiry, Physical Sciences

Introduction to the principles of chemistry. Chemistry and measurements, chemical formulas and equations, chemical reactions, gas laws, thermochemistry, quantum theory of the atom, electron configurations and periodicity, ionic and covalent bonding, molecular geometry and chemical bonding, states of matter, and solutions. Satisfies General Education laboratory requirement upon completion of both CHM 1100 and 1130. Only two credits if taken after CHM 1020. No credit if taken after CHM 1125. Offered Every Term.

Prerequisites: (CHM 1040 with a minimum grade of C-, CHM Permit to Reg (L1-L3) CPE with a test score minimum of 2-3, or (CHM 1020 with a minimum grade of C- and 1 of (MAT 1070 with a minimum grade of C-, MAT Permit to Reg ACT/SAT with a test score minimum of 3-4, or Math Permit to Reg - (L1-L4) with a test score minimum of 3-4)))

Equivalent: CHM 1125

CHM 1125 General Chemistry I for Engineers Cr. 3

Satisfies General Education Requirement: Natural Scientific Inquiry, Physical Sciences

Introduction to the principles of chemistry. Chemistry and measurements, chemical formulas and equations, chemical reactions, gas laws, thermochemistry, quantum theory of the atom, electron configurations and periodicity, ionic and covalent bonding, molecular geometry and chemical bonding, states of matter, and solutions. Satisfies General Education laboratory requirement upon completion of both CHM 1125 and 1130. Only one credit if taken after CHM 1020. No credit if taken after CHM 1100. Offered Every Term.

Prerequisites: (CHM 1040 with a minimum grade of C-, CHM Permit to Reg (L1-L3) CPE with a test score minimum of 2-3, or (CHM 1020 with a minimum grade of C- and 1 of (MAT 1070 with a minimum grade of C-, MAT Permit to Reg ACT/SAT with a test score minimum of 3-4, or Math Permit to Reg - (L1-L4) with a test score minimum of 3-4)))

Restriction(s): Enrollment limited to students in the College of Engineering.

Equivalent: CHM 1100

CHM 1130 General Chemistry I Laboratory Cr. 1

Laboratory course designed to introduce students to the scientific method, properties of materials, the role of energy, structure and spectroscopy. Satisfaction of General Education lab requirement is awarded only upon successful completion of both CHM 1100 (or CHM 1125) and this lab course. Offered Every Term.

Prerequisites: CHM 1100 with a minimum grade of C- (may be taken concurrently) or CHM 1125 with a minimum grade of C- (may be taken concurrently)

Fees: \$110

CHM 1140 General Chemistry II Cr. 4

Kinetics, equilibria, acids, bases, thermodynamics, electrochemistry, oxidation-reduction reactions, and coordination chemistry. A variety of examples from science, engineering, technology and everyday life will be emphasized. Offered Every Term.

Prerequisites: CHM 1100 with a minimum grade of C-, CHM 1220 with a minimum grade of C-, CHM 1125 with a minimum grade of C-, or CHM 1225 with a minimum grade of C-

Equivalent: CHM 1145

CHM 1145 General Chemistry II for Engineers Cr. 3

Kinetics, equilibria, acids, bases, thermodynamics, electrochemistry, oxidation-reduction reactions, and coordination chemistry. A variety of examples from science, engineering, technology and everyday life will be emphasized. Offered Every Term.

Prerequisites: CHM 1100 with a minimum grade of C-, CHM 1220 with a minimum grade of C-, CHM 1125 with a minimum grade of C-, or CHM 1225 with a minimum grade of C-

Restriction(s): Enrollment limited to students in the College of Engineering.

Equivalent: CHM 1140

CHM 1150 General Chemistry II Laboratory Cr. 1

Experiments in advanced topics such as chemical equilibrium, monoprotic acid and base titrations, buffers, electrochemistry, solubility equilibria and chemical kinetics. Offered Every Term.

Prerequisites: CHM 1140 with a minimum grade of C- (may be taken concurrently) and (CHM 1130 with a minimum grade of C- or CHM 1230 with a minimum grade of C-)

Fees: \$110

CHM 1240 Organic Chemistry I Cr. 4

Introductory organic chemistry combined with the general principles of chemistry. Carbon compounds and chemical bonding, acid-based chemistry, stereochemistry and introductory organic reactions. Offered Every Term.

Prerequisites: CHM 1140 with a minimum grade of C-

CHM 1250 Organic Chemistry I Laboratory Cr. 1

Integrated general/organic chemistry laboratory focusing on spectroscopy, acid-based chemistry, molecular modeling and organic reactions as well as some attention to chromatography. Offered Every Term.

Prerequisites: CHM 1240 with a minimum grade of C- (may be taken concurrently) and CHM 1150 with a minimum grade of C-

Fees: \$110

CHM 2220 Organic Chemistry II Cr. 4

Organic reactions of functional groups such as aldehydes, ketones and related carbonyl compounds. Extensive discussion of the interface of organic/biochemistry and bioinorganic chemistry. No credit after if taken after CHM 2225. Offered Every Term.

Prerequisites: CHM 1240 with a minimum grade of C-

CHM 2225 Organic Chemistry II for Engineers Cr. 3

Organic reactions of functional groups such as aldehydes, ketones and related carbonyl compounds. Extensive discussion of the interface of organic/biochemistry and bioinorganic chemistry. No credit after if taken after CHM 2220. Offered Every Term.

Prerequisites: CHM 1240 with a minimum grade of C-

Restriction(s): Enrollment is limited to Undergraduate level students; enrollment limited to students in the College of Engineering.

CHM 2230 Organic Chemistry II Laboratory Cr. 1

Synthesis of organic and bio-organic compounds. Offered Every Term.

Prerequisites: CHM 2220 with a minimum grade of C- (may be taken concurrently) and CHM 1250 with a minimum grade of C-

Fees: \$110

CHM 2999 Honors Research Problems in Chemistry Cr. 2-4

Research projects under the direction of a senior faculty member. Offered Every Term.

Prerequisites: (CHM 1240 with a minimum grade of C and CHM 1250 with a minimum grade of C) or CHM 1410 with a minimum grade of C

CHM 3000 Metals in Biology Cr. 3

Descriptive approach to metals involved in biological systems. Offered Fall.

Prerequisites: CHM 1240 with a minimum grade of C

CHM 3020 Intermediate Inorganic Chemistry I Cr. 3

Emphasizes chemistry of the main group elements and includes basic coordination chemistry of the transition metals. Offered Winter.

Prerequisites: CHM 1240 with a minimum grade of C

CHM 3120 Analytical Chemistry Cr. 3

The basic principles of analytical chemistry with an emphasis on quantitative chemical analysis, theoretical and practical aspects of equilibrium calculations including statistics, spectroscopy and instrumentation will be covered. Analytical examples from science, engineering, technology and biochemistry will be included. Offered Fall, Winter.

Prerequisites: CHM 1140 with a minimum grade of C and CHM 1150 with a minimum grade of C

CHM 3130 Analytical Chemistry Laboratory Cr. 1

In this laboratory course, students will learn to use quantitative analytical chemistry techniques to determine the amount of various compounds in an unknown sample. These techniques include acid-base titrations, reduction-oxidation (redox) titrations, uv-vis spectrophotometry, fluorescence spectrophotometry, column and gas chromatography. Offered Fall, Winter.

Prerequisites: CHM 3120 with a minimum grade of C (may be taken concurrently)

Fees: \$100

CHM 4850 Frontiers in Chemistry Cr. 1

Fields of fundamental chemistry now under investigation, presented by invited specialists actively engaged in research. Offered Fall, Winter.

Restriction(s): Enrollment is limited to students with a major in Chemistry or Chemistry Honors; enrollment limited to students in a BS in Chemistry or Bachelor of Arts degrees.

Repeatable for 2 Credits

CHM 5020 Intermediate Inorganic Chemistry II Cr. 3

Transition metal chemistry. Coordination compounds and organometallics. Bonding theories and reactivity. Synthesis, purification, and characterization of inorganic compounds with an emphasis on transition metal compounds. Offered Fall.

Prerequisites: CHM 6070 with a minimum grade of C or (CHM 3020 with a minimum grade of C and CHM 5400-5440 with a minimum grade of C)

Fees: \$110

CHM 5160 Instrumental Analytical Chemistry Cr. 3

Application of modern instrumental methods to quantitative analysis. Methods that relate instrumental response to chemical concentrations or content. Calibration, data handling, and data evaluation. Emission, flame, infrared, Raman, fluorescence, and magnetic resonance spectroscopy. Mass spectrometry. Electrochemical methods. Chromatography. Offered Fall.

Prerequisites: (CHM 5400 with a minimum grade of C, CHM 5420 with a minimum grade of C, or CHM 5440 with a minimum grade of C), CHM 3120 with a minimum grade of C, and PHY 2180 with a minimum grade of C

CHM 5400 Biological Physical Chemistry Cr. 3

Presentation of physical chemistry topics: thermodynamics, solution equilibria, chemical kinetics, quantum chemistry, spectroscopy, statistical mechanics, transport processes, and structure with biological applications. Offered Winter.

Prerequisites: CHM 3120 with a minimum grade of C, MAT 2010 with a minimum grade of C, and (PHY 2130 with a minimum grade of C (may be taken concurrently) or PHY 2170 with a minimum grade of C (may be taken concurrently))

CHM 5420 Physical Chemistry I Cr. 3

Chemical thermodynamics, phase equilibrium, solutions, surface chemistry, electrochemistry. Only two credits applicable toward degree after CHM 5400. Offered Fall.

Prerequisites: (CHM 2280 with a minimum grade of C or CHM 3120 with a minimum grade of C), MAT 2020 with a minimum grade of C, and PHY 2170 with a minimum grade of C (may be taken concurrently)

CHM 5440 Physical Chemistry II Cr. 4

Kinetic theory, empirical and theoretical kinetics, quantum theory, atomic and molecular structure, molecular spectroscopy, statistical mechanics. Only three credits applicable to degree after CHM 5400. Offered Winter.

Prerequisites: (CHM 2280 with a minimum grade of C or CHM 3120 with a minimum grade of C), MAT 2020 with a minimum grade of C, and PHY 2170 with a minimum grade of C (may be taken concurrently)

CHM 5510 Chemical Synthesis Laboratory Cr. 3

Advanced techniques for the synthesis, purification and characterization of organic compounds. Offered Fall.

Prerequisites: CHM 1420 with a minimum grade of C or (CHM 2220 with a minimum grade of C and CHM 2230 with a minimum grade of C)

Fees: \$110

CHM 5550 Physical Chemistry Laboratory Cr. 2

Satisfies General Education Requirement: Writing Intensive Competency Principles of measurement. Fundamental investigations of thermodynamics. Fundamental spectroscopic and kinetic measurements. Offered Fall, Winter.

Prerequisites: (CHM 5400 with a minimum grade of C (may be taken concurrently), CHM 5420 with a minimum grade of C (may be taken concurrently), or CHM 5440 with a minimum grade of C (may be taken concurrently)) and PHY 2180 with a minimum grade of C

Fees: \$110

CHM 5570 Instrumental Analytical Chemistry Laboratory Cr. 2

Lecture and laboratory experiments covering electronics, measurement, and instrumentation. Principles and analytical applications of electrochemistry, chromatography, and spectroscopy including UV-visible, IR, magnetic resonance, and mass spectroscopy. Offered Winter.

Prerequisites: CHM 5160 with a minimum grade of C

Fees: \$110

CHM 5600 Survey of Biochemistry Cr. 3

Protein structure and its relationship to function. Principles of enzyme catalysis. Allosteric regulation of protein function and enzyme catalysis. Pathways of carbohydrate, fat, and protein metabolism in eukaryotic organisms. Introduction to mechanisms of energy coupling and photosynthesis. Information transfer in living systems. Molecular biology. Offered Fall, Winter.

Prerequisites: CHM 1420 with a minimum grade of C, CHM 2220 with a minimum grade of C, or CHM 2225 with a minimum grade of C

CHM 5900 Biomedical Research as Discovery Cr. 2

Solving biochemical research problems using laboratory research tools including computational methods. Offered Yearly.

Prerequisites: CHM 6610 with a minimum grade of C and CHM 6620 with a minimum grade of C

Fees: \$100

CHM 5998 Honors Thesis Research in Chemistry Cr. 2-4

Original investigation under direction of senior staff member. Submission of B.S. thesis or manuscript in publication format. Presentation of public lecture on B.S. research. Offered Every Term.

Restriction(s): Enrollment is limited to students with a major in Biochem & Chem Bio Honors or Chemistry Honors.

Repeatable for 8 Credits

CHM 5999 Research in Chemistry Cr. 2-4

Original investigation under the direction of a senior staff member. Submission of B.S. thesis or manuscript in publication format. Offered Every Term.

Restriction(s): Enrollment is limited to students with a major in Biochem & Chem Bio Honors, Biochem & Chemical Biology, Chemistry or Chemistry Honors.

Repeatable for 8 Credits

CHM 6060 Materials Chemistry and Engineering Cr. 3

Solid state structure and bonding. Crystallography, defects, and non-stoichiometry. Phase diagrams. Synthesis and properties of extended solids and nanomaterials. Molecular interactions and statistical physics of soft matter. Synthesis and characterization techniques of polymeric and colloidal material. Physical properties, phase behavior, self-assembly and ordering in synthetic and biological soft matter. Offered Intermittently.

Prerequisites: CHM 3020 with a minimum grade of C

CHM 6070 Advanced Bioinorganic Chemistry Cr. 3

Applications of inorganic chemistry principles to understanding biological systems including metalloenzymes. Offered Winter.

Prerequisite: CHM 3000 with a minimum grade of C

CHM 6090 Organometallic Chemistry Cr. 3

Models and Applications of the Organometallic Chemistry of the Transition Metals including Activation of Small Molecules and Bioorganometallics. Offered Winter.

Prerequisite: CHM 5020 with a minimum grade of C

CHM 6100 Theory of Analytical Chemistry Cr. 3

Provides an overview of the fundamental theory and instruments required to conduct analytical measurements for diverse applications. Offered Yearly.

Prerequisites: (CHM 2280 with a minimum grade of C and CHM 2290 with a minimum grade of C) or (CHM 3120 with a minimum grade of C and CHM 3130 with a minimum grade of C)

CHM 6120 Electroanalytical Chemistry Cr. 3

This course provides an overview of the fundamental concepts of electrochemical science and their applications in catalysis, batteries, electrochemical sensors. Offered Intermittently.

Prerequisites: (CHM 2280 with a minimum grade of C and CHM 2290 with a minimum grade of C) or (CHM 3120 with a minimum grade of C and CHM 3130 with a minimum grade of C)

CHM 6160 Separation Science Cr. 3

Fundamentals, instrumentation, and modern applications in medicine, cannabis and food testing, and environmental monitoring. Offered Intermittently.

Prerequisite: CHM 2280 with a minimum grade of C or CHM 3120 with a minimum grade of C

CHM 6170 Advances in Bioanalytical Chemistry Cr. 3

How analytical methods are used to obtain information regarding biological systems. Offered Intermittently.

Prerequisites: (CHM 2280 with a minimum grade of C and CHM 2290 with a minimum grade of C) or (CHM 3120 with a minimum grade of C and CHM 3130 with a minimum grade of C)

CHM 6180 Mass Spectrometry Cr. 3

This course provides an overview of the fundamental concepts of electrochemical science and their applications in catalysis, batteries, electrochemical sensors. Offered Intermittently.

Prerequisites: ((CHM 2280 with a minimum grade of C and CHM 2290 with a minimum grade of C) or (CHM 3120 with a minimum grade of C and CHM 3130 with a minimum grade of C)) and CHM 5160 with a minimum grade of C

CHM 6200 Organic Structures and Mechanisms Cr. 3

Structure and stereochemistry of organic molecules. Correlations between structure and chemical and physical properties. Reaction mechanisms. Offered Fall.

Prerequisites: CHM 2220 with a minimum grade of C or CHM 2225 with a minimum grade of C

CHM 6220 Organic Reactions and Synthesis Cr. 3

Alkylation, condensation, and Grignard reactions; synthesis of acid derivatives; cycloadditions and unimolecular rearrangements. Scope and limitations of important synthetic methods of organic chemistry. Offered Winter.

Prerequisite: CHM 6200 with a minimum grade of C

CHM 6240 Organic Spectroscopy Cr. 3

Application of IR, NMR, UV, and mass spectrometry to the identification of organic compounds. Emphasis on interpretation of spectra, especially NMR. Recommended for students intending to do graduate or industrial work in organic chemistry. Offered Winter.

Prerequisite: CHM 1420 with a minimum grade of C or CHM 2220 with a minimum grade of C

CHM 6270 Advanced Bioorganic Chemistry and Drug Design Cr. 3

Studies of biological problems using organic synthetic methods and applications to drug design. Offered Fall.

Prerequisite: CHM 6620 with a minimum grade of C

CHM 6410 Statistical Thermodynamics Cr. 3

Statistical methods of determining thermodynamic properties of bulk materials from molecular properties. Real gases at high density, crystals, liquids; phase transitions, transport properties Offered Intermittently.

Prerequisite: CHM 5400 with a minimum grade of C or CHM 5420 with a minimum grade of C or CHM 5440 with a minimum grade of C

CHM 6440 Computational Chemistry Cr. 3

Aspects of computational chemistry pertinent to effective use of molecular modeling techniques. Molecular mechanics, semi-empirical and ab initio calculations, molecular dynamics. Offered Intermittently.

Prerequisite: CHM 5440 with a minimum grade of C

Fees: \$95

CHM 6470 Quantum Chemistry Cr. 3

Theorems of quantum mechanics, approximation methods, solutions to simple atomic and molecular systems, electronic structure of many-electron atoms and molecules, chemical bonding. Offered Intermittently.

Prerequisites: CHM 5400 with a minimum grade of C, CHM 5420 with a minimum grade of C, or CHM 5440 with a minimum grade of C

CHM 6610 Biological Chemistry Laboratory Cr. 3

Satisfies General Education Requirement: Writing Intensive Competency
Basic experiments in isolation, purification, and analysis of biomolecules.
Techniques currently used in molecular biology and recombinant DNA
procedures stressed. Offered Fall, Winter.

Prerequisite: CHM 6620 with a minimum grade of C

Restriction(s): Enrollment is limited to students with a major in Biochem
& Chem Bio Honors, Biochem & Chemical Biology, Chemistry or Chemistry
Honors.

Fees: \$110

CHM 6620 Metabolism: Pathways and Regulation Cr. 3

Major metabolic pathways of carbohydrate, fatty acid, amino acid, and
nucleotide synthesis and degradation. Pathways and mechanisms of
energy generation. Hormonal and allosteric regulation of enzyme activity.
Offered Fall.

Prerequisites: CHM 2220 with a minimum grade of C

CHM 6635 Tools of Molecular Biology Cr. 3

Principles underlying genetic and biochemical methods; complements
work in lab CHM 6610. Offered Winter.

Prerequisite: CHM 6620 with a minimum grade of C

CHM 6640 Molecular Biology Cr. 3

Nucleic acid structure and function. Mechanism and control
of replication, transcription, and translation. Mutation, genetic
recombination, and recombinant DNA. Membranes and organelles.
Offered Winter.

Prerequisite: CHM 6620 with a minimum grade of C

CHM 6680 Clinical and Molecular Aspects of Cancer Cr. 3

Current molecular, biochemical, and clinical aspects of human cancer for
students without prior exposure to the topic. Offered Yearly.

Prerequisite: CHM 6620 with a minimum grade of C or (CHM 5600 with a
minimum grade of C and BIO 1510 with a minimum grade of C)

**CHM 6700 Green Chemistry: Mindful Design in Science, Engineering, and
Medicine Cr. 3**

Green Chemistry is the design of chemical products, processes, and
instrumentation that reduce or eliminate the use and generation of
hazardous substances. While there are many mechanisms and tools
available to assess the impact of materials and processes on human
health and the environment, there are few tools available to help design
and create products as such. This course will present the fundamentals
of the 12 principles of green chemistry and explore relevant examples of
their practical use in commercial applications. It will explore examples
from a wide spectrum of industrial sectors including research and
development, medical applications, and electronics/instrumentation.
Students will analyze how chemists and other researchers in the
sciences engineering, and medicine can help address global human
health and environmental issues. They will also evaluate the extent to
which a focus on green chemistry can boost innovation and time to
market while lowering costs. Offered Yearly.

Prerequisites: CHM 2220 with a minimum grade of C (may be taken
concurrently) or CHM 2225 with a minimum grade of C (may be taken
concurrently)

CHM 6740 Laboratory Safety Cr. 1-2

Discussion and demonstration of safe laboratory practice. Use, storage
and disposal of ordinary and hazardous substances; personal protection
devices; regulations and codes. Required for all graduate degrees in
chemistry. Not for chemistry major credit. Offered Fall, Winter.

CHM 6990 Directed Study Cr. 1-4

Offered Every Term.

Repeatable for 8 Credits

CHM 6991 Internship in Chemistry Cr. 1

Practical research experience through visiting a university, industry, or
national laboratory. Offered Every Term.

Restriction(s): Enrollment is limited to students with a major in
Chemistry; enrollment is limited to Graduate level students.

Repeatable for 2 Credits