

## CHE

## Chemistry

**CHE 101 MOLECULAR SCIENCE FOR CITIZENS. (3)**

A conceptual introduction to the molecular nature of all natural and man-made materials as well as the key molecules of biological organisms. The important classes of molecules (structural and high-technology materials, cosmetics, fibers, fuels, polymers, metals, water, carbon dioxide, food, vitamins, detergents, pharmaceuticals, proteins, bio-molecules, environmental pollutants) will be discussed in terms of their properties, synthesis, transformations, and utility.

**CHE 103 CHEMISTRY FOR HEALTH PROFESSIONALS. (4)**

A study of the basic concepts of general, organic, and biological chemistry. Topics include electronic structure of atoms and molecules, periodicity of the elements, stoichiometry, states of matter, kinetics, equilibria, acids and bases, organic functional groups, stereochemistry, carbohydrates, lipids, proteins, and enzymes. Topics are presented with an emphasis on application to the allied health professions. Prereq: Two years of high school algebra and math ACTE of 19 or above, or Math placement test, or completion of MA 108R.

**CHE 104 INTRODUCTORY GENERAL CHEMISTRY. (3)**

A study of the general principles including laws of definite and multiple proportions, stoichiometry, gases, electronic structure, chemical bonding, periodic relationships, oxidation-reduction, acid bases, chemical equilibrium and acids/bases. Intended for students interested in a one-semester course in general chemistry and recommended for students seeking careers in nursing, nutrition and allied health science fields. Not open to students who have already completed both CHE 105 and 107. Prereq: Two years of high school algebra and Math ACTE of 19 or above (or Math placement test), or completion of MA 108R.

**\*CHE 105 GENERAL COLLEGE CHEMISTRY I. (3)**

A study of the principles of chemistry and their application to the more important elements and their compounds. Not open to students who have already completed both CHE 104 and 106 or CHE 104 and CHE 108, but open to students who have completed just CHE 104. Prereq: Math ACTE of 23 or above (or Math placement test), or MA 109, or MA 110, or the KCTCS course CHE 102R or CHM 100.

**CHE 106 INTRODUCTION TO INORGANIC, ORGANIC AND BIOCHEMISTRY. (4)**

A continuation of CHE 104. A study of selected aspects of inorganic, organic and biochemistry including the chemistry of metals and nonmetals, introduction to organic functional group chemistry, proteins, nucleic acids and lipids. Lecture, three hours; laboratory, three hours per week. Not open to students who have already completed CHE 105 and 107. Not recommended for students seeking careers in medicine, science, dentistry, engineering, veterinary science, agricultural sciences, education, or allied fields for which the recommended sequence is CHE 105-107-115. Prereq: CHE 104 or the KCTCS course CHM 100.

**CHE 107 GENERAL COLLEGE CHEMISTRY II. (3)**

A continuation of CHE 105. A study of the principles of chemistry and their application to the more important elements and their compounds. Not open to students who have completed only CHE 104 but is open to students who have completed both CHE 104 and 106. Prereq: CHE 105 or both CHE 104 and 108.

**CHE 108 INTRODUCTION TO INORGANIC, ORGANIC AND BIOCHEMISTRY WITHOUT LABORATORY. (3)**

A continuation of CHE 104. A study of selected aspects of inorganic, organic, and biochemistry including the chemistry of metals and nonmetals, basic organic functional groups, proteins, nucleic acids, and lipids. Lecture material is identical to that of CHE 106, but there is no laboratory component. Not open to students who have already completed CHE 105 and 107 or CHE 106. Not recommended for students seeking careers in medicine, science, dentistry, engineering, veterinary science, agricultural sciences, education, or allied fields for which the recommended sequence is CHE 105/107/115. Prereq: CHE 104 or the KCTCS course CHM 100.

**CHE 111 LABORATORY TO ACCOMPANY GENERAL CHEMISTRY I. (1)**

A laboratory course, to accompany CHE 105, dealing with the properties of chemical substances and providing an introduction to quantitative chemical analysis. Prereq or concur: CHE 105.

**CHE 113 LABORATORY TO ACCOMPANY GENERAL CHEMISTRY II. (2)**

A laboratory course, to accompany CHE 107, emphasizing qualitative and quantitative chemical analysis. Prereq: CHE 111; prereq or concur: CHE 107.

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- CHE 115 GENERAL CHEMISTRY LABORATORY. (3)**  
An introductory laboratory course dealing with chemical and physical properties; qualitative analysis, and an introduction to quantitative analysis. Lecture, one hour; laboratory, four hours. Prereq or concur: CHE 107.
- CHE 195 GENERAL CHEMISTRY WORKSHOP I. (1)**  
Peer-led team problem solving. Two-hour workshop offered on a pass-fail basis only. Enrollment in CHE 105 need not be accompanied by enrollment in CHE 195. Prereq: Concurrent registration in CHE 105 required.
- CHE 197 GENERAL CHEMISTRY WORKSHOP II. (1)**  
Peer-led team problem solving. Two-hour workshop offered on a pass-fail basis only. Enrollment in CHE 107 need not be accompanied by enrollment in CHE 197. Prereq: Concurrent registration in CHE 107 required.
- CHE 199 RESEARCH EXPERIENCE IN CHEMISTRY. (0)**  
Participation in laboratory research in chemistry. Offered pass/fail only. Prereq: Permission of instructor.
- CHE 226 ANALYTICAL CHEMISTRY. (3-5)**  
An introduction to the theory and practice of quantitative analysis. Lecture, two hours; laboratory, three to six hours. Prereq: CHE 107 and 113.
- CHE 230 ORGANIC CHEMISTRY I. (3)**  
Fundamental principles and theories of organic chemistry. Prereq: CHE 107 and 113.
- CHE 231 ORGANIC CHEMISTRY LABORATORY I. (2)**  
Laboratory for CHE 230 or CHE 236. Laboratory, six hours per week. Prereq or concur: CHE 230 or CHE 236.
- CHE 232 ORGANIC CHEMISTRY II. (3)**  
A continuation of CHE 230. Prereq: CHE 230.
- CHE 233 ORGANIC CHEMISTRY LABORATORY II. (2)**  
Laboratory for CHE 232. Laboratory, six hours per week. Prereq: CHE 231. Prereq or concur: CHE 232.
- CHE 236 SURVEY OF ORGANIC CHEMISTRY. (3)**  
A one-semester course in organic chemistry. Not open to students who have already completed both CHE 230 and 232. Prereq: CHE 107 and 113.
- CHE 295 ORGANIC CHEMISTRY WORKSHOP I. (1)**  
Peer-led team problem solving. Two-hour workshop offered on a pass-fail basis only. Enrollment in CHE 230 need not be accompanied by enrollment in CHE 295. Prereq: Concurrent registration in CHE 230 required.
- CHE 297 ORGANIC CHEMISTRY WORKSHOP II. (1)**  
Peer-led team problem solving. Two-hour workshop offered on a pass-fail basis only. Enrollment in CHE 232 need not be accompanied by enrollment in CHE 297. Prereq: Concurrent enrollment in CHE 232 required.
- CHE 395 INDEPENDENT WORK IN CHEMISTRY. (1-3)**  
May be repeated to a maximum of nine credits. Prereq: Major and a standing of 3.0 in the department.
- CHE 410G INORGANIC CHEMISTRY. (2)**  
An overview of inorganic chemistry, including fundamental aspects of structure, bonding, periodicity, spectroscopic properties, reaction mechanisms and applications. Prereq: CHE 231 and 232; prereq or concur: a physical chemistry course at or above the 400 level.
- CHE 412G INORGANIC CHEMISTRY LABORATORY. (2)**  
A laboratory course that will acquaint the student with the synthesis, characterization and properties of inorganic and organometallic compounds of both main-group and transition elements. Laboratory, six hours per week. Prereq: CHE 410G; prereq or concur: a physical chemistry course at or above the 400 level.

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- CHE 440G INTRODUCTORY PHYSICAL CHEMISTRY. (4)**  
An introduction to the laws of thermodynamics, the thermo-dynamic functions and their application to phase equilibria, chemical equilibria, solutions and electrochemistry. Chemical kinetics, including rate laws, reaction mechanisms, Arrhenius, collision, and activated complex theories, and catalysis. Quantum theory including an elementary introduction to spectroscopy. The fourth hour to be devoted to problem solving and problem-solving techniques. Prereq: CHE 226; MA 114; PHY 213 or 232.
- CHE 441G PHYSICAL CHEMISTRY LABORATORY. (2)**  
Laboratory studies in physical chemistry, including quantum chemistry, spectroscopy, thermodynamics and chemical kinetics. Laboratory, six hours. Prereq: A physical chemistry course at or above the 400 level.
- CHE 442G THERMODYNAMICS AND KINETICS. (3)**  
Principles of physical chemistry including thermodynamics, chemical kinetics, and statistical thermodynamics. Prereq: CHE 226; MA 213; PHY 213 or 232.
- CHE 446G PHYSICAL CHEMISTRY FOR ENGINEERS. (3)**  
An introductory course in physical chemistry for engineering students. Kinetic theory, thermodynamics, phase diagrams, colligative properties, electrochemistry, transport properties, kinetics, quantum theory, spectroscopy. Prereq: CHE 107, 113; PHY 232; MA 213; CME 200 or the equivalent.
- CHE 510 ADVANCED INORGANIC CHEMISTRY. (3)**  
A course dealing with the concepts of inorganic chemistry with emphasis on atomic structure, periodicity, nomenclature, bonding, reaction mechanisms and acid-base theories. Prereq: CHE 107 or 226.
- CHE 514 DESCRIPTIVE INORGANIC CHEMISTRY. (3)**  
A course dealing in detail with descriptive chemistry of the elements and their compounds, excluding the hydrocarbons and their derivatives. Prereq: CHE 226 and CHE 232; or CHE 450G, or permission of instructor.
- CHE 520 RADIOCHEMISTRY. (3)**  
Applications of radionuclides in chemistry with emphasis on principles of radioactive decay, interactions of radiation with matter, use of isotopic tracers, activation analysis, isotope dilution analysis, hot atom chemistry and nuclear dating methods. Prereq: CHE 107, or 226.
- CHE 522 INSTRUMENTAL ANALYSIS. (4)**  
The theory and application of instrumental methods of analysis. Lecture, two hours; laboratory, six hours. Prereq or concur: A physical chemistry course at or above the 400 level.
- CHE 524 CHEMICAL INSTRUMENTATION. (4)**  
Aspects of electronics, microcomputers, computer interfacing, and data analysis as they apply to chemical measurements and measurement systems. Lecture, two hours; laboratory, six hours per week. Prereq: A physical chemistry course at or above the 400 level or consent of instructor.
- CHE 525 BIOANALYTICAL SENSORS. (3)**  
Theory, principles, and applications of bioanalytical sensors and sensing systems, including transducers, molecular recognition, and microfabrication. Prereq: A physical chemistry course at or above the 400 level, or consent of instructor.
- CHE 526 CHEMICAL SEPARATIONS. (2)**  
An advanced study of the theory, instrumentation, and analytical applications of chemical separation methods. Prereq: A physical chemistry course at or above the 400 level, or consent of instructor.
- CHE 532 SPECTROMETRIC IDENTIFICATION OF ORGANIC COMPOUNDS. (2)**  
Problems involving the use of nuclear magnetic resonance, ultraviolet and infrared spectroscopy, mass spectrometry and differential chemical reactivity in determining the structure of organic compounds. Discussion of chemical and physical methods for separation of mixtures of organic compounds. Prereq: CHE 231 and CHE 232.

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- CHE 533 QUALITATIVE ORGANIC ANALYSIS LABORATORY. (2)**  
The identification of unknown organic compounds using nuclear magnetic resonance, ultraviolet and infrared spectroscopy, mass spectrometry and traditional chemical techniques. Separation techniques are also emphasized. Laboratory, six hours. Prereq: CHE 532.
- CHE 535 SYNTHETIC ORGANIC CHEMISTRY. (3)**  
A general survey of organic chemistry with emphasis on synthetic methods and the synthesis of natural products. Prereq: CHE 232.
- CHE 538 PRINCIPLES OF ORGANIC CHEMISTRY. (3)**  
A general survey of the field of organic chemistry. Topics emphasized are: mechanistic principles relating molecular structure to reaction outcome, stereoisomerism and its effect on chemical reactivity, and simple molecular orbital theory as required to understand aromaticity and to predict the occurrence and stereochemistry of pericyclic reactions. Prereq: CHE 232.
- CHE 547 PRINCIPLES OF PHYSICAL CHEMISTRY I. (3)**  
An introduction to quantum chemistry and spectroscopy, emphasizing modern applications of quantum theory to the calculation of molecular properties. Practical experience with quantum chemistry software on various computer platforms is included. Prereq: MA 213; PHY 213 or 232; or consent of instructor.
- CHE 548 PRINCIPLES OF PHYSICAL CHEMISTRY II. (3)**  
Fundamental principles of classical physical chemistry, including thermodynamics, statistical thermodynamics, and chemical kinetics. Prereq: A physical chemistry course at the 400 level or above, or consent of instructor.
- CHE 550 BIOLOGICAL CHEMISTRY I. (3)**  
An introduction to biological chemistry. Topics include amino acids and proteins; nucleic acids and nucleotides; enzyme structure, function and energetics; metabolism including glycolysis; the tricarboxylic acid cycle; electron transport and oxidative phosphorylation; glycogen metabolism; hormone action; and other aspects of modern biological chemistry. Prereq: CHE 232 and a physical chemistry course at or above the 400 level, or consent of instructor.
- CHE 552 BIOLOGICAL CHEMISTRY II. (3)**  
A further introduction to biological chemistry. Topics include lipid metabolism, biosynthesis and metabolism of nitrogen-containing compounds, storage and utilization of genetic information, immunochemistry, and other contemporary topics in biological chemistry. Prereq: CHE 232 and a physical chemistry course at or above the 400 level, or consent of instructor.
- CHE 553 CHEMISTRY AND MOLECULAR BIOTECHNOLOGY. (3)**  
This course focuses on the chemical aspects of biotechnology development. Current topics in biotechnology are emphasized through extensive reading and classroom discussion of the most recent scientific literature. Biotechnology development in fields as diverse as agriculture, the environment, and medicine will be covered. Prereq: An introductory course in biology, biological chemistry, or biochemistry; and CHE 232; or consent of instructor.
- CHE 554 BIOLOGICAL CHEMISTRY LABORATORY. (2)**  
An introductory biological chemistry laboratory course. Areas of experimentation will include spectroscopic methods, electrophoresis, chromatography, and isolation and characterization of biological macromolecules. Prereq: CHE 232, CHE 550 or CHE 552, and a physical chemistry course at or above the 400 level, or consent of instructor.
- CHE 555 HOMONUCLEAR NMR. (3)**  
This course will give students hands-on experience with modern NMR experiments that are the mainstays of chemical structural analysis and biophysical studies of macromolecules and pharmaceuticals. Lecture, two hours; laboratory, three hours per week. Prereq: CHE 232 or 236; and a physical chemistry course at or above the 400 level.
- CHE 558 HORMONE RECEPTORS AND CELL SIGNALS. (3)**  
This course starts with the general concepts on hormones and their receptors and describes how hormones interact with their receptors and generate hormone signals and responses. Prereq: BIO 315 or equivalent, BCH 401G or equivalent, CHE 550 or 552 or equivalent, or consent of instructor.

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- CHE 559 MOLECULAR BIOPHYSICS. (3)**  
Overview of intermolecular forces responsible for formulation tertiary structure and macromolecular assemblies, as well as linked equilibria, allostery and propagation of signals. Extension of these principles to explain macromolecular machines, complex molecular behavior and, ultimately, processes of life. Prereq: A physical chemistry course at the 400 level or above, or consent of instructor.
- CHE 565 ENVIRONMENTAL CHEMISTRY. (3)**  
A study of the sources, reactions, transport, effects, and fates of chemical species in the atmosphere, hydrosphere, lithosphere and biosphere. Prereq: Two semesters of general college chemistry are required. Courses in analytical and physical chemistry are recommended, but are not required.
- CHE 572 COMMUNICATION IN CHEMISTRY. (1)**  
Reports and discussions on recent research and current chemical literature in seminar format; literature searching methods; resume construction; preparation of effective presentations, abstracts, and visual aids. May be repeated for a total of two credits.
- CHE 580 TOPICS IN CHEMISTRY. (1-3)**  
A detailed investigation of a topic of current significance in chemistry. May be repeated to a maximum of six credits. Lecture and/or laboratory: variable. Prereq: CHE 232 and a physical chemistry course at the 400 level or above, or consent of instructor.
- CHE 610 CHEMISTRY OF THE TRANSITION METALS. (3)**  
A detailed treatment of the chemistry of the transition elements, lanthanides and actinides, including the structure of coordination complexes, bonding, reaction mechanisms and preparations. Prereq: CHE 510.
- CHE 612 INORGANIC CHEMISTRY OF THE NON-METALS. (3)**  
A detailed treatment of the inorganic chemistry of the nonmetals. Topics include theories of bonding, spectral characteristics, reaction mechanisms, preparations, physical methods of characterization and structural determination, and applications. Prereq: CHE 510.
- CHE 614 ORGANOTRANSITION METAL CHEMISTRY. (3)**  
A detailed treatment of the organometallic chemistry of the transition metals, including lanthanides and actinides. Topics include synthesis, structure, bonding theories, reactions, characterization by physical methods, and applications in organic chemistry and catalysis. Prereq: CHE 232, and CHE 410G or 510, and a physical chemistry course at the 400 level or above, or consent of instructor.
- CHE 616 NUCLEAR CHEMISTRY. (3)**  
An advanced study of nuclear chemistry and topics related to nuclear and radiochemistry. Prereq: CHE 520 and a physical chemistry course at the 400 level or above.
- CHE 620 ELECTROCHEMICAL METHODS OF ANALYSIS. (3)**  
An intensive study of the fundamental theories and principles of electrochemistry, and their practical applications for physical and quantitative analytical measurements. Topics include potentiometric, voltammetric, amperometric, and coulometric methods. Prereq: CHE 522 or a physical chemistry course at the 400 level or above.
- CHE 623 CHEMICAL EQUILIBRIUM AND DATA ANALYSIS. (3)**  
An advanced treatment of chemical equilibrium, sampling, and the evaluation of data obtained from chemically related measurements. Prereq: CHE 226 or 522 or a physical chemistry course at the 400 level or above.
- CHE 625 SPECTROCHEMICAL ANALYSIS. (3)**  
An intensive study of the theory, instrumentation, and analytical applications of modern atomic and molecular spectrometric methods. Prereq: CHE 522.
- CHE 626 ADVANCED ANALYTICAL CHEMISTRY. (3)**  
An advanced study of the theory and practice of quantitative analysis.
- CHE 643 SPECTROSCOPY AND PHOTOPHYSICS. (3)**  
An integrated treatment of modern spectroscopy and photophysics. Topics to include atomic spectroscopy, microwave, infrared and UV-visible spectroscopy of diatomic and polyatomic molecules, lasers, creation and detection of excited states, fluorescence, phosphorescence, radiationless processes and photochemical transformations. Prereq: CHE 547 or 446G or permission of instructor.

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- CHE 646 CHEMICAL KINETICS.** (3)  
 Studies of chemical reactions from the standpoint of velocity and mechanism. Prereq: CHE 442G.
- CHE 664 MULTIDISCIPLINARY SENSORS LABORATORY.** (3)  
 A multidisciplinary laboratory course with laboratory experiences in areas related to sensors and sensing architectures, typically including chemistry, chemical and materials engineering, and electrical engineering. Lecture, 1 hour; laboratory, 2 hours. Prereq: One year of college chemistry, calculus and physics. GS 660 or by consent of instructor. (Same as CME/EE/MSE 664.)
- CHE 710 TOPICS IN INORGANIC CHEMISTRY.** (2-4)  
 Discussion of topics of recent interest in inorganic chemistry, including physical methods, syntheses, and structural theories. May be repeated to a maximum of 12 credits. Prereq: CHE 610 or 612.
- CHE 736 TOPICS IN ORGANIC CHEMISTRY.** (2-4)  
 Selected topics which may include heterocyclic organic compounds, natural and synthetic dyes, carbohydrates, nitrogen compounds, and recent advances in the field of organic chemistry. May be repeated to a maximum of 12 credits.
- CHE 746 TOPICS IN PHYSICAL CHEMISTRY.** (2-4)  
 Selected topics which may include photochemistry, structure of crystals, molecular spectra, nature of the chemical bond, and other recent advances in the field of physical chemistry. May be repeated to a maximum of 12 credits. Prereq: A physical chemistry course at the 400 level or above.
- CHE 748 MASTER'S THESIS RESEARCH.** (0)  
 Half-time to full-time work on thesis. May be repeated to a maximum of six semesters. Prereq: All course work toward the degree must be completed.
- CHE 749 DISSERTATION RESEARCH.** (0)  
 Half-time to full-time work on dissertation. May be repeated to a maximum of six semesters. Prereq: Registration for two full-time semesters of 769 residence credit following the successful completion of the qualifying exams.
- CHE 767 DISSERTATION RESIDENCY CREDIT.** (2)  
 Residency credit for dissertation research after the qualifying examination. Students may register for this course in the semester of the qualifying examination. A minimum of two semesters are required as well as continuous enrollment (Fall and Spring) until the dissertation is completed and defended.
- CHE 768 RESIDENCE CREDIT FOR MASTER'S DEGREE.** (1-6)  
 May be repeated to a maximum of 12 hours.
- CHE 769 RESIDENCE CREDIT FOR DOCTOR'S DEGREE.** (0-12)  
 May be repeated indefinitely.
- CHE 772 SEMINAR IN CHEMISTRY INSTRUCTION.** (1)  
 A seminar for teaching assistants on the methods and techniques of effective instruction in laboratory and recitation classes in chemistry. Required of all new graduate teaching assistants. Prereq: Admission to M.S. or Ph.D. program in chemistry.
- CHE 776 GRADUATE SEMINAR.** (1)  
 Reports and discussions on recent research and current literature. Required of all graduate students. May be repeated for a total of eight credits.
- CHE 779 MEMBRANE SCIENCES COLLOQUIUM.** (1)  
 Outstanding membrane scientists present their current research on biological and/or synthetic membranes. Students read a pertinent paper by the speaker prior to his/her talk and write a short paper on the talk; especially important is relevance of the main points of the talk to membrane science in general and the student's own research in particular. May be repeated to a maximum of six credits. (Same as BCH/CME/PHA/PHR 779.)

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**CHE 780 INDIVIDUAL WORK IN CHEMISTRY.**

**(1-5)**

Selected library and laboratory problems in conformance with the student's interest will be attacked and pursued under the direction of a suitable staff member who is proficient in the area under investigation.

**CHE 790 RESEARCH IN CHEMISTRY.**

**(1-12)**

Work may be taken in the following fields, subject to the approval of the Departmental Graduate Committee: analytical chemistry, industrial chemistry, inorganic chemistry, organic chemistry, radiochemistry, or physical chemistry. May be repeated indefinitely.