

CHEM - CHEMISTRY

CHEM131 Chemistry I - Fundamentals of General Chemistry (3 Credits)

An overview of the Periodic Table, inorganic substances, ionic and covalent bonding, bulk properties of materials, chemical equilibrium, and quantitative chemistry. CHEM131 is the first course in a four-semester sequence for students majoring in the sciences, other than Chemistry and Biochemistry majors.

Prerequisite: Must have math eligibility of MATH120 or higher.

Corequisite: CHEM132.

Recommended: For Science majors.

Credit Only Granted for: CHEM103, CHEM131, CHEM135, CHEM153 or CHEM146.

Formerly: CHEM103.

CHEM132 General Chemistry I Laboratory (1 Credit)

Introduction to the quantification of chemical substances, including the concept of the mole and chemical stoichiometry. Additional work involves the synthesis of ionic substances and their qualitative characterization. Must be taken concurrently with CHEM131.

Prerequisite: Must have math eligibility of MATH120 or higher.

Corequisite: CHEM131.

Credit Only Granted for: CHEM103, CHEM132, CHEM136, CHEM143, CHEM147 or CHEM177.

Formerly: CHEM103.

CHEM134 Chemical Principles for Engineering (1 Credit)

Basic chemistry for engineering students. Introduction to organic structures and polymers, gas laws, liquids, solids, phase changes, chemical kinetics and electrochemistry.

Prerequisite: Minimum grade of C- in CHEM131; or minimum grade of C- in CHEM146.

Credit Only Granted for: CHEM 134 or CHEM 135.

CHEM135 General Chemistry for Engineers (3 Credits)

The nature and composition of matter, solutions, chemical reactions, equilibria, and electrochemistry, with applications to various fields of engineering.

Prerequisite: Must have math eligibility of MATH120 or higher.

Credit Only Granted for: CHEM103, CHEM113, CHEM131, CHEM135, or CHEM146.

CHEM136 General Chemistry Laboratory for Engineers (1 Credit)

A laboratory course for engineering majors intending to take CHEM231 and CHEM232.

Prerequisite: Must have completed or be concurrently enrolled in CHEM135 and must have math eligibility of MATH120 or higher.

Restriction: Must be in a major in ENGR-A. James Clark School of Engineering.

CHEM146 Principles of General Chemistry (3 Credits)

An overview of the Periodic Table, inorganic substances, ionic and covalent bonding, bulk properties of materials, chemical equilibrium, and quantitative chemistry. CHEM146 is the first course in a four-semester sequence for Chemistry and Biochemistry majors.

Prerequisite: Must have math eligibility of MATH140 or higher.

Corequisite: CHEM177.

Restriction: Must be in one of the following programs (Chemistry; Biochemistry).

Credit Only Granted for: CHEM103, CHEM131, CHEM135, CHEM143, or CHEM146.

Formerly: CHEM143.

CHEM177 Introduction to Laboratory Practices and Research in the Chemical Sciences (2 Credits)

First semester laboratory course required for CHEM and BCHM majors. Introduction to laboratory techniques, including safety practices, scientific ethics, and presentation of current research topics.

Prerequisite: Must have math eligibility of MATH120 or higher.

Corequisite: CHEM146, CHEM131, or CHEM135.

Restriction: Must be in a major within CMNS-Chemistry & Biochemistry department; or permission of CMNS-Chemistry & Biochemistry department.

Credit Only Granted for: CHEM132, CHEM136, CHEM147, or CHEM177.

CHEM231 Organic Chemistry I (3 Credits)

The chemistry of carbon: aliphatic compounds, aromatic compounds, stereochemistry, arenes, halides, alcohols, esters and spectroscopy.

Prerequisite: CHEM131, CHEM135, or CHEM146; and (CHEM132, CHEM136, CHEM147, or CHEM177); and a grade of C- or better in the prerequisites is required of College of Computer, Mathematical, and Natural Sciences majors and recommended for all students.

Corequisite: CHEM232.

Credit Only Granted for: CHEM104, CHEM231, CHEM233 or CHEM237.

Formerly: CHEM233.

CHEM232 Organic Chemistry Laboratory I (1 Credit)

Provides experience in developing some basic laboratory techniques, recrystallization, distillation, extraction, chromatography.

Prerequisite: CHEM131 and CHEM132; or (CHEM135 and CHEM136); or (CHEM146 and CHEM147). And a grade of C- or better in the prerequisites is required for College of Computer, Mathematical, and Natural Sciences majors and recommended for all students.

Corequisite: CHEM231.

Credit Only Granted for: CHEM104, CHEM231, CHEM233 or CHEM237.

Formerly: CHEM233.

CHEM237 Principles of Organic Chemistry I (4 Credits)

The chemistry of carbons: aliphatic compounds, aromatic compounds, stereochemistry, arenes, halides, alcohols, esters, and spectroscopy.

Prerequisite: CHEM131, CHEM135, or CHEM146; and (CHEM132, CHEM136, or CHEM147); and a grade of C- or better in the prerequisites is required of College of Computer, Mathematical, and Natural Sciences majors and recommended for all students. Or permission of CMNS-Chemistry & Biochemistry department.

Restriction: Must be in one of the following programs (Chemistry; Biochemistry) ; or must be in a major in ENGR-A. James Clark School of Engineering.

Credit Only Granted for: CHEM233, (CHEM231 and CHEM232), or CHEM237.

CHEM241 Organic Chemistry II (3 Credits)

A continuation of CHEM231 with emphasis on molecular structure; substitution reactions; carbonium ions; aromaticity; synthetic processes; macromolecules.

Prerequisite: CHEM231 and CHEM232; or CHEM237. And a grade of C- or better in the prerequisites is required for College of Computer, Mathematical, and Natural Sciences majors and recommended for all students.

Credit Only Granted for: (CHEM241 and CHEM242) or CHEM247.

CHEM242 Organic Chemistry Laboratory II (1 Credit)

Synthetic organic chemistry through functional group manipulation, introduction to instrumentation essential to analysis and structure elucidation.

Prerequisite: CHEM231 and CHEM232; or CHEM237. And a grade of C- or better in the prerequisites is required for College of Computer, Mathematical, and Natural Sciences majors and recommended for all students.

Corequisite: CHEM241.

Credit Only Granted for: (CHEM241 and CHEM242) or CHEM247.

CHEM247 Principles of Organic Chemistry II (4 Credits)

A continuation of CHEM237 with emphasis on molecular structure, substitution reactions; carbonium ions; aromaticity; synthetic processes; macromolecules.

Prerequisite: Minimum grade of C- in CHEM237; or permission of CMNS-Chemistry & Biochemistry department.

Restriction: Must be in one of the following programs (Chemistry; Biochemistry); or must be an honors student.

Credit Only Granted for: (CHEM241 and CHEM242) or CHEM247.

CHEM271 General Chemistry and Energetics (2 Credits)

An introduction to the physical aspects of chemistry; chemical kinetics, thermodynamics and electrochemistry in the context of current chemistry research.

Prerequisite: CHEM241 and CHEM242; or CHEM247. And a grade of C- or better in the prerequisites for College of Computer, Mathematical, and Natural Sciences majors and recommended for all students.

Corequisite: CHEM272.

Credit Only Granted for: CHEM113, CHEM153, CHEM271 or CHEM276.

Formerly: CHEM113.

CHEM272 General Bioanalytical Chemistry Laboratory (2 Credits)

An introduction to analytical chemistry with an emphasis on bio-analytical instrumentation and techniques.

Prerequisite: CHEM241 and CHEM242; or CHEM247. And a grade of C- or better in the prerequisites is required for College of Computer, Mathematical, and Natural Sciences majors and recommended for all students.

Corequisite: CHEM271.

Credit Only Granted for: CHEM227, CHEM272 or CHEM277.

CHEM276 General Chemistry and Energetics - Majors (2 Credits)

An introduction to the physical aspects of chemistry for Biochemistry and Chemistry majors. Chemical kinetics, thermodynamics and electrochemistry in the context of current chemistry research.

Prerequisite: Minimum grade of C- in CHEM241 and CHEM242; or minimum grade of C- in CHEM247.

Corequisite: CHEM277.

Restriction: Must be in one of the following programs (Chemistry; Biochemistry).

Credit Only Granted for: CHEM113, CHEM153, CHEM271 or CHEM276.

Formerly: CHEM153.

CHEM277 Fundamentals of Analytical and Bioanalytical Chemistry Laboratory (3 Credits)

Quantitative analysis, inorganic analytical chemistry, and an introduction to bio-analytical instrumentation and techniques.

Prerequisite: Minimum grade of C- in CHEM241 and CHEM242; or minimum grade of C- in CHEM247.

Corequisite: CHEM276.

Restriction: Must be in one of the following programs (Chemistry; Biochemistry).

Credit Only Granted for: CHEM153, CHEM227, CHEM272 or CHEM277.

CHEM298 Special Topics in Chemistry (3 Credits)

Course topics to be determined by instructor.

CHEM298Q Quantum Steampunk Science-Fiction Workshop (3 Credits)

Steampunk is a science-fiction genre in which futuristic technologies populate Victorian-era settings. Recently, steampunk has come to life in the scientific field of quantum thermodynamics. Thermodynamics, the study of energy, grew out of the Industrial Revolution. Two centuries later, quantum physics is transforming computing and cryptography. Quantum science is now revolutionizing 19th-century thermodynamics in quantum thermodynamics, which features quantum engines, automata, and more. Quantum thermodynamics inspired the growing subgenre of quantum steampunk. In this course, you will read science fiction, write quantum steampunk short stories, receive feedback, and critique classmates' writing. In parallel, you will learn about quantum physics, technologies, and thermodynamics.

Cross-listed with: ARHU270, CMSC298Q, ENGL289Q, ENME299Q, PHYS299Q.

Credit Only Granted for: ARHU270, ARHU298Q, CHEM298Q, CMSC298Q, ENGL289Q, ENME299Q or PHYS299Q.

CHEM316 Chemical Demonstrations and Outreach (1 Credit)

The purpose of this course is to provide students with the experience, skills, and knowledge of performing chemical demonstrations. The goal is to illustrate chemical principles using engaging and visually stimulating experiments. There will be an emphasis on safety and understanding the chemistry behind how each chemical demonstration works. In addition to learning experiments, students will be expected to perform an outreach project.

Prerequisite: (CHEM241 and CHEM242) or CHEM247; and (CHEM271 or CHEM276) and (CHEM272 or CHEM277).

Restriction: Permission of the Chemistry and Biochemistry Department.

CHEM389 Pedagogy and Instruction in Chemistry (1-2 Credits)

Methodologies, theory and educational tools applicable to the field of undergraduate chemistry education. Examples covered will use content from introductory general and organic chemistry courses.

Prerequisite: Permission of instructor; and minimum grade of B- in CHEM231; and must have completed or be concurrently enrolled in CHEM241.

Repeatable to: 6 credits.

CHEM395 Professional Issues in Chemistry and Biochemistry (1 Credit)

Seminar on professional issues. Professional responsibilities, ethics, interview techniques, career opportunities, graduate/professional school, race and gender issues.

Restriction: Junior standing or higher; and must be in one of the following programs (Chemistry; Biochemistry).

CHEM398 Special Projects (2 Credits)

Honors projects for undergraduate students.

CHEM399 Introduction to Chemical Research (1-3 Credits)

Basic (chemical) research conducted under the supervision of a faculty member.

Restriction: Junior standing or higher; and permission of CMNS-Chemistry & Biochemistry department.

Repeatable to: 6 credits.

CHEM401 Inorganic Chemistry (3 Credits)

An overview of basic concepts of the electronic structure of the elements, chemical bonding and reactivity, from simple diatomic molecules to coordination compounds. These are viewed from simple (Lewis) to the most comprehensive molecular orbital theory. Symmetry and group theory are used throughout the course.

Prerequisite: CHEM276 or CHEM271; and (CHEM247 or CHEM241).

CHEM403 Radiochemistry (3 Credits)

Radioactive decay; introduction to properties of atomic nuclei; nuclear processes in cosmology; chemical, biomedical and environmental applications of radioactivity; nuclear processes as chemical tools; interaction of radiation with matter.

Prerequisite: Must have completed one year of college chemistry and one year of college physics.

CHEM425 Instrumental Methods of Analysis (4 Credits)

Modern instrumentation in analytical chemistry. Electronics, spectroscopy, chromatography and electrochemistry.

Prerequisite: CHEM272 and CHEM271; or (CHEM276 and CHEM277).

CHEM433 Atmospheric Chemistry and Climate (3 Credits)

The effects of human activity on atmospheric composition, focused on global warming, the carbon cycle, air pollution, and the ozone layer. Fundamentals of atmospheric chemistry (spectroscopy, kinetics, isotopic analysis, and biogeochemical cycles) are related to the modern understanding of climate change, air quality, and ozone depletion, based on resources such as satellite missions, field campaigns, and scientific assessments published by international agencies. We also examine how society's energy needs could be met, in the future, in a manner with less impact on atmospheric composition than the present heavy reliance on combustion of fossil fuels.

Prerequisite: CHEM131, CHEM135, or CHEM146. And MATH241; or permission of CMNS-Atmospheric & Oceanic Science department; or permission of CMNS-Chemistry & Biochemistry department. Cross-listed with AOSC433.

Credit Only Granted for: AOSC433, AOSC633, CHEM433, or CHEM633.

Formerly: CHEM434.

CHEM434 Air Pollution and Environmental Justice (3 Credits)

Basic concepts in physics and chemistry of the atmosphere as applied to air pollution and environmental justice. Production, transformation, spatial scales, transport, and removal of air pollutants. The problems of photochemical smog, the greenhouse effect & climate change, stratospheric ozone, visibility. Numerical simulation of air pollution. Health and environmental effects of air pollution in the developed and developing world; why some communities suffer disproportionately

Prerequisite: CHEM131 and MATH241; or permission of instructor.

Cross-listed with: AOSC434.

Credit Only Granted for: AOSC434 or CHEM434.

CHEM441 Advanced Organic Chemistry (3 Credits)

An advanced study of the compounds of carbon, with special emphasis on molecular orbital theory and organic reaction mechanisms.

Prerequisite: Must have completed or be concurrently enrolled in CHEM480 or CHEM481; and 1 course with a minimum grade of C- from (CHEM241, CHEM247).

Jointly offered with: CHEM641.

CHEM460 Structure Determination Using Spectroscopic Methods (3 Credits)

The use of infrared, ultraviolet-visible, proton and carbon-13 nuclear magnetic resonance and mass spectroscopy for structure determination in organic chemistry.

Prerequisite: Must have completed CHEM243; or CHEM247; or (CHEM241 and CHEM242).

Formerly: CHEM660.

CHEM471 Techniques in Pulse NMR (1 Credit)

NMR techniques to operate, adjust, and calibrate the spectrometers and acquire and process NMR data in one and two dimensional NMR applications.

Prerequisite: CHEM241 and CHEM242; or CHEM247.

Recommended: CHEM460.

Restriction: Senior standing or higher.

Additional Information: Persons with heart pacemakers and/or metal implants cannot take the course due to potential health hazards.

CHEM480 Principles of Physical Chemistry (3 Credits)

Covers elementary thermodynamics, principles of kinetics and catalysis and selected topics in molecular quantum mechanics, spectroscopy and statistical mechanics. Topics will emphasize core subjects along with applications to biosciences, materials science, environmental science and related areas.

Prerequisite: (CHEM276 or CHEM271); and (CHEM277 or CHEM272); and (MATH140 or MATH136); and (PHYS260 and PHYS261) or PHYS132.

Credit Only Granted for: CHEM480 or CHEM481; CHEM480, BCHM485 or CHEM482.

CHEM481 Physical Chemistry I (3 Credits)

Thermodynamics and kinetics of chemical and molecular systems.

Topics may include internal energy, heat, work, enthalpy, entropy, free energy, and spontaneity as well as reaction order, differential rate laws, integrated rate laws, and rate laws for multi-step processes.

Prerequisite: Minimum grade of C- in CHEM135; or minimum grade of C- in CHEM271 and CHEM272; or minimum grade of C- in CHEM276 and CHEM277. And minimum grade of C- in MATH141. And minimum grade of C- in PHYS260 and PHYS261; or minimum grade of C- in PHYS142.

Credit Only Granted for: CHEM481 or CHEM480.

CHEM482 Physical Chemistry II (3 Credits)

Quantum mechanical nature of atoms and molecules. Topics may include model systems for electronic, vibrational, rotational and translational energies as well as connections to molecular spectroscopy and thermal distributions.

Prerequisite: Minimum grade of C- in CHEM135; or minimum grade of C- in CHEM271 and CHEM272; or minimum grade of C- in CHEM276 and CHEM277. And minimum grade of C- in MATH141. And minimum grade of C- in PHYS260 and PHYS261; or minimum grade of C- in PHYS142.

Credit Only Granted for: CHEM482, BCHM485 or CHEM480.

CHEM483 Physical Chemistry Laboratory I (2 Credits)

An introduction to the principles and application of quantitative techniques in physical chemical measurements. Experiments will be coordinated with topics in CHEM481.

Prerequisite: Must have completed or be concurrently enrolled in CHEM481.

CHEM484 Physical Chemistry Laboratory II (2 Credits)

Advanced quantitative techniques necessary in physical chemical measurements. Experiments will be coordinated with topics in CHEM482.

Prerequisite: Must have completed or be concurrently enrolled in CHEM482.

CHEM498 Special Topics in Chemistry (3 Credits)

Prerequisite: Prerequisite varies with the nature of the topic being considered.