

CHEMISTRY (CH)

CH 101. CHEMISTRY IN YOUR WORLD. (3 Credits)

For students who need some additional preparation before enrolling in a general chemistry course. Explores the impact of chemistry on our everyday lives while acquiring the skills it takes to be successful in general chemistry.

Prerequisites: Math Placement - ALEKS with a score of 046 or MTH 095 (may be taken concurrently) with C- or better or MTH 103 (may be taken concurrently) with C- or better or MTH 111 with C- or better or MTH 241 with C- or better or MTH 251 with C- or better or MTH 251H with C- or better or MTH 252 with C- or better or MTH 252H with C- or better

CH 110. *ROYGBIV: THE CHEMISTRY OF COLORS. (4 Credits)

An introduction to the concepts of chemistry and the importance of these concepts in understanding color. Lec/lab.

Attributes: CPPS – Core, Pers, Physical Science

CH 121. GENERAL CHEMISTRY. (5 Credits)

A general chemistry sequence for students who have had no previous training in chemistry and for those whose college aptitude test scores indicate the need for a more elementary introduction to chemistry. Entering students are expected to have a working knowledge of high school algebra, logarithms, and scientific notation. Lec/lab/rec. (CH 122, CH 123 are Bacc Core Courses)

Equivalent to: CH 104

CH 122. *GENERAL CHEMISTRY. (5 Credits)

A general chemistry sequence intended for majors in fields other than the physical sciences. Lec/lab/rec. (CH 122 and CH 123 are Bacc Core courses.)

Attributes: CPPS – Core, Pers, Physical Science

Prerequisites: CH 121 with C- or better or (CH 201 with C- or better or (CH 231 with C- or better or CH 231H with C- or better))

CH 123. *GENERAL CHEMISTRY. (5 Credits)

A general chemistry sequence intended for majors in fields other than the physical sciences. (CH 122 and CH 123 are Bacc Core courses.) Lec/rec/lab.

Attributes: CPPS – Core, Pers, Physical Science

Prerequisites: CH 122 with C- or better or ((CH 232 with C- or better or CH 232H with C- or better) and (CH 262 [C-] or CH 262H [C-] or CH 272 [C-])) or (CH 202 [C-] and CH 205 [C-]))

CH 124. GENERAL CHEMISTRY. (3 Credits)

A bridge course, allowing students who have taken one term of General Chemistry (CH 121) to complete the equivalent of one full semester of general chemistry. Entering students are expected to have a working knowledge of high school algebra, logarithms, and scientific notation. Lec/lab.

Prerequisites: CH 121 with D- or better

CH 125. GENERAL CHEMISTRY. (2 Credits)

A bridge course, allowing students who also take one term of General Chemistry (CH 123) to complete the equivalent of one full semester of General Chemistry. Entering students are expected to have a working knowledge of high school algebra, logarithms, and scientific notation. Lec/lab. Offered via Ecampus only.

Prerequisites: CH 121 with D- or better and CH 124 [D-]

Recommended: One semester of general chemistry at another institution

CH 130. GENERAL CHEMISTRY OF LIVING SYSTEMS. (4 Credits)

Introduction to organic chemistry and the chemistry of biological systems. Organic nomenclature and fundamental reactions, emphasizing topics such as amino acids, proteins, biochemical energy, and nucleic acids (DNA and RNA). Intended as a terminal course in chemistry, not to serve as a prerequisite to higher numbered chemistry courses. Lec/lab. Does not count toward a chemistry minor.

CH 140. GENERAL, ORGANIC, AND BIOLOGICAL CHEMISTRY. (6 Credits)

An introduction to general, organic, and biological chemistry. Intended as a terminal course in chemistry, not to serve as a prerequisite to higher numbered chemistry courses. Offered via Ecampus only.

Recommended: Entering students should have a working knowledge of high school algebra, logarithms, and scientific notation

CH 199. SPECIAL TOPICS. (1-3 Credits)

This course is repeatable for 3 credits.

CH 201. CHEMISTRY FOR ENGINEERING MAJORS. (3 Credits)

A sequence of selected chemistry topics for pre-engineering students. Lec.

Prerequisites: MTH 111 (may be taken concurrently) with D- or better or MTH 112 (may be taken concurrently) with D- or better or MTH 251 (may be taken concurrently) with D- or better or MTH 251H (may be taken concurrently) with D- or better or MTH 252 (may be taken concurrently) with D- or better or MTH 252H (may be taken concurrently) with D- or better or MTH 254 (may be taken concurrently) with D- or better or MTH 254H (may be taken concurrently) with D- or better or Math Placement - ALEKS with a score of 060

CH 202. CHEMISTRY FOR ENGINEERING MAJORS. (3 Credits)

A sequence of selected chemistry topics for pre-engineering students. Lec.

Prerequisites: CH 121 with C- or better or CH 201 with C- or better or CH 231 with C- or better or CH 231H with C- or better

CH 205. LABORATORY FOR CH 202. (1 Credit)

Three-hour weekly session for the development of laboratory skills in general chemistry for engineers. Lec/lab.

Prerequisites: CH 202 (may be taken concurrently) with D- or better

CH 211. RECITATION FOR CHEMISTRY 201. (1 Credit)

80-minute weekly session for the development of problem-solving skills in general chemistry for engineers. Rec.

Corequisites: CH 201

CH 212. RECITATION FOR CHEMISTRY 202. (1 Credit)

One-hour weekly session for the development of problem-solving skills in general chemistry for engineers. Rec.

Corequisites: CH 202

CH 220. CAREERS IN CHEMISTRY. (1 Credit)

Course for chemistry majors that discusses strategies for success in the study of chemistry and the varied career opportunities available. Topics range from surviving freshman chemistry to choices of advanced classes, study abroad opportunities, internships, getting into and succeeding in graduate school, choices of chemical careers in academia, industry, government, non-governmental organizations, and using chemistry as a foundation for careers in other areas such as law and business. Graded P/N.

CH 231. GENERAL CHEMISTRY. (4 Credits)

A general chemistry sequence for students majoring in most sciences, pharmacy, and chemical engineering. CH 231 is a lecture course; CH 261 is the laboratory component. Lec/rec. (Bacc Core Course if taken with CH 261)

Attributes: CPPL – Core, Pers, PhySci Attached Lec

Prerequisites: MTH 111 (may be taken concurrently) with C- or better or MTH 112 (may be taken concurrently) with C- or better or MTH 251 (may be taken concurrently) with C- or better or MTH 251H (may be taken concurrently) with C- or better or MTH 252 (may be taken concurrently) with C- or better or MTH 252H (may be taken concurrently) with C- or better or MTH 254 (may be taken concurrently) with C- or better or MTH 254H (may be taken concurrently) with C- or better or Math Placement - ALEKS with a score of 060

Equivalent to: CH 221, CH 221H, CH 224H, CH 231H

CH 231H. GENERAL CHEMISTRY. (4 Credits)

A general chemistry sequence for students majoring in most sciences, pharmacy, and chemical engineering. CH 231H is a lecture course; CH 261H is the laboratory component. Lec/rec. (Bacc Core Course if taken with CH 261H)

Attributes: CPPL – Core, Pers, PhySci Attached Lec; HNRS – Honors Course Designator

Prerequisites: MTH 111 (may be taken concurrently) with C- or better or MTH 112 (may be taken concurrently) with C- or better or MTH 251 (may be taken concurrently) with C- or better or MTH 251H (may be taken concurrently) with C- or better or MTH 252 (may be taken concurrently) with C- or better or MTH 252H (may be taken concurrently) with C- or better or MTH 254 (may be taken concurrently) with C- or better or MTH 254H (may be taken concurrently) with C- or better or Math Placement - ALEKS with a score of 060

Equivalent to: CH 231

CH 232. GENERAL CHEMISTRY. (4 Credits)

A general chemistry sequence for students majoring in most sciences, pre-pharmacy, and chemical engineering. CH 232 is a lecture course; CH 262 is the laboratory component. Lec/rec. (Bacc Core Course if taken with CH 262)

Attributes: CPPL – Core, Pers, PhySci Attached Lec

Prerequisites: (CH 231 with C- or better or CH 231H with C- or better) or CH 221 with C- or better

Equivalent to: CH 222, CH 225H, CH 232H

CH 232H. GENERAL CHEMISTRY. (4 Credits)

A general chemistry sequence for students majoring in most sciences, pre-pharmacy, and chemical engineering. CH 232H is a lecture course; CH 262H is the laboratory component. Lec/rec. (Bacc Core Course if taken with CH 262H)

Attributes: CPPL – Core, Pers, PhySci Attached Lec; HNRS – Honors Course Designator

Prerequisites: (CH 231 with C- or better or CH 231H with C- or better) or CH 221 with C- or better

Equivalent to: CH 232

CH 233. GENERAL CHEMISTRY. (4 Credits)

A general chemistry sequence for students majoring in most sciences, pharmacy, and chemical engineering. CH 233 is a lecture course; CH 263 is the laboratory component. (Bacc Core Course if taken with CH 263) Lec/rec.

Attributes: CPPL – Core, Pers, PhySci Attached Lec

Prerequisites: (CH 232 with C- or better or CH 232H with C- or better) or CH 222 with C- or better

Equivalent to: CH 223, CH 226H, CH 233H

CH 233H. GENERAL CHEMISTRY. (4 Credits)

A general chemistry sequence for students majoring in most sciences, pharmacy, and chemical engineering. CH 233H is a lecture course; CH 263H is the laboratory component. Lec/rec. (Bacc Core Course if taken with CH 263H)

Attributes: CPPL – Core, Pers, PhySci Attached Lec; HNRS – Honors Course Designator

Prerequisites: (CH 232 with C- or better or CH 232H with C- or better) or CH 222 with C- or better

Equivalent to: CH 233

CH 261. *LABORATORY FOR CHEMISTRY 231. (1 Credit)

A general chemistry laboratory sequence for students majoring in most sciences, pharmacy, and chemical engineering. (Bacc Core Course if taken with CH 231)

Attributes: CPPS – Core, Pers, Physical Science

Corequisites: CH 231

Equivalent to: CH 261H, CH 271

CH 261H. *LABORATORY FOR CHEMISTRY 231H. (1 Credit)

A general chemistry laboratory sequence for students majoring in most sciences, pharmacy, and chemical engineering. (Bacc Core Course if taken with CH 231H)

Attributes: CPPS – Core, Pers, Physical Science; HNRS – Honors Course Designator

Corequisites: CH 231H

Equivalent to: CH 261

CH 262. *LABORATORY FOR CHEMISTRY 232. (1 Credit)

A general chemistry laboratory sequence for students majoring in most sciences, pharmacy, and chemical engineering. (Bacc Core Course if taken with CH 232)

Attributes: CPPS – Core, Pers, Physical Science

Prerequisites: CH 261 with D- or better or CH 261H with D- or better or

CH 271 with D- or better or CH 221 with D- or better or CH 224H with D- or better

Corequisites: CH 232

Equivalent to: CH 262H, CH 272

CH 262H. *LABORATORY FOR CHEMISTRY 232H. (1 Credit)

A general chemistry laboratory sequence for students majoring in most sciences, pharmacy, and chemical engineering. (Bacc Core Course if taken with CH 232H)

Attributes: CPPS – Core, Pers, Physical Science; HNRS – Honors Course Designator

Prerequisites: CH 261 with D- or better or CH 261H with D- or better or

CH 271 with D- or better or CH 221 with D- or better or CH 224H with D- or better

Corequisites: CH 232H

Equivalent to: CH 262

CH 263. *LABORATORY FOR CHEMISTRY 233. (1 Credit)

A general chemistry laboratory sequence for students majoring in most sciences, pharmacy, and chemical engineering. (Bacc Core Course if taken with CH 233)

Attributes: CPPS – Core, Pers, Physical Science

Prerequisites: CH 262 with D- or better or CH 262H with D- or better or

CH 272 with D- or better or CH 222 with D- or better or CH 225H with D- or better

Corequisites: CH 233

Equivalent to: CH 263H, CH 273

CH 263H. *LABORATORY FOR CHEMISTRY 233H. (1 Credit)

A general chemistry laboratory sequence for students majoring in most sciences, pharmacy, and chemical engineering. (Bacc Core Course if taken with CH 233H)

Attributes: CPPS – Core, Pers, Physical Science; HNRS – Honors Course Designator

Prerequisites: CH 262 with D- or better or CH 262H with D- or better or CH 272 with D- or better or CH 222 with D- or better or CH 225H with D- or better

Corequisites: CH 233H

Equivalent to: CH 263

CH 271. *LABORATORY FOR CH 231 FOR CHEMISTRY MAJORS. (1 Credit)

A general chemistry laboratory sequence for students majoring in chemistry. (Bacc Core Course if taken with CH 231)

Attributes: CPPS – Core, Pers, Physical Science

Corequisites: CH 231

Equivalent to: CH 271H

CH 272. *LABORATORY FOR CH 232 FOR CHEMISTRY MAJORS. (1 Credit)

A general chemistry laboratory sequence for students majoring in chemistry. (Bacc Core Course if taken with CH 232)

Attributes: CPPS – Core, Pers, Physical Science

Prerequisites: CH 271 with D- or better or CH 221 with D- or better or CH 224H with D- or better

Corequisites: CH 232

Equivalent to: CH 272H

CH 273. *LABORATORY FOR CH 233 FOR CHEMISTRY MAJORS. (1 Credit)

A general chemistry laboratory sequence for students majoring in chemistry. (Bacc Core Course if taken with CH 233)

Attributes: CPPS – Core, Pers, Physical Science

Prerequisites: CH 272 with D- or better or CH 222 with D- or better or CH 225H with D- or better

Corequisites: CH 233

Equivalent to: CH 273H

CH 324. QUANTITATIVE ANALYSIS. (4 Credits)

A basic course in modern chemical analysis. Self-paced laboratory. CH 130 does not meet the prerequisites for this course.

Prerequisites: CH 123 with D- or better or CH 223 with D- or better or CH 226H with D- or better or ((CH 233 with D- or better or CH 233H with D- or better) and (CH 263 [D-] or CH 263H [D-] or CH 273 [D-]))

Recommended: One year of general chemistry

CH 331. ORGANIC CHEMISTRY. (4 Credits)

Service course covering aliphatic and aromatic chemistry. Introduction to nomenclature, mechanism and synthesis. Lec/rec. CH 130 does not meet the prerequisites for this course.

Prerequisites: CH 123 with C- or better or CH 223 with C- or better or CH 226H with C- or better or ((CH 233 with C- or better or CH 233H with C- or better) and (CH 263 [C-] or CH 263H [C-] or CH 273 [C-]))

Recommended: One year of general chemistry

CH 332. ORGANIC CHEMISTRY. (4 Credits)

Service course covering aliphatic and aromatic chemistry. Introduction to nomenclature, mechanism and synthesis. Lec/rec.

Prerequisites: CH 331 with C- or better

Recommended: one year of general chemistry.

CH 334. ORGANIC CHEMISTRY. (3 Credits)

Professional course for majors in chemistry, biochemistry, chemical engineering and other students who need a year of organic chemistry. In-depth treatment of major classes of organic compounds. Interrelation of mechanistic and synthetic approaches.

Prerequisites: CH 123 with D- or better or CH 223 with D- or better or CH 226H with D- or better or ((CH 233 with D- or better or CH 233H with D- or better) and (CH 263 [D-] or CH 263H [D-] or CH 273 [D-]))

Recommended: One year of general chemistry

CH 335. ORGANIC CHEMISTRY. (3 Credits)

Professional course for majors in chemistry, biochemistry, chemical engineering and other students who need a year of organic chemistry. In-depth treatment of major classes of organic compounds. Interrelation of mechanistic and synthetic approaches.

Prerequisites: CH 334 with D- or better

Recommended: One year of general chemistry

CH 336. ORGANIC CHEMISTRY. (3 Credits)

Professional course for majors in chemistry, biochemistry, chemical engineering and other students who need a year of organic chemistry. In-depth treatment of major classes of organic compounds. Interrelation of mechanistic and synthetic approaches.

Prerequisites: CH 335 with D- or better

Recommended: One year of general chemistry

CH 337. ORGANIC CHEMISTRY LABORATORY. (4 Credits)

Laboratory course in organic chemistry for nonmajors, designed to supplement CH 331, CH 332 and CH 334, CH 335, CH 336. Lec/lab.

Prerequisites: (CH 331 with D- or better and CH 332 [D-]) or (CH 334 [D-] and CH 335 [D-] and CH 336 [D-])

CH 361. EXPERIMENTAL CHEMISTRY I. (3 Credits)

First term of integrated laboratory program for chemistry majors highlighting techniques in organic, physical, and analytical chemistry.

First-hand experience is gained using specialized glassware, scientific equipment and instrumentation plus computers. Essential technical laboratory standards and technical writing are emphasized. Lec/lab.

Prerequisites: ((CH 221 with D- or better and CH 222 [D-] and CH 223 [D-]) or (CH 224H [D-] and CH 225H [D-] and CH 226H [D-]) or ((CH 231 [D-] or CH 231H [D-]) and (CH 261 [D-] or CH 261H [D-] or CH 271 [D-]) and (CH 232 [D-] or CH 232H [D-]) and (CH 262 [D-] or CH 262H [D-] or CH 272 [D-]) and (CH 233 [D-] or CH 233H [D-]) and (CH 263 [D-] or CH 263H [D-] or CH 273 [D-])) and (MTH 251 (may be taken concurrently) [D-] or MTH 251H (may be taken concurrently) [D-]) and (PH 201 (may be taken concurrently) [D-] or PH 211 (may be taken concurrently) [D-]) and CH 334 (may be taken concurrently) [D-])

Equivalent to: CH 361H

CH 361H. EXPERIMENTAL CHEMISTRY I. (3 Credits)

First term of integrated laboratory program for chemistry majors highlighting techniques in organic, physical, and analytical chemistry. First-hand experience is gained using specialized glassware, scientific equipment and instrumentation plus computers. Essential technical laboratory standards and technical writing are emphasized. Lec/lab.

Attributes: HNRS – Honors Course Designator

Prerequisites: ((CH 221 with D- or better and CH 222 [D-] and CH 223 [D-]) or (CH 224H [D-] and CH 225H [D-] and CH 226H [D-]) or ((CH 231 [D-] or CH 231H [D-]) and (CH 261 [D-] or CH 261H [D-] or CH 271 [D-]) and (CH 232 [D-] or CH 232H [D-]) and (CH 262 [D-] or CH 262H [D-] or CH 272 [D-]) and (CH 233 [D-] or CH 233H [D-]) and (CH 263 [D-] or CH 263H [D-] or CH 273 [D-])) and (MTH 251 (may be taken concurrently) [D-] or MTH 251H (may be taken concurrently) [D-]) and (PH 201 (may be taken concurrently) [D-] or PH 211 (may be taken concurrently) [D-]) and CH 334 (may be taken concurrently) [D-])

Equivalent to: CH 361

CH 362. EXPERIMENTAL CHEMISTRY I. (3 Credits)

First-level integrated laboratory course for majors in chemistry and related disciplines, covering experimental techniques of analytical, inorganic, organic and physical chemistry. Lec/lab.

Prerequisites: (CH 361 with D- or better or CH 361H with D- or better) and CH 335 (may be taken concurrently) [D-]

Equivalent to: CH 362H

CH 362H. EXPERIMENTAL CHEMISTRY I. (3 Credits)

First-level integrated laboratory course for majors in chemistry and related disciplines, covering experimental techniques of analytical, inorganic, organic and physical chemistry. Lec/lab.

Attributes: HNRS – Honors Course Designator

Prerequisites: (CH 361 with D- or better or CH 361H with D- or better) and CH 335 (may be taken concurrently) [D-]

Equivalent to: CH 362

CH 374. *TECHNOLOGY, ENERGY, AND RISK. (3 Credits)

Decision-making in a technical, democratic society. Discussion of current issues such as acid rain, toxic organic chemicals in the environment, energy resources, etc. Does not meet the prereq for any other chemistry course. Does not meet requirements for chemistry minor. (Bacc Core Course)

Attributes: CSST – Core, Synthesis, Science/Technology/Society

Recommended: Completion of Bacc Core in physical science

CH 390. ENVIRONMENTAL CHEMISTRY. (3 Credits)

Sources, reactions, transport, effects, and fates of chemical species in water, soil, air, and living environments and the effects of technology thereon.

Prerequisites: CH 331 with D- or better or CH 334 with D- or better

CH 399. SPECIAL TOPICS. (1-16 Credits)

Discussion of special topics in chemistry.

This course is repeatable for 99 credits.

Recommended: Completion of Bacc Core in the physical sciences

CH 401. RESEARCH. (1-16 Credits)

This course is repeatable for 16 credits.

CH 403. THESIS. (1-16 Credits)

This course is repeatable for 16 credits.

CH 405. READING AND CONFERENCE. (1-16 Credits)

This course is repeatable for 16 credits.

CH 406. PROJECTS. (1-16 Credits)

This course is repeatable for 16 credits.

CH 407. SEMINAR. (1-16 Credits)

Equivalent to: CH 407H

This course is repeatable for 16 credits.

CH 407H. SEMINAR. (1-16 Credits)

Attributes: HNRS – Honors Course Designator

Equivalent to: CH 407

This course is repeatable for 16 credits.

CH 410. INTERNSHIP. (1-16 Credits)

This course is repeatable for 16 credits.

CH 411. INORGANIC CHEMISTRY. (3 Credits)

Fundamental principles of inorganic chemistry including atomic structure, bonding models for molecules and solids, symmetry, acid/base chemistry, oxidation-reduction, and metal-ligand complexes.

Recommended: One year of general chemistry and college-level physics

CH 412. INORGANIC CHEMISTRY. (3 Credits)

Descriptive chemistry of the elements, focusing on main-group compounds, transition metal complexes, and solid-state chemistry.

Prerequisites: CH 411 with D- or better

CH 418. NUCLEAR CHEMISTRY. (3 Credits)

Radioactive decay, nuclear properties, nuclear structure, alpha, beta, and gamma decay, nuclear reactions, fission, interaction of radiation with matter, chemical techniques, radiation safety, and nuclear instrumentation.

Recommended: Concurrent enrollment in (CH 440 or CH 540) or PH 314

CH 421. ANALYTICAL CHEMISTRY. (3 Credits)

A professional sequence for majors in chemistry and related disciplines. Chemical equilibrium, analytical electrochemistry, separations, spectroscopy, instrumentation, and treatment of data.

Recommended: One year of general chemistry and one year of college physics. Concurrent enrollment in CH 440 or CH 540

CH 422. ANALYTICAL CHEMISTRY. (3 Credits)

A professional sequence for majors in chemistry and related disciplines. Chemical equilibrium, analytical electrochemistry, separations, spectroscopy, basic electronics and instrumentation, and treatment of data.

Recommended: One year of general chemistry and one year of college physics. Concurrent enrollment in CH 441 or CH 541

CH 424. BIOANALYTICAL CHEMISTRY. (3 Credits)

Analytical methods employed in the study of biologically important molecules. Separations (chromatography, electrophoresis), spectroscopy, mass spectrometry, biosensors, and immunoassays. Lec/lab. Not offered every year.

Recommended: One year of organic chemistry and one term of organic chemistry laboratory.

CH 435. STRUCTURE DETERMINATION BY SPECTROSCOPIC METHODS. (3 Credits)

Use of ultraviolet, infrared, nuclear magnetic resonance, and mass spectra for determination of structures and stereochemistry of complex organic molecules.

Prerequisites: CH 336 with D- or better and (CH 442 [D-] or CH 542 [D-])

CH 440. PHYSICAL CHEMISTRY. (3 Credits)

Thermodynamics, electrochemistry, solutions, kinetic theory of gases, chemical kinetics, quantum theory and statistical mechanics, molecular structure and spectroscopy.

Prerequisites: MTH 254 with D- or better or MTH 254H with D- or better

Recommended: One year of general chemistry and one year of college physics

CH 441. PHYSICAL CHEMISTRY. (3 Credits)

Thermodynamics, electrochemistry, solutions, kinetic theory of gases, chemical kinetics, quantum theory and statistical mechanics, molecular structure and spectroscopy.

Prerequisites: (CH 440 with C- or better or CHE 311 with C- or better) and (MTH 254 [C-] or MTH 254H [C-])

CH 442. PHYSICAL CHEMISTRY. (3 Credits)

Thermodynamics, electrochemistry, solutions, kinetic theory of gases, chemical kinetics, quantum theory and statistical mechanics, molecular structure and spectroscopy.

Prerequisites: (MTH 254 with D- or better or MTH 254H with D- or better) and CH 441 [D-]

Recommended: One year of general chemistry and one year of college physics

CH 450. INTRODUCTORY QUANTUM CHEMISTRY. (3 Credits)

Elementary wave mechanics and matrix mechanics of atoms and molecules. Quantum basis of chemical structure. Not offered every year.

Prerequisites: CH 442 with D- or better or CH 542 with D- or better

Recommended: One year college physics

CH 461. EXPERIMENTAL CHEMISTRY II. (3 Credits)

Second-level integrated laboratory course for majors in chemistry and related disciplines, covering experimental techniques of analytical, inorganic, organic and physical chemistry. Lec/lab.

Prerequisites: (CH 362 with D- or better or CH 362H with D- or better) and CH 421 (may be taken concurrently) [D-] and CH 440 (may be taken concurrently) [D-]

Equivalent to: CH 461H

CH 461H. EXPERIMENTAL CHEMISTRY II. (3 Credits)

Second-level integrated laboratory course for majors in chemistry and related disciplines, covering experimental techniques of analytical, inorganic and physical chemistry. Lec/Lab.

Attributes: HNRS – Honors Course Designator

Prerequisites: (CH 362 with D- or better or CH 362H with D- or better) and CH 421 (may be taken concurrently) [D-] and CH 440 (may be taken concurrently) [D-]

Equivalent to: CH 461

CH 462. ^EXPERIMENTAL CHEMISTRY II. (3 Credits)

Second-level integrated laboratory course for majors in chemistry and related disciplines, covering experimental techniques of analytical, inorganic, organic and physical chemistry. Lec/lab. (Writing Intensive Course)

Attributes: CWIC – Core, Skills, WIC

Prerequisites: (CH 362 with D- or better or CH 362H with D- or better) and CH 441 (may be taken concurrently) [D-] and (CH 324 [D-] or CH 461 [D-] or CH 461H [D-])

Equivalent to: CH 462H

Recommended: CH 422

CH 462H. ^EXPERIMENTAL CHEMISTRY II. (3 Credits)

Second-level integrated laboratory course for majors in chemistry and related disciplines, covering experimental techniques of analytical, inorganic, organic and physical chemistry. Lec/lab. (Writing Intensive Course)

Attributes: CWIC – Core, Skills, WIC; HNRS – Honors Course Designator

Prerequisites: (CH 362 with D- or better or CH 362H with D- or better) and CH 441 (may be taken concurrently) [D-] and (CH 324 [D-] or CH 461 [D-] or CH 461H [D-])

Equivalent to: CH 462

Recommended: CH 422

CH 463. ^EXPERIMENTAL CHEMISTRY II. (3 Credits)

Second-level integrated laboratory course for majors in chemistry and related disciplines, covering experimental techniques of analytical, inorganic, organic and physical chemistry. Lec/lab. (Writing Intensive Course)

Attributes: CWIC – Core, Skills, WIC

Prerequisites: (CH 362 with D- or better or CH 362H with D- or better) and (CH 324 [D-] or CH 461 [D-] or CH 461H [D-]) and CH 442 (may be taken concurrently) [D-]

Equivalent to: CH 463H

CH 463H. ^EXPERIMENTAL CHEMISTRY II. (3 Credits)

Second-level integrated laboratory course for majors in chemistry and related disciplines, covering experimental techniques of analytical, inorganic, organic and physical chemistry. Lec/lab. (Writing Intensive Course)

Attributes: CWIC – Core, Skills, WIC; HNRS – Honors Course Designator

Prerequisites: (CH 362 with D- or better or CH 362H with D- or better) and (CH 324 [D-] or CH 461 [D-] or CH 461H [D-]) and CH 442 (may be taken concurrently) [D-]

Equivalent to: CH 463

CH 464. ^EXPERIMENTAL CHEMISTRY II. (3 Credits)

Second-level integrated laboratory course for majors in chemistry and related disciplines, covering experimental techniques of analytical, inorganic, organic and physical chemistry. Lec/lab. (Writing Intensive Course)

Attributes: CWIC – Core, Skills, WIC

Prerequisites: (CH 362 with D- or better or CH 362H with D- or better) and CH 442 (may be taken concurrently) [D-]

Equivalent to: CH 464H

Recommended: CH 461 or CH 461H or CH 324

CH 464H. ^EXPERIMENTAL CHEMISTRY II. (3 Credits)

Second-level integrated laboratory course for majors in chemistry and related disciplines, covering experimental techniques of analytical, inorganic, organic and physical chemistry. Lec/lab. (Writing Intensive Course)

Attributes: CWIC – Core, Skills, WIC; HNRS – Honors Course Designator

Prerequisites: (CH 362 with D- or better or CH 362H with D- or better) and CH 442 (may be taken concurrently) [D-]

Equivalent to: CH 464

Recommended: CH 461 or CH 461H or CH 324

CH 471. ADVANCED ORGANIC CHEMISTRY. (3 Credits)

Principles of synthetic organic chemistry. Particular emphasis will be directed at understanding stereochemical outcomes in carbon-carbon bond-forming reactions (Diels-Alder, aldol, and pericyclic reactions). Other topics will include oxidation/reduction reactions, organometallic chemistry, and enantioselective methodologies.

Prerequisites: CH 336 with D- or better or CH 337 with D- or better

CH 490. COMPUTER PROGRAMMING FOR SCIENTISTS. (3 Credits)

Programming, numerical and graphical analysis, problem solving, simulations and use of databases for information handling and retrieval. Applications to problems in chemistry.

Prerequisites: MTH 252 with D- or better or MTH 252H with D- or better

CH 501. RESEARCH. (1-16 Credits)

Graded P/N.

This course is repeatable for 16 credits.

CH 503. THESIS. (1-16 Credits)

This course is repeatable for 999 credits.

CH 505. READING AND CONFERENCE. (1-16 Credits)

This course is repeatable for 16 credits.

CH 506. PROJECTS. (1-16 Credits)

This course is repeatable for 16 credits.

CH 507. SEMINAR. (1-16 Credits)

Student should enroll in the seminar section that meets the specific divisional requirements for credits and grading scheme or that is designated for teaching or mentoring programs. Graded P/N.

This course is repeatable for 16 credits.

CH 510. INTERNSHIP. (1-16 Credits)

This course is repeatable for 16 credits.

CH 511. INORGANIC CHEMISTRY. (4 Credits)

Fundamental principles of inorganic chemistry including atomic structure, bonding models for molecules and solids, symmetry, acid/base chemistry, oxidation-reduction, metal-ligand complexes, sol-gel chemistry and nanochemistry.

Recommended: CH 442 or CH 542

CH 512. INORGANIC CHEMISTRY. (4 Credits)

Descriptive chemistry of the elements, focusing on main-group compounds, transition metal complexes, and solid-state chemistry.

Prerequisites: CH 511 with C or better

CH 513. SOLID STATE CHEMISTRY. (3-4 Credits)

Basic principles of chemistry are applied to descriptions of structure-property relationships in inorganic solids. Topics include crystal structure, materials synthesis, chemical bonding, electronic properties, optical properties, and magnetism. Students who register for 4 credits will perform independent study of an advanced topic based on research literature.

This course is repeatable for 4 credits.

Recommended: CH 442 or CH 542

CH 516. RADIOCHEMISTRY. (4 Credits)

Selected methods in radiochemical analysis. Actinide chemistry, activation analysis, radionuclide solvent extraction, and microbial reactions with radionuclides. Designed for majors in chemistry, chemical engineering, nuclear engineering, and radiation health physics. Lec/lab. CROSSLISTED as NSE 516.

Prerequisites: NE 531 with C or better or (RHP 531 with C or better and RHP 536 [C])

Equivalent to: CHE 516, NE 516, NSE 516, RHP 516

This course is repeatable for 12 credits.

CH 518. NUCLEAR CHEMISTRY. (3 Credits)

Radioactive decay, nuclear properties, nuclear structure, alpha, beta, and gamma decay, nuclear reactions, fission, interaction of radiation with matter, chemical techniques, radiation safety, and nuclear instrumentation.

Recommended: Concurrent enrollment in (CH 440 or CH 540) or PH 314

CH 521. ANALYTICAL CHEMISTRY. (3 Credits)

A professional sequence for majors in chemistry and related disciplines. Chemical equilibrium, analytical electrochemistry, separations, spectroscopy, instrumentation, and treatment of data.

Recommended: One year of college chemistry and physics. Concurrent enrollment in CH 540

CH 522. ANALYTICAL CHEMISTRY. (3 Credits)

A professional sequence for majors in chemistry and related disciplines. Chemical equilibrium, analytical electrochemistry, separations, spectroscopy, basic electronics and instrumentation, and treatment of data.

Recommended: One year of college chemistry and physics. Concurrent enrollment in CH 541

CH 524. BIOANALYTICAL CHEMISTRY. (3 Credits)

Analytical methods employed in the study of biologically important molecules. Separations (chromatography, electrophoresis), spectroscopy, mass spectrometry, biosensors, and immunoassays. Lec/lab. Not offered every year.

Equivalent to: VM 524, VMB 524

Recommended: One year of organic chemistry and one term of organic chemistry laboratory.

CH 535. STRUCTURE DETERMINATION BY SPECTROSCOPIC METHODS. (3 Credits)

Use of ultraviolet, infrared, nuclear magnetic resonance, and mass spectra for determination of structures and stereochemistry of complex organic molecules.

Recommended: CH 336 and (CH 442 or CH 542)

CH 540. PHYSICAL CHEMISTRY. (3 Credits)

Thermodynamics, electrochemistry, solutions, kinetic theory of gases, chemical kinetics, quantum theory and statistical mechanics, molecular structure and spectroscopy.

Recommended: MTH 254 and one year of college chemistry and one year of college physics

CH 541. PHYSICAL CHEMISTRY. (3 Credits)

Thermodynamics, electrochemistry, solutions, kinetic theory of gases, chemical kinetics, quantum theory and statistical mechanics, molecular structure and spectroscopy.

Recommended: (CH 440 or CHE 311) AND (MTH 254 or MTH 254H)

CH 542. PHYSICAL CHEMISTRY. (3 Credits)

Thermodynamics, electrochemistry, solutions, kinetic theory of gases, chemical kinetics, quantum theory and statistical mechanics, molecular structure and spectroscopy.

Recommended: CH 541

CH 550. INTRODUCTORY QUANTUM CHEMISTRY. (3 Credits)

Elementary wave mechanics and matrix mechanics of atoms and molecules. Quantum basis of chemical structure. Not offered every year.

Prerequisites: CH 542 with C or better

Recommended: One year college physics

CH 553. CHEMICAL THERMODYNAMICS. (3 Credits)

The laws of chemical thermodynamics applied to analyze properties of gases, gas mixtures, liquid solutions, fluctuations, critical phenomena, and magnetic systems. Not offered every year.

Recommended: CH 542

CH 571. ADVANCED ORGANIC CHEMISTRY. (3 Credits)

Principles of synthetic organic chemistry. Particular emphasis will be directed at understanding stereochemical outcomes in carbon-carbon bond-forming reactions (Diels-Alder, aldol, and pericyclic reactions). Other topics will include oxidation/reduction reactions, organometallic chemistry, and enantioselective methodologies.

Recommended: CH 336 or CH 337

CH 582. CHEMISTRY AND MATERIALS OF BATTERIES AND SUPER CAPACITORS. (3 Credits)

Examines the chemistry and materials currently in use and proposed for future primary and secondary batteries and supercapacitors. After a brief historical review, we will examine in detail the state-of-the-art technologies including lithium-ion, lithium, and sodium-sulfur batteries and electrochemical double-layer capacitors, and future technologies such as metal-air and lithium-sulfur. Class discussions will focus on structure/performance relationships and other issues such as environmental impact, safety and cost. Offered via Ecampus only.

Recommended: Full year of general chemistry, college-level physics and materials science background

CH 584. INSTRUMENTS AND ONLINE INTERACTIONS IN THE SCIENCES. (3 Credits)

Examine methods and technologies for and incorporating virtual instruments and online interactions into laboratory courses to support learners in becoming critical thinkers and creative producers of their knowledge and understanding in science.

Recommended: Basic computer literacy and one year of general chemistry, physics or biology

CH 590. COMPUTER PROGRAMMING FOR SCIENTISTS. (3 Credits)

Programming, numerical and graphical analysis, problem solving, simulations and use of databases for information handling and retrieval. Applications to problems in chemistry.

Recommended: MTH 252

CH 601. RESEARCH. (1-16 Credits)

This course is repeatable for 16 credits.

CH 603. THESIS. (1-16 Credits)

This course is repeatable for 999 credits.

CH 605. READING AND CONFERENCE. (1-16 Credits)

This course is repeatable for 16 credits.

CH 607. SEMINAR. (1-16 Credits)

Student should enroll in the seminar section that meets the specific divisional requirements for credits and grading scheme or that is designated for teaching or mentoring programs.

This course is repeatable for 16 credits.

CH 614. SELECTED TOPICS IN INORGANIC CHEMISTRY. (4 Credits)

Nonsequence courses designed to acquaint the advanced graduate student with recent advances in fields such as solid state chemistry, theoretical inorganic chemistry, spectroscopy and magnetism, chemistry of coordination compounds, kinetics and mechanisms of inorganic reactions, acid-base theory and reactions in nonaqueous solvents, organometallic chemistry, and chemistry of the less familiar elements. Not offered every year.

Equivalent to: CH 514

This course is repeatable for 8 credits.

Recommended: CH 413 or CH 513

CH 615. SELECTED TOPICS INORGANIC CHEMISTRY. (4 Credits)

Focus is on cutting edge research topics in inorganic materials chemistry, which will evolve from year-to-year to stay up-to-date. Current journal articles, software programs, and lab demonstrations will be utilized. Students will learn both content of a research area, as well as tools used in the practice.

CH 616. CRYSTALLOGRAPHY AND X-RAY DIFFRACTION. (4 Credits)

Principles of crystallography and x-ray diffraction as applied to the structural characterization of both single crystals, powders, and thin films.

Equivalent to: CH 516

Recommended: At least one upper-level undergraduate inorganic chemistry course

CH 630. ADVANCED ORGANIC CHEMISTRY. (3 Credits)

Molecular orbital bonding theory, orbital symmetry, reaction mechanisms, stereoisomerism, conformational analysis, and advanced methods of synthesis. Not offered every year.

Equivalent to: CH 530

Recommended: CH 336 and (CH 442 or CH 542)

CH 631. ADVANCED ORGANIC CHEMISTRY. (4 Credits)

Carbon-carbon bond forming reactions, reaction mechanisms, stereoisomerism, conformational analysis, and advanced methods of synthesis. Not offered every year.

Equivalent to: CH 531

Recommended: CH 630

CH 632. ADVANCED ORGANIC CHEMISTRY. (3 Credits)

Molecular orbital bonding theory, orbital symmetry, reaction mechanisms, stereoisomerism, conformational analysis, and advanced methods of synthesis. Not offered every year.

Equivalent to: CH 532

Recommended: CH 336 and (CH 442 or CH 542)

CH 633. HYPOTHESIS, EVIDENCE, AND ARGUMENT IN ORGANIC CHEMISTRY. (2 Credits)

Immerses the student in the tools of scientific method as applied to current research topics in the chemical literature. The student will perform an extensive review of a modern topic in organic chemistry, prepare a written summary and analysis of this literature review and make a public oral presentation and discussion.

Prerequisites: CH 632 with C or better

This course is repeatable for 4 credits.

CH 636. SELECTED TOPICS IN ORGANIC CHEMISTRY. (3 Credits)

Nonsequence courses designed to acquaint students with recent advances in organic chemistry and their application to special fields of study. Topics covered vary from term to term and year to year. Topics include: theoretical organic chemistry, recent advances in reaction mechanisms, advanced synthesis, free radical reactions, organic sulfur chemistry, and biosynthesis of natural products. CH 636, CH 637, CH 638 need not be taken in order. Not offered every year.

Equivalent to: CH 536

This course is repeatable for 12 credits.

CH 637. SELECTED TOPICS IN ORGANIC CHEMISTRY. (3 Credits)

Nonsequence courses designed to acquaint students with advances in organic chemistry, specifically focusing on biosynthesis of natural products and enzyme reaction mechanisms. CH 636, CH 637, CH 638 need not be taken in order.

Equivalent to: CH 537

This course is repeatable for 12 credits.

CH 638. SELECTED TOPICS IN ORGANIC CHEMISTRY. (3 Credits)

Nonsequence courses designed to acquaint students with recent advances in organic chemistry and their application to special fields of study. Topics covered vary from term to term and year to year. Topics include: theoretical organic chemistry, recent advances in reaction mechanisms, advanced synthesis, free radical reactions, organic sulfur chemistry, and biosynthesis of natural products. CH 636, CH 637, CH 638 need not be taken in order. Not offered every year.

Equivalent to: CH 538

This course is repeatable for 12 credits.

CH 651. QUANTUM MECHANICS OF ATOMS AND MOLECULES. (3 Credits)

Not offered every year.

Equivalent to: CH 551

Recommended: CH 450 or CH 550

CH 652. QUANTUM MECHANICS OF MOLECULAR SPECTROSCOPY. (3 Credits)

Not offered every year.

Equivalent to: CH 552

Recommended: CH 651

CH 660. SPECTROCHEMICAL ANALYSIS. (3 Credits)

Theoretical concepts and methodology of optical spectrochemical methods of analysis, components of spectrometers, flame and electrothermal atomic spectrophotometry, ICP atomic emission spectrometry, molecular absorption and fluorescence spectrometry.

Equivalent to: CH 560

Recommended: CH 442 or CH 542

CH 661. SEPARATIONS: CHROMATOGRAPHY AND RELATED METHODS. (4 Credits)

Theory, instrumentation, and practice of modern separation techniques (gas chromatography, liquid chromatography, electrokinetic separations) and sample preparation methods; handling and interpretation of chromatographic and electrophoretic data.

Equivalent to: CH 561

Recommended: CH 440 or CH 540

CH 662. ANALYTICAL ELECTROCHEMISTRY. (4 Credits)

Study of current, voltage and time relationships in electrochemical cells. Offered alternate years.

Equivalent to: CH 562

Recommended: CH 442

CH 680. SELECTED TOPICS IN PHYSICAL CHEMISTRY. (3 Credits)

Nonsequence courses designed to acquaint students with recent advances in physical chemistry. Topics include molecular structure dynamics determination (UV-visible, near-IR light sources, x-ray, electron and neutron diffraction), spectroscopy (ultrafast, nonlinear, multidimensional, multiphoton, magnetic resonance, photoelectron), physical chemistry of condensed phase systems (biomolecules, aqueous solution, novel materials, ionic, molecular and liquid crystals, critical phenomena, mass transport), theoretical chemistry (chemical bonding, scattering theory, group theory, dynamics), electronic structure theory of molecules, structural dynamics of complex systems. Need not be taken in order. Not offered every year.

Prerequisites: CH 550 with B- or better

Equivalent to: CH 580

This course is repeatable for 12 credits.

CH 681. SELECTED TOPICS IN PHYSICAL CHEMISTRY. (2 Credits)

Nonsequence courses designed to acquaint students with recent advances in physical chemistry. Topics include molecular structure determination (x-ray, electron and neutron diffraction), spectroscopy (nonlinear and multiphoton, magnetic resonance, photoelectron, Moessbauer effect), physical chemistry of condensed phases (ionic, molecular and liquid crystals, critical phenomena, mass transport), theoretical chemistry (chemical bonding, scattering theory, group theory, dynamics), electronic structure theory of molecules. Need not be taken in order. Not offered every year.

Equivalent to: CH 581

This course is repeatable for 12 credits.

CH 682. SELECTED TOPICS IN PHYSICAL CHEMISTRY. (2 Credits)

Nonsequence courses designed to acquaint students with recent advances in physical chemistry. Topics include molecular structure determination (x-ray, electron and neutron diffraction), spectroscopy (nonlinear and multiphoton, magnetic resonance, photoelectron, Moessbauer effect), physical chemistry of condensed phases (ionic, molecular and liquid crystals, critical phenomena, mass transport), theoretical chemistry (chemical bonding, scattering theory, group theory, dynamics), electronic structure theory of molecules. Need not be taken in order. Not offered every year.

Equivalent to: CH 582

This course is repeatable for 12 credits.

CH 683. SELECTED TOPICS IN ANALYTICAL CHEMISTRY. (2 Credits)

Nonsequence courses designed to acquaint the advanced graduate student with recent advances in analytical chemistry. Not offered every year.

Equivalent to: CH 583

This course is repeatable for 12 credits.

CH 684. SELECTED TOPICS IN ANALYTICAL CHEMISTRY. (2 Credits)

Nonsequence courses designed to acquaint the advanced graduate student with recent advances in analytical chemistry. Not offered every year.

Equivalent to: CH 584

This course is repeatable for 12 credits.

CH 685. SELECTED TOPICS IN ANALYTICAL CHEMISTRY. (2 Credits)

Nonsequence courses designed to acquaint the advanced graduate student with recent advances in analytical chemistry. Not offered every year.

Equivalent to: CH 585

This course is repeatable for 12 credits.

CH 686. SELECTED TOPICS IN NUCLEAR AND RADIATION CHEMISTRY. (2 Credits)

Nonsequence courses designed to acquaint the advanced graduate student with recent advances in nuclear and radiation chemistry. Not offered every year.

Equivalent to: CH 586

This course is repeatable for 12 credits.

CH 687. SELECTED TOPICS IN NUCLEAR AND RADIATION CHEMISTRY. (2 Credits)

Nonsequence courses designed to acquaint the advanced graduate student with recent advances in nuclear and radiation chemistry. Not offered every year.

Equivalent to: CH 587

This course is repeatable for 12 credits.

CH 688. SELECTED TOPICS IN NUCLEAR AND RADIATION CHEMISTRY. (2 Credits)

Nonsequence courses designed to acquaint the advanced graduate student with recent advances in nuclear and radiation chemistry. Not offered every year.

Equivalent to: CH 588

This course is repeatable for 12 credits.

CH 692. ENVIRONMENTAL TRANSFORMATION OF ORGANIC COMPOUNDS. (3 Credits)

Chemical, photochemical, and biological transformation reactions of organic compounds in the environment. Test methods and predictive models for determining the persistence of organic compounds in the environment. Offered alternate years.

Recommended: CH 336 and CH 440

CH 697. MASS SPECTROMETRY OF ORGANIC COMPOUNDS. (4 Credits)

Physical principles of mass spectrometric instrumentation and interpretation of the mass spectra of organic compounds and biomolecules. Not offered every year.

Equivalent to: TOX 637