

CHEMISTRY (CHEM)

Course numbers with the # symbol included (e.g. #400) have not been taught in the last 3 years.

CHEM 400 - Freshman Seminar

Credits: 1

An introduction to the chemistry profession. Talks and workshops on the career of a chemist in academia, industry, medicine, law, teaching and government. Required for chemistry majors. Cr/F.

Repeat Rule: May be repeated for a maximum of 2 credits.

CHEM 403 - General Chemistry I

Credits: 0 or 4

Fundamental laws and concepts applied to nonmetals, metals, and their compounds. For students who plan to take further chemistry courses. Previous chemistry recommended. Knowledge of algebra, exponentials, and logarithms required. Special fee. Lab. Cannot be taken for credit if credit received for CHEM 405. Required for chemistry majors.

Attributes: Discovery Lab Course; Physical Science(Discovery)

Equivalent(s): CHEM 405

CHEM 404 - General Chemistry II

Credits: 0 or 4

Fundamental laws and concepts applied to nonmetals, metals, and their compounds. For students who plan to take further chemistry courses. Previous chemistry recommended. Knowledge of algebra, exponentials, and logarithms required. Required for chemistry majors. Special fee. Lab.

Attributes: Discovery Lab Course; Physical Science(Discovery)

Prerequisite(s): CHEM 403 with a minimum grade of D-

Equivalent(s): CHEM 404H, CHEM 405, CHEM 415, CHEM 416

CHEM 404H - Honors/General Chemistry II

Credits: 0 or 4

Fundamental laws and concepts applied to nonmetals, metals, and their compounds. For students who plan to take further chemistry courses. Previous chemistry recommended. Knowledge of algebra, exponentials, and logarithms required. Required for chemistry majors. Special fee. Lab. Honors course is designed for students who have enrolled in the honors degree program. Special fee. Lab. Cannot be taken for credit if credit received for CHEM 402.

Attributes: Discovery Lab Course; Honors course; Physical Science(Discovery)

Prerequisite(s): CHEM 403 with a minimum grade of D-

Equivalent(s): CHEM 404, CHEM 405, CHEM 415, CHEM 416

CHEM 405 - Chemical Principles for Engineers

Credits: 0 or 4

Basic principles; atomic structure, bonding, equilibria, and thermodynamics. One year of high school chemistry, algebra, and knowledge of logarithms. Cannot be taken for credit if credit received for CHEM 403 and CHEM 404. Required for chemical engineering, mechanical engineering, electrical and computer engineering, environmental engineering; industrial majors. Not applicable for credit for majors in chemistry or biochemistry.

Attributes: Discovery Lab Course; Physical Science(Discovery)

Equivalent(s): CHEM 403, CHEM 404, CHEM 404H, CHEM 413, CHEM #414

CHEM 408 - Green Goggles: Introduction to Green Chemistry

Credits: 4

In this course, we investigate the principles and practice of Green Chemistry as they connect to real world examples. Green Chemistry is the field of science that uses a principle-based approach to design chemical reactions and processes to make them more sustainable. In exploring green chemistry, many of the fundamental concepts of a general chemistry course are investigated. Some topics include use of renewable feedstocks, atom economy, catalysis, waste prevention, and design for degradation.

Attributes: Physical Science(Discovery)

Equivalent(s): CHEM 444G

CHEM 409 - Chemistry and Society

Credits: 4

Elementary survey of chemistry; integrates principles and applications. For students who do not intend to take any other chemistry courses and those interested in satisfying a general education science requirement. Not a prerequisite for any other chemistry courses. (Not offered every year.) Chemistry majors are excluded from taking this course.

Attributes: Physical Science(Discovery); Inquiry (Discovery)

CHEM 411 - Introductory Chemistry for Life Sciences

Credits: 4

Fundamental and pragmatic aspects of chemistry, particularly as foundation for nutritional biochemistry. Includes basics of bonding, acid/base behavior, reaction energy, intermolecular forces, stoichiometry, and equilibrium. High school chemistry not required. This course is not a replacement to CHEM 403 and is not an acceptable pre-requisite for CHEM 404. Special fee.

Attributes: Discovery Lab Course; Physical Science(Discovery)

CHEM 413 - General Chemistry Lecture I

Credits: 3

Fundamental laws and concepts applied to nonmetals, metals, and their compounds. For students who plan to take further chemistry courses. Previous chemistry recommended. Knowledge of algebra, exponentials, and logarithms required. Special permission required. Not offered every summer. Cannot be taken for credit if credit received for CHEM 401, CHEM 403, CHEM 405, or CHEM 409.

Equivalent(s): CHEM 401, CHEM 403, CHEM 405, CHEM 409

CHEM #414 - General Chemistry Lab I

Credits: 1

Lab application of fundamental laws and concepts applied to nonmetals, metals and their compounds. Previous general chemistry lecture required. Special permission. Special fee. Not offered every summer. Cannot be taken for credit if credit received for CHEM 401, CHEM 403, CHEM 405, or CHEM 409. Not open to Chemistry majors.

Equivalent(s): CHEM 401, CHEM 403, CHEM 405, CHEM 409

CHEM 415 - General Chemistry Lecture II

Credits: 3

Fundamental laws and concepts applied to nonmetals, metals, and their compounds. For students who plan to take further chemistry courses. Previous chemistry recommended. Knowledge of algebra, exponentials, and logarithms required. Cannot be taken for credit if credit received for CHEM 402 or CHEM 404.

Prerequisite(s): (CHEM 403 with a minimum grade of D- or CHEM 413 with a minimum grade of D-).

Equivalent(s): CHEM 402, CHEM 404, CHEM 404H

CHEM 416 - General Chemistry Lab II**Credits:** 1

Lab application of fundamental laws and concepts applied to nonmetals, metals and their compounds. Previous general chemistry lecture required. Special permission. Special fee. Not offered every summer. Cannot be taken for credit if credit received for CHEM 402 or CHEM 404. Not open to Chemistry majors.

Prerequisite(s): (CHEM 403 with a minimum grade of D- or CHEM #414 with a minimum grade of D-).

Equivalent(s): CHEM 402, CHEM 404, CHEM 404H

CHEM #4440 - The Story of Oxygen**Credits:** 4

The course will deal with a single element - oxygen. We will examine the role that oxygen compounds play in the atmosphere, including the ozone layer, global warming, and smog. In addition, the history of oxygen can be seen as emblematic of the development of chemistry from the mystical philosophy of alchemy to a quantitative science. We will discuss the development of chemistry by considering the history of our understanding of the element.

Attributes: Physical Science(Discovery); Inquiry (Discovery)

CHEM 501 - Peer-led Team Learning in Chemistry**Credits:** 2

Initial experience as peer instructional leader. Practical application of theories of cognition, group dynamics, learning, and motivation to helping other students learn chemistry in general chemistry. Requires one weekly meeting with students.

Prerequisite(s): (CHEM 403 with a minimum grade of D- or CHEM 404 with a minimum grade of D- or CHEM 404H with a minimum grade of D-).

CHEM 502 - Advanced Peer-led Team Leadership in Chemistry**Credits:** 1

Development and assessment of leadership skills. Practical application of theories of cognition, group dynamics, learning, and motivation to helping other students learn chemistry in general chemistry. Requires one weekly meeting with students. Permission required.

Prerequisite(s): CHEM 501 with a minimum grade of D-.

CHEM 503 - Mentoring for Peer Team Learning**Credits:** 1

Experienced leaders mentor a new leader in implementation of PLTL model, including initial co-leading and observational formative assessment. Mentors report on mentee development, visit other experienced leaders, and provide a final evaluation. Mentors lead their own weekly group and assist part-time in the PLTL leader meetings.

Prerequisite(s): CHEM 501 with a minimum grade of D-.

CHEM 517 - Quantitative Analysis**Credits:** 4

Combines lecture, laboratory, and in-class problem solving to study solubility, acid-base, redox, and complexation reactions and their application for quantitative chemical measurements. Lab.

Co-requisite: CHEM 518

Prerequisite(s): (CHEM 403 with a minimum grade of D- or CHEM 405 with a minimum grade of D-).

Equivalent(s): CHEM 406

CHEM 518 - Quantitative Analysis Laboratory**Credits:** 1

Volumetric methods with an emphasis on technique; separations; and selected instrumental methods such as potentiometry, spectrophotometry, atomic absorption, and gas chromatography. Special fee.

Co-requisite: CHEM 517

Prerequisite(s): (CHEM 404 with a minimum grade of D- or CHEM 404H with a minimum grade of D- or CHEM 405 with a minimum grade of D-).

Equivalent(s): CHEM 407

CHEM 545 - Organic Chemistry**Credits:** 3

Introductory study of carbon compounds for those who desire a brief terminal course. This course is a one semester course only. CHEM 545 and 546 are not applicable for pre-med, pre-vet, pharmacological majors or minors requiring a year long course of organic. CHEM 545 and CHEM 546 cannot be used to meet semester 1 of the year long-organic course (CHEM 547 or CHEM 651). CHEM 545 and CHEM 546L are co-requisites and must be taken together.

Co-requisite: CHEM 546

Prerequisite(s): (CHEM 404 with a minimum grade of D- or CHEM 404H with a minimum grade of D- or CHEM 405 with a minimum grade of D-).

Equivalent(s): CHEM 547, CHEM 548, CHEM 651, CHEM 652

CHEM 546 - Organic Chemistry Laboratory**Credits:** 2

Introductory study of carbon compounds for those who desire a brief terminal course. Lab.

Co-requisite: CHEM 545

Prerequisite(s): (CHEM 404 with a minimum grade of D- or CHEM 404H with a minimum grade of D- or CHEM 405 with a minimum grade of D-).

CHEM 547 - Organic Chemistry I**Credits:** 3

Principal classes of organic compounds, aliphatic and aromatic; class reactions and structural theory. Intended primarily for chemistry and biochemistry majors. Students receiving credit for CHEM 547-548 may not receive credit for either CHEM 545 or CHEM 651 and CHEM 652.

Co-requisite: CHEM 549

Prerequisite(s): (CHEM 404 with a minimum grade of D- or CHEM 404H with a minimum grade of D- or CHEM 405 with a minimum grade of D-).

Equivalent(s): CHEM 545, CHEM 651, CHEM 652

CHEM 548 - Organic Chemistry II**Credits:** 3

Principal classes of organic compounds, aliphatic and aromatic; class reactions and structural theory. Intended primarily for chemistry and biochemistry majors. Students receiving credit for CHEM 547 and CHEM 548 may not receive credit for either CHEM 545 or CHEM 651 and CHEM 652. Only listed majors allowed: Chemistry (BS), Chemistry (BA), Biochemistry, and Biochemistry.

Co-requisite: CHEM 550

Prerequisite(s): (CHEM 404 with a minimum grade of D- or CHEM 404H with a minimum grade of D- or CHEM 405 with a minimum grade of D-) and CHEM 547 with a minimum grade of D-.

Equivalent(s): CHEM 545, CHEM 651, CHEM 652

CHEM 549 - Organic Chemistry Laboratory**Credits:** 2

Special fee. Lab.

Co-requisite: CHEM 547

Equivalent(s): CHEM 653

CHEM 550 - Organic Chemistry Laboratory**Credits:** 2

Special fee. Lab.

Co-requisite: CHEM 548**Equivalent(s):** CHEM 654**CHEM 574 - Chemistry Across the Periodic Table****Credits:** 4

Ninety-eight elements form the building blocks of every substance on Earth—they are elegantly organized into what we now call The Periodic Table. This course will discuss the structure/property/reactivity patterns inherent in The Periodic Table, their origins according to the quantum mechanical model of the atom, and how they are manifest in current research advancements and modern applications of main group element chemistry, transition metal chemistry, and the chemistry of solids and materials.

Attributes: Inquiry (Discovery)**Prerequisite(s):** (CHEM 404 with a minimum grade of D- or CHEM 404H with a minimum grade of D- or CHEM 405 with a minimum grade of D-).**CHEM 576 - Experimental Inorganic Chemistry****Credits:** 2

This laboratory course is an introduction to synthetic methods in inorganic chemistry and the study of the elements across the periodic table. This course will emphasize the use of spectroscopic and analytical techniques specifically aimed at characterizing and identifying inorganic compounds, such as multi-nuclear NMR, UV\Vis, IR spectroscopy, X-ray diffraction and mass spectrometry. An introduction to scientific writing will be included. Special fee.

Prerequisite(s): CHEM 574 (may be taken concurrently) with a minimum grade of D-.**CHEM 651 - Organic Chemistry I****Credits:** 3

Principal classes of organic compounds, aliphatic and aromatic, class reactions and structural theory. Intended primarily for pre-healing arts, biological science, and health science students. Students receiving credit for CHEM 651 and CHEM 652 may not receive credit for either CHEM 545 or CHEM 547 and CHEM 548.

Co-requisite: CHEM 653**Prerequisite(s):** (CHEM 404 with a minimum grade of D- or CHEM 404H with a minimum grade of D- or CHEM 405 with a minimum grade of D-).**Equivalent(s):** CHEM 545, CHEM 547, CHEM 548**CHEM 652 - Organic Chemistry II****Credits:** 3

Principal classes of organic compounds, aliphatic and aromatic, class reactions and structural theory. Intended primarily for pre-healing arts, biological science, and health science students.

Co-requisite: CHEM 654**Prerequisite(s):** CHEM 651 with a minimum grade of D- and CHEM 653 with a minimum grade of D-.**Equivalent(s):** CHEM 545, CHEM 547, CHEM 548**CHEM 652A - Organic Chemistry II****Credits:** 3

Principal classes of organic compounds, aliphatic and aromatic, class reactions, and structural theory. Intended primarily for pre-healing arts, biological science, and health science students. Students receiving credit for CHEM 651 and CHEM 652 may not receive credit for either CHEM 545 or CHEM 547 and CHEM 548. This course is for Chemical Engineers only.

Prerequisite(s): CHEM 651 with a minimum grade of D- and CHEM 653 with a minimum grade of D-.**CHEM 653 - Organic Chemistry Laboratory****Credits:** 2

Special fee. Lab.

Co-requisite: CHEM 651**Equivalent(s):** CHEM 549**CHEM 654 - Organic Chemistry Laboratory****Credits:** 2

Special fee. Lab.

Co-requisite: CHEM 652**Equivalent(s):** CHEM 550**CHEM 683 - Physical Chemistry I****Credits:** 3

Topics may be chosen from: properties of gases, liquids, and solids; thermochemistry, and thermodynamics; chemical equilibria; reaction rates; quantum chemistry and spectroscopy.

Co-requisite: CHEM 685

Prerequisite(s): (CHEM 404 with a minimum grade of D- or CHEM 404H with a minimum grade of D- or CHEM 405 with a minimum grade of D-) and (MATH 426 with a minimum grade of D- or MATH 426H with a minimum grade of D-) and (PHYS 402 (may be taken concurrently) with a minimum grade of D- or PHYS 407 (may be taken concurrently) with a minimum grade of D- or PHYS 407H (may be taken concurrently) with a minimum grade of D- or PHYS 407S (may be taken concurrently) with a minimum grade of D-).

Equivalent(s): CHEM 681, CHEM 682**CHEM 684 - Physical Chemistry II****Credits:** 3

Topics may be chosen from: properties of gases, liquids, and solids; thermochemistry, and thermodynamics; chemical equilibria; reaction rates; quantum chemistry and spectroscopy.

Co-requisite: CHEM 686**Prerequisite(s):** CHEM 683 with a minimum grade of D- and (MATH 426 with a minimum grade of D- or MATH 426H with a minimum grade of D-).**CHEM 685 - Physical Chemistry Laboratory****Credits:** 0 or 2

Measurement of thermodynamic properties, chemical kinetics, and methods of determining the structure of matter. Special fee.

Co-requisite: CHEM 683

Prerequisite(s): (CHEM 404 with a minimum grade of D- or CHEM 404H with a minimum grade of D- or CHEM 405 with a minimum grade of D-) and (MATH 426 with a minimum grade of D- or MATH 426H with a minimum grade of D-) and (PHYS 407 (may be taken concurrently) with a minimum grade of D- or PHYS 407H (may be taken concurrently) with a minimum grade of D- or PHYS 402 (may be taken concurrently) with a minimum grade of D- or PHYS 407S (may be taken concurrently) with a minimum grade of D-).

CHEM 686 - Physical Chemistry Laboratory**Credits:** 2

Measurement of thermodynamic properties, chemical kinetics, and methods of determining the structure of matter. Special fee.

Co-requisite: CHEM 684

Prerequisite(s): CHEM 683 with a minimum grade of D- and CHEM 685 with a minimum grade of D- and (PHYS 407 (may be taken concurrently) with a minimum grade of D- or PHYS 407H with a minimum grade of D- or PHYS 402 (may be taken concurrently) with a minimum grade of D- or PHYS 407S (may be taken concurrently) with a minimum grade of D-).

Equivalent(s): CHEM 686W

CHEM 696 - Independent Study**Credits:** 1-4

For exceptional students. Individual reading, writing, or laboratory work carried out under the tutelage of a faculty member. May be used to replace specific required courses in chemistry.

Prerequisite(s): (CHEM 404 with a minimum grade of D- or CHEM 404H with a minimum grade of D- or CHEM 405 with a minimum grade of D-).

CHEM 708 - Spectroscopic Investigations of Organic Molecules**Credits:** 3

Identification and structural analysis of chemical compounds by selected instrumental methods. Typical topics include proton and carbon-13 NMR spectroscopy, IR and UV spectroscopy, and mass spectrometry.

CHEM 755 - Advanced Organic Chemistry**Credits:** 3

Methods of synthesis and determination of structure, including stereochemistry of complex organic compounds.

Prerequisite(s): (CHEM 548 with a minimum grade of D- or CHEM 652 with a minimum grade of D-).

CHEM #756 - Advanced Organic Chemistry Laboratory**Credits:** 2 or 3

Synthesis and structural determination of complex organic compounds, techniques for the separation, determination of purity, and identification of compounds by spectroscopic and chemical means. Coreq for CHEM majors: 755.

Co-requisite: CHEM 755

Equivalent(s): CHEM 756W

CHEM 762 - Instrumental Methods of Chemical Analysis**Credits:** 3

Theory, instrumentation, and application of methods such as atomic absorption, coulometry, emission spectrography, gas and liquid chromatography, polarography, potentiometry, IR and UV-VIS absorption spectrophotometry, and mass spectrometry to chemical analysis.

Co-requisite: CHEM 763

Prerequisite(s): CHEM 517 with a minimum grade of D- and CHEM 518 with a minimum grade of D- and CHEM 684 (may be taken concurrently) with a minimum grade of D-.

CHEM 763 - Instrumental Methods of Chemical Analysis Laboratory**Credits:** 2 or 3

Experimental parameters, error analysis, and applications of the methods covered in CHEM 762. Special fee.

Co-requisite: CHEM 762

Equivalent(s): CHEM 763W

CHEM 774 - Inorganic Chemistry**Credits:** 3

Basic theoretical concepts and their applications to inorganic reactions and compounds.

Prerequisite(s): (CHEM 548 with a minimum grade of D- or CHEM 652 with a minimum grade of D-).

CHEM 775 - Inorganic Chemistry Laboratory**Credits:** 2

In-depth instruction of selected techniques of synthesis and characterization of inorganic compounds. Emphasis on the analysis and presentation of results and experiment planning. Includes open-ended and collaborative projects. Special fee.

Co-requisite: CHEM 774

Equivalent(s): CHEM 775W

CHEM 776 - Physical Chemistry III**Credits:** 3

Application of quantum theory to atomic electron structure, molecular structure, and spectroscopy. Advanced topics in physical chemistry. Special fee.

Prerequisite(s): CHEM 684 with a minimum grade of D-.

CHEM 777 - Advanced Synthesis and Characterization**Credits:** 3

This is an advanced laboratory course involving the synthesis and characterization of organic and inorganic compounds. Students will leave this course with sufficient proficiency to reproduce synthetic procedures and prepare compounds from the chemical literature. Special fee.

Prerequisite(s): CHEM 550 with a minimum grade of D- and CHEM 576 with a minimum grade of D-.

CHEM 795 - Special Topics**Credits:** 2-4

New or specialized topics not covered in regular course offerings.

Repeat Rule: May be repeated for a maximum of 4 credits.

CHEM 798 - Senior Seminar**Credits:** 1

Student reports on topics of interest. Writing intensive. Cr/F.

Attributes: Writing Intensive Course

Prerequisite(s): (CHEM 548 with a minimum grade of D- or CHEM 652 with a minimum grade of D-) and CHEM 684 with a minimum grade of D-.

Equivalent(s): CHEM 698

CHEM 799 - Senior Thesis**Credits:** 4

Yearlong investigation in a selected topic, with background and experimental investigation. For chemistry majors who have completed CHEM 548, CHEM 694, and CHEM 762. Required for B.S. majors. Strongly recommended for B.A. chemistry majors. 2.50 average and approval of department chairperson. Lab. Two semesters of 4 credits each are required.

Attributes: Writing Intensive Course

Prerequisite(s): CHEM 548 with a minimum grade of D- and CHEM 684 with a minimum grade of D-.

Repeat Rule: May be repeated up to 1 time.

Equivalent(s): CHEM 699