

# CHEMISTRY (CH)

## CH 110 - Chemistry of Foods and Flavors With Lab

Credits: 4

A study of the chemical makeup of food and nutrients, and their biochemical functions. Different food processing techniques and their effects on the chemical, physical, and biological properties of food will be discussed. The chemical basis of flavor, composition of some common flavor ingredients, and the role of flavor in nutrient assimilation will be explored.

**Prerequisites:** QR1.

**Note(s):** Three hours of lecture and three hours of lab per week. Fulfills Natural Sciences requirement and QR2 requirements.

## CH 111 - Environmental Chemistry

Credits: 3

A study of fundamental chemical principles as they relate to environmental issues such as air pollution, acid rain, global warming, destruction of the ozone layer, the production and consumption of energy, and water pollution. A basic understanding of chemical principles and practices is necessary to fully appreciate the scope and complexity of current global environmental issues. Specific examples of international environmental problems are presented as case studies to reinforce the course material. Chemical concepts such as atomic structure, bonding, thermodynamics, nuclear chemistry, and chemical reactivity are introduced as they pertain to particular environmental issues.

**Prerequisites:** QR1.

**Note(s):** Fulfills QR2 requirement.

## CH 112 - Environmental Chemistry with Lab

Credits: 4

A study of fundamental chemical principles as they relate to environmental issues such as air pollution, acid rain, global warming, destruction of the ozone layer, the production and consumption of energy, and water pollution. A basic understanding of chemical principles and practices is necessary to fully appreciate the scope and complexity of current global environmental issues. Specific examples of international environmental problems are presented as case studies to reinforce the course material. Chemical concepts such as atomic structure, bonding, thermodynamics, nuclear chemistry, and chemical reactivity are introduced as they pertain to particular environmental issues. Laboratory exercises that relate to the environmental issues presented in lectures serve to reinforce students' understanding of the underlying chemical principles.

**Prerequisites:** QR1.

**Note(s):** Fulfills Natural Sciences and QR2 requirements.

## CH 115 - Fundamentals of Chemistry with Lab

Credits: 4

An Introductory course for students with little to no background in chemistry. Fundamental chemical concepts such as atomic structure, bonding, chemical reactions, and the properties of solids, liquids, and gases are presented. Emphasis is placed on learning the "language of chemistry," achieving the ability to visualize and understand natural processes on an atomic and molecular level, and developing quantitative reasoning and problem solving skills. Laboratory exercises and experiments serve to illustrate concepts presented in the lecture, and reinforce the mathematical skills necessary to investigate chemical systems. This course is appropriate for students preparing to take CH 125 or 126-Principles of Chemistry and for students who seek a one-semester survey of the subject.

**Prerequisites:** QR1 or MA 100 or placement at the FQR level or placement at the AQR level and placement based on the online Chemistry diagnostic exam.

**Note(s):** May not be used to satisfy major or minor requirements in chemistry or biology. Fulfills QR2 and Natural Sciences requirements; fulfills Fundamental QR requirement.

## CH 125 - Principles of Chemistry

Credits: 4

An introduction to the fundamental principles of chemistry that provides one of the bases for the in-depth study of natural science disciplines; appropriate for students who intend to major in the natural sciences. Topics include atomic and molecular structure, periodic relationships, properties of gases, kinetics, equilibria, acids and bases, electrochemistry, and thermodynamics. Laboratory experiments serve to illustrate concepts learned in the classroom. In both the classroom and laboratory, emphasis is placed on using quantitative reasoning skills to understand, interpret, and make predictions about chemical systems.

**Prerequisites:** Placement at the AQR level or completion of an FQR course or QR1 and CH 115 or placement based on the online Chemistry diagnostic exam.

**Note(s):** Three hours of lecture/discussion and one three-hour lab per week. Partially fulfills the writing requirement in the major. Fulfills QR2 and Natural Sciences requirements; fulfills Applied QR and Scientific Inquiry requirements.

## CH 126 - Principles of Chemistry

Credits: 4

An introduction to the fundamental principles of chemistry that provides one of the bases for the in-depth study of natural science disciplines; appropriate for students who intend to major in the natural sciences. Topics include atomic and molecular structure, periodic relationships, properties of gases, kinetics, equilibria, acids and bases, electrochemistry, and thermodynamics. Laboratory experiments serve to illustrate concepts learned in the classroom. In both the classroom and laboratory, emphasis is placed on using quantitative reasoning skills to understand, interpret, and make predictions about chemical systems.

**Prerequisites:** CH 115 or permission of the instructor, which is predicated on placement at AQR level or completion of an FQR course. (Three hours of lecture/discussion and one three-hour lab per week. Partially fulfills the writing requirement in the major. Only offered in the Spring for students who have completed CH 115. First year students who were in London in the Fall and place into CH 125 should contact the department chair. Fulfills QR2 and Natural Sciences requirements; fulfills Applied QR and Scientific Inquiry requirements).

**CH 171 - Introduction to Chemical Research**

Credits: 1

An introductory exploration of research in the chemical sciences. Each student works in collaboration with a faculty member to develop and demonstrate familiarity with chemical research methods. This experience allows students in the early stages of their careers to sample research methodologies in particular sub-disciplines of chemistry.

**Prerequisites:** Completion of one 100-level course in chemistry and permission of instructor.

**Note(s):** Three to six hours of work under the supervision of the individual faculty mentor. CH 171 does not count toward the chemistry major, nor the chemistry major with a biochemistry concentration. Must be taken S/U.

**CH 207H - Intermediate Topics In Chemistry**

Credits: 4

Intermediate-level, topic-based, honors courses that offer highly motivated students the opportunity to refine their critical thinking and quantitative problem-solving skills while examining an area of special interest in the field of chemistry. Specific topics may vary from year to year. The topic offered during a given semester is listed in master schedule. Descriptions of the various topics can be found on the Chemistry Department's website.

**Prerequisites:** CH 125 or permission of the department.

**Note(s):** Three hours of lecture-discussion and one three-hour lab per week.

**CH 214 - Inorganic Compounds and Materials**

Credits: 5

An intermediate-level examination of inorganic compounds and materials. Topics will include atomic structure, properties and periodicity of the elements, bonding, the structure and properties of solid-state materials, and coordination chemistry. Laboratory experiments will illustrate concepts learned in the classroom and introduce techniques used in the synthesis and characterization of these chemical species.

**Prerequisites:** CH 106 or CH 107H or CH 125.

**Note(s):** Three hours of lecture-discussion and one four-hour lab per week.

**CH 221 - Organic Chemistry I**

Credits: 5

The structures, physical properties, reactivity, and reaction mechanisms of aliphatic and aromatic hydrocarbons are investigated. The lab introduces the student to synthesis, purification, and chemical and spectroscopic methods of characterizing organic compounds.

**Prerequisites:** CH 125 or CH 126.

**Note(s):** Three hours of lecture-discussion and four hours of lab per week.

**CH 222 - Organic Chemistry II**

Credits: 5

The structure, physical properties, reactivity, and reaction mechanisms of important organic functional groups are investigated. The lab work focuses on structure determination and synthesis projects.

**Prerequisites:** CH 221.

**Note(s):** Three hours of lecture-discussion and four hours of lab per week. Partially fulfills the writing requirement in the major.

**CH 232 - Analytical Methods in Chemistry**

Credits: 5

A study of the process of developing analysis methods that yield accurate and precise results. The entire method development process will be interrogated from sampling techniques and statistical treatment of data to the theory and application of modern analytical chemical techniques. The lab includes hands-on experience with many types of modern analytical instrumentation.

**Prerequisites:** CH 125 or CH 126.

**Note(s):** Three hours lecture and four hours lab per week.

**CH 251 - Topics in Chemistry**

Credits: 5

Topically organized course based on a subfield of chemistry at the intermediate level. The specific topic examined may differ from year to year. In the laboratory section, students will learn basic methods of experimentation and instrumental analysis specific to the subfield.

**Prerequisites:** CH 125 or permission of instructor.

**Note(s):** Three hours of lecture-discussion and three hours of lab per week.

**CH 271 - Intermediate Chemical Research**

Credits: 2

An intermediate exploration of laboratory research in the chemical sciences in which students will develop a research project with a faculty member. Students will gain proficiency with standard techniques and protocols of chemical research.

**Prerequisites:** CH 125 and permission of instructor.

**Note(s):** Six to nine hours of work under supervision of the individual faculty mentor. CH 271 does not count toward the chemistry major, nor the chemistry major with biochemistry concentration. Must be taken S/U.

**CH 299 - Professional Internship in Chemistry**

Credits: 1-4

Internship opportunity for students whose curricular foundations and cocurricular experience have prepared them for professional work related to the major field. With faculty sponsorship and departmental approval, students may extend their educational experience into such areas as chemical research, environmental or material science, or chemical engineering.

**Prerequisites:** CH 125.

**CH 301 - Polymer Chemistry**

Credits: 3

Introduction to all types of polymers with emphasis on organic polymers. Mechanisms of polymerization reactions, the characterization of products, and the technological application of polymers will be discussed. Additionally, the student will be introduced systematically to the historical and current literature in the field.

**Prerequisites:** CH 222.

**CH 313 - Inorganic Chemistry**

Credits: 3

A study of the modern theories of atomic structure and chemical bonding as they pertain to inorganic systems. Topics include symmetry and group theory, bonding in ionic, covalent, and metallic substances, acid-base concepts, and coordination chemistry

**Prerequisites:** CH 330 or CH 332 or permission of instructor.

**CH 314 - Inorganic Chemistry With Lab**

Credits: 5

A study of the modern theories of atomic structure and chemical bonding as they pertain to inorganic systems. Topics include symmetry and group theory, bonding in ionic, covalent, and metallic substances, acid-base concepts, and coordination chemistry.

**Prerequisites:** CH 222 or permission of instructor.

**CH 323 - Advanced Organic Chemistry**

Credits: 3

A study of the advanced synthetic methodology and mechanistic theory of organic chemistry.

**Prerequisites:** CH 222.

**Note(s):** Three hours of lecture-discussion per week.

**CH 324 - Advanced Organic Chemistry With Lab**

Credits: 5

A study of the advanced synthetic methodology and mechanistic theory of organic chemistry. Students in the lab learn to work on projects in organic synthesis using modern instrumentation techniques.

**Prerequisites:** CH 222.

**Note(s):** Three hours of lecture-discussion and four hours of lab per week.

**CH 330 - Physical Chemistry I**

Credits: 3

The fundamental principles and concepts of equilibrium thermodynamics including entropy, energy, temperature, heat, work, and chemical potential. Applications include chemical reactions, phase changes, environmental science, and biochemical systems.

**Prerequisites:** CH 106 or CH 125, MA 113, PY 208.

**Note(s):** Three hours of lecture-discussion per week. This non-lab course may be used to satisfy a requirement for the chemistry major with biochemistry concentration but may not be used to satisfy any requirements for the chemistry major. CH 330 is the same as the lecture-discussion component of CH 332.

**CH 331 - Physical Chemistry II**

Credits: 3

The fundamental principles of kinetic theory, reaction kinetics, statistical thermodynamics, chemical application of quantum mechanics, bonding, molecular spectroscopy and structure.

**Prerequisites:** CH 330 or CH 332 or permission of the department.

**Note(s):** Three hours of lecture-discussion per week.

**CH 332 - Physical Chemistry I with Lab**

Credits: 5

The fundamental principles and concepts of equilibrium thermodynamics including entropy, energy, temperature, heat, work, and chemical potential. Applications include chemical reactions, phase changes, environmental science, and biochemical systems. Lab experiments provide opportunities for quantitative experimental investigation of thermodynamic systems, including studies of heat exchange, chemical equilibrium, and phase equilibrium.

**Prerequisites:** CH 222 or CH 303, MA 113, PY 208.

**Note(s):** Three hours of lecture-discussion and four hours of lab per week.

**CH 333 - Physical Chemistry II with Lab**

Credits: 5

The fundamental principles of kinetic theory, reaction kinetics, statistical thermodynamics, chemical application of quantum mechanics, bonding, molecular spectroscopy, and structure. Lab and computer based experiments provide an opportunity for quantitative experimental investigation of phenomena such as reaction rates, transport properties, bonding, and spectroscopy.

**Prerequisites:** CH 330 or CH 332 or permission of the department.

**Note(s):** Three hours of lecture-discussion, four hours of lab per week. Partially fulfills the writing requirement in the major.

**CH 340 - Biochemistry: Macromolecular Structure and Function**

Credits: 3

A study of the organic, physical, and biological chemistry of proteins, carbohydrates, lipids, nucleic acids, and enzymes. Structure-function relationships are explored at the molecular level using structural geometry and chemical reactivity concepts.

**Prerequisites:** CH 222.

**CH 341 - Biochemistry: Macromolecular Structure and Function with Lab**

Credits: 5

A study of the organic, physical, and biological chemistry of proteins, carbohydrates, lipids, nucleic acids, and enzymes. Structure-function relationships are explored at the molecular level using structural geometry and chemical reactivity concepts. The lab includes modern techniques for the purification, characterization, and identification of biomolecules.

**Prerequisites:** CH 222.

**Note(s):** Three hours of lecture-discussion and four hours of lab per week. Partially fulfills the writing requirement in the major.

**CH 342 - Biochemistry: Intermediary Metabolism**

Credits: 3

Intermediary metabolism, bioenergetics, and the nature of enzyme-catalyzed reactions are discussed.

**Prerequisites:** CH 340 or CH 341.

**Note(s):** Three hours of lecture discussion per week.

**CH 343 - Experimental Biochemistry Laboratory**

Credits: 2

A project-driven laboratory course to provide advanced training in experimental biochemistry. The course focuses on the isolation, purification, manipulation, and characterization of biological macromolecules, in particular proteins, in an investigative context. Students will be asked to apply previously learned biochemical knowledge and skills to answer an open question in biochemistry while also learning new laboratory techniques. Emphasis is placed on the proper collection, interpretation, synthesis, and presentation of in vitro and in silico results.

**Prerequisites:** CH 341.

**Note(s):** Fulfills a component of the Senior Experience Coda requirement.

**CH 351 - Special Topics in Chemistry**

Credits: 1-4

A variety of topics at the advanced, available to students with an interest in chemistry. Some examples of topics are atmospheric chemistry, food chemistry and nanotechnology. Specific choice of topics will depend on student interest and background. The course may be offered with or without lab.

**Prerequisites:** CH 222 and permission of the department.

**CH 352 - Special Topics in Biochemistry**

Credits: 1-4

A variety of topics at the advanced level, available to students with an interest in biochemistry. Specific choice of topics will depend on student interest and background. The course may be offered with or without lab.

**Prerequisites:** CH 222 and permission of the department.

**CH 353 - Topics in Environmental Chemistry**

Credits: 3

An advanced study of selected global, national, and local topics in environmental chemistry. Possible topics include stratospheric ozone cycle, global climate changes, tropospheric smog, acid deposition, nutrient cycling, alkalinity, eutrophication, water treatment, and hazardous wastes.

**Prerequisites:** CH 221.

**Note(s):** Three hours of lecture-discussion per week.

**CH 355 - Peer-Tutoring In Chemistry Laboratory**

Credits: 2

A course designed to introduce students to techniques of laboratory instruction and management. Students will participate in teaching laboratory sessions of first- and second-year chemistry courses and will receive training in preparation and delivery of pre-lab lectures, interaction with students in a supervisory role, safety issues in laboratory management, and assessment of experimental and written works by students.

**Prerequisites:** Permission of the department.

**Note(s):** Open to seniors majoring in chemistry or chemistry with biochemistry concentration. Fulfills a component of the Senior Experience Coda requirement.

**CH 371 - Capstone in Chemistry: Student-Faculty Collaborative Research**

Credits: 3

An elective course offered to upper level students who are interested in pursuing chemical research. Students work in collaboration with their faculty mentors to learn advanced techniques and protocols specific to their research fields. Each student develops a research project in collaboration with a faculty mentor and gives a formal presentation of their results.

**Prerequisites:** Permission of the instructor. (Students who intend to seek advanced degrees are particularly encouraged to take this course, CH 385, and/or CH 371. Nine to twelve hours of work under the supervision of the individual faculty mentor. Two semesters of 300-level research in chemistry (CH 385 and/or CH 371) are required for consideration for honors in chemistry. Fulfills a component of the Senior Experience Coda requirement.)

**CH 375 - Literature Investigation in Chemistry**

Credits: 3

Students prepare an in-depth written report on a current topic in chemistry or biochemistry. The chemical literature is investigated by both traditional methods and modern computer-based techniques. Individual and group conferences throughout the semester, as well as oral presentations are required.

**Prerequisites:** Permission of the department.

**Note(s):** Fulfills a component of the Senior Experience Coda requirement.

**CH 377 - Senior Seminar In Chemistry and Biochemistry**

Credits: 1

A course designed to help students connect what they've learned in the major to their liberal arts education at Skidmore, issues that are taking place throughout the world, and their plans for the future. Students will take an inventory of the knowledge and skills they have acquired, reflect on how these impact their career goals, and develop relevant materials to help them succeed as they move beyond Skidmore. Discussions will focus on pertinent issues in STEM disciplines including racial and gender inequality, and ethical concerns. Students will also meet with a variety of chemists and biochemists to discuss career paths, and will further develop communication skills by making presentations to both scientific and general audiences.

**Note(s):** Both CH 377 and CH 378 are required of all senior chemistry majors. Each of these courses may be repeated once for credit. Must be taken S/U. Fulfills a component of the Senior Experience Coda requirement.

**CH 378 - Senior Seminar in Chemistry and Biochemistry**

Credits: 1

A course designed to help students connect what they've learned in the major to their liberal arts education at Skidmore, issues that are taking place throughout the world, and their plans for the future. Students will take an inventory of the knowledge and skills they have acquired, reflect on how these impact their career goals, and develop relevant materials to help them succeed as they move beyond Skidmore. Discussions will focus on pertinent issues in STEM disciplines including racial and gender inequality, and ethical concerns. Students will also meet with a variety of chemists and biochemists to discuss career paths, and will further develop communication skills by making presentations to both scientific and general audiences.

**Note(s):** Both CH 377 and CH 378 are required of all senior chemistry majors. Each of these courses may be repeated once for credit. Must be taken S/U. Fulfills a component of the Senior Experience Coda requirement.

**CH 385 - Senior Thesis in Chemistry**

Credits: 4

An opportunity for Chemistry seniors to engage in chemical research under supervision of a Chemistry faculty member culminating in a senior thesis paper and presentation to the department.

**Prerequisites:** Agreement by a faculty member to serve as mentor and permission of the instructor.

**Note(s):** Students who intend to seek advanced degrees are particularly encouraged to take this course, CH 385, and/or CH 371. Twelve to fifteen hours of work under the supervision of the individual faculty mentor. Students enrolling in CH 385 are expected to write a senior thesis and present it to the department by the end of the semester. A senior thesis, an oral presentation of the thesis to the department, and two semesters of 300-level research in chemistry, CH 385 and/or CH 371 are required for consideration for honors in chemistry along with a 3.0 overall GPA and 3.5 GPA in the major. In addition for honors, the senior thesis must be read by the faculty mentor and a second reader who both must assess the thesis to be excellent and of honors caliber. For honors, the oral presentation must also be of sufficient quality. Fulfills a component of the Senior Experience Coda requirement.

**CH 399 - Professional Internship in Chemistry**

Credits: 1-4

Professional experience at an advanced level for juniors and seniors with substantial academic and cocurricular experience in the major field. With faculty sponsorship and department approval, students may extend their educational experience into such areas as chemical research, environmental or material science, or chemical engineering.

**Prerequisites:** CH 222 and one additional 300-level course in chemistry.

**Note(s):** Only three semester hours may count toward the major. Fulfills a component of the Senior Experience Coda requirement.