

# CHEMISTRY (CH)

## CH 0007 Introduction to Forensic Science

3 Credits

**Attributes:** EDCG Educational Studies Cognate

This course provides an introduction to the scientific techniques used for the analysis of common types of physical evidence encountered at crime scenes. Using critical thinking and laboratory experiences, students become crime scene investigators. They are charged with the task of solving a mock crime. The investigations include fabric analysis, ink analysis, blood analysis, DNA analysis, fingerprint analysis, ballistics, and/or blood alcohol analysis. The lecture part of the course focuses on exploring the underlying chemical principles behind the techniques and includes discussion of historical case studies. Note: This course counts as a science core course but does not satisfy requirements for the chemistry major or minor.

## CH 0010 Chemistry: Sights and Insights

3 Credits

This course, which fulfills a science requirement and has no prerequisites, presents chemistry via lecture, demonstration, and laboratory work. The course provides students with insights into the microscopic world of atoms and molecules to better understand the macroscopic, observable properties of real substances, and applies the models developed in the course to representative substances from inorganic, organic chemistry, and biochemistry. Note: This course counts as a science core course but does not satisfy requirements for the chemistry major or minor.

## CH 0033 Chemistry of Nutrition

3 Credits

**Attributes:** EDCG Educational Studies Cognate, HSST Health Studies: Science and Technology

This course introduces basic chemical concepts, such as the atom, molecules, chemical reactivity and energy, as well as integrating fundamental biological concepts including cell structure and basic anatomy. Further explored, on a chemical level, are the structure and function of basic nutritional components: proteins, carbohydrate, lipids, vitamins, and minerals. With a scientific foundation established, topics pertaining to nutrition and human evolution, the life cycle, and exercise will be discussed. Current social and health issues such as obesity, food technology, and fad dieting will be incorporated throughout the course. Note: This course counts as a science core course but does not satisfy requirements for the chemistry major or minor.

## CH 0072 Philosophy and Biochemistry of Food and Eating Practices

3 Credits

**Prerequisite:** PH 0101.

An essential component of our daily lives, food offers itself as one of the most interesting topics of cultural and scientific discussion. This course is designed to analyze food and eating practices from the twofold perspective of philosophy and biochemistry. The intersections of philosophy and biochemistry will be highlighted in topics such as "Food as Art" (juxtaposing the aesthetic and biomolecular properties of food) and "Food in Culture" (contrasting how societies prepare and eat food with the nutrition and technology of food science). The course combines lecture with activities such as trips to museums, guest lectures, and in-class laboratory activities. Note: Students may take either CH 0033 or CH 0072 as a core science requirement, but not both.

## CH 0076 Environmental Science

3 Credits

**Attributes:** EVME Environmental Studies Major Elective, EVNS Environmental Studies: Natural Science, EVPE Environmental Studies Elective

The science of the environment is presented through examination of the interconnections among physical, chemical, and biological fields of inquiry. This course looks at how the global environment is altered by the human population, technology, and production of fuels and food. In this course, students will acquire a scientific understanding of current issues in environmental science and learn to evaluate claims about current environmental problems.

## CH 0083 Survey of Chemistry

3 Credits

This one-semester course presumes no previous chemistry and fulfills a science requirement. The course consists of an introduction to atomic and molecular structure and the correlation of structural models to observable phenomena. The course discusses topics of historical and current relevance to society, including environmental issues, energy sources, natural products, and the application of chemistry in industry and medicine. Note: This course counts as a science core course but does not satisfy requirements for the chemistry major or minor.

## CH 0084 General Chemistry for Health Science

3 Credits

**Attributes:** EDCG Educational Studies Cognate, HSST Health Studies: Science and Technology

**Corequisite:** CH 0084L.

This course introduces the general principles of chemistry (matter and measurement, atomic and molecular structure, energetics, acids and bases, oxidation, and reduction) in a manner that prepares students to relate to properties of organic materials and biologically relevant substances such as carbohydrates, lipids, peptides, proteins, and nucleic acids. The course focuses on general principles and introduces organic and biologically relevant substances. This course is directed to School of Nursing students and students in the Health Studies minor.

## CH 0084L General Chemistry for Health Science Lab

1 Credit

**Fee:** \$60 Science Lab Fee

**Corequisite:** CH 0084.

This lab illustrates lecture concepts of CH 0084 and allows students to observe relevant physical systems.

## CH 0085 Chemistry, Energy, and the Environment

3 Credits

**Attributes:** EDCG Educational Studies Cognate, EVME Environmental Studies Major Elective, EVNS Environmental Studies: Natural Science, EVPE Environmental Studies Elective

This course explores the flow of energy in modern society from the perspective of chemistry. Topics include the fossil fuels coal, petroleum, and natural gas, followed by an exploration of alternatives, including biomass, hydro, solar, tidal, wind, and nuclear energy sources. Students consider the source of energy, how it is harvested, and the short- and long-term environmental consequences of using each energy source and how these consequences are determined. The course uses the concepts of bonding, thermodynamics, kinetics, and work to investigate these and related ideas. The course also discusses economic and political forces that shape our use of energy. Note: This course counts as a science core course but does not satisfy requirements for the chemistry major or minor.

**CH 0086 Chemistry and Art****3 Credits****Attributes:** EDCG Educational Studies Cognate

This basic chemistry course with a strong orientation to the visual arts fulfills a core science requirement. Basic concepts include atoms, molecules, elements, compounds, the periodic table, chemical bonding and reaction, acids and bases, oxidation and reduction, and polymers. The lab employs these concepts to examine aspects of art media such as light, color, dyes, paint, metals, stone, ceramics, glass, plastics, paper, and fibers. Note: This course counts as a science core course but does not satisfy requirements for the chemistry major or minor.

**CH 0087 Molecules of Life****3 Credits**

This course explores the modern science of biologically relevant compounds and substances, which exist at the intersection of chemistry, biology, and medicine. We examine the major molecular components of the cell - proteins, nucleic acids, lipids, and more - and illustrate the application of chemical principles to understanding their structure and function. Since our lives are increasingly influenced by the availability of new pharmaceutical agents ranging from drugs that lower cholesterol to those that influence behavior, we develop insights needed to understand drug action and consider the design of new ways to intercede in the disease process. Note: This course counts as a science core course but does not satisfy requirements for the chemistry major or minor.

**CH 0111 General Chemistry I****3 Credits****Corequisite:** CH 0111L.

This course, the first in a two-semester sequence, covers atomic and molecular weights, the mole concept, Avogadro's number, stoichiometry, energy relationships in chemical systems, the properties of gases, the electronic structures of atoms, periodic relationships among the elements, chemical bonding, geometrics of molecules, molecular orbitals, liquids, solids, intermolecular forces, solutions, rates of chemical reactions, chemical equilibrium, free energy, entropy, acids and bases, aqueous equilibria, electrochemistry, nuclear chemistry, chemistry of some metals and nonmetals, and chemistry of coordination compounds.

**CH 0111L General Chemistry I Lab****1 Credit****Fee:** \$60 Science Lab Fee**Corequisite:** CH 0111.

This lab offers the opportunity to explore and experience the rigors of an experimental physical science. Students make and record observations on simple chemical systems while learning fundamental laboratory manipulative and measurement skills. Experiments demonstrate and supplement concepts introduced in lecture. The first semester emphasizes weighing, filtering, titrating, using volumetric glassware, observing data, and recording and synthetic techniques. The second semester integrates these techniques in experimental procedures and explores physical properties and quantitative analysis of selected chemical systems.

**CH 0112 General Chemistry II****3 Credits****Attributes:** HSST Health Studies: Science and Technology**Corequisite:** CH 0112L.**Prerequisite:** CH 0111.

This course, the second in a two-semester sequence, covers atomic and molecular weights, the mole concept, Avogadro's number, stoichiometry, energy relationships in chemical systems, the properties of gases, the electronic structures of atoms, periodic relationships among the elements, chemical bonding, geometrics of molecules, molecular orbitals, liquids, solids, intermolecular forces, solutions, rates of chemical reactions, chemical equilibrium, free energy, entropy, acids and bases, aqueous equilibria, electrochemistry, nuclear chemistry, chemistry of some metals and nonmetals, and chemistry of coordination compounds.

**CH 0112L General Chemistry II Lab****1 Credit****Fee:** \$60 Science Lab Fee**Corequisite:** CH 0112.

This lab offers the opportunity to explore and experience the rigors of an experimental physical science. Students make and record observations on simple chemical systems while learning fundamental laboratory manipulative and measurement skills. Experiments demonstrate and supplement concepts introduced in lecture. The first semester emphasizes weighing, filtering, titrating, using volumetric glassware, observing data, and recording and synthetic techniques. The second semester integrates these techniques in experimental procedures and explores physical properties and quantitative analysis of selected chemical systems.

**CH 0211 Organic Chemistry I****3 Credits****Corequisite:** CH 0211L.**Prerequisite:** CH 0112.

This course, an introduction to the chemistry of carbon compounds, discusses common functional groups from the perspective of molecular structure. Areas of emphasis include structure and characterization, preparation or organic synthesis, and the relations of physical and chemical properties to molecular structure. Stereochemical concepts introduced early in the course are used throughout.

**CH 0211L Organic Chemistry I Lab****1 Credit****Fee:** \$60 Science Lab Fee**Corequisite:** CH 0211.

This lab emphasizes the manipulative techniques of separation, purification, analysis, and simple syntheses.

**CH 0212 Organic Chemistry II****3 Credits****Corequisite:** CH 0212L.**Prerequisite:** CH 0211.

This course is a continuation of CH 0211 and presents the chemistry of aromatic, carbonyl, acyl, and nitrogen compounds. The course relates the chemical properties of naturally occurring substances such as carbohydrates, lipids, proteins, and nucleic acids to those of simpler monofunctional compounds. Spectroscopic methods of structure determination are introduced early in the course and used throughout.

**CH 0212L Organic Chemistry II Lab****1 Credit****Fee:** \$60 Science Lab Fee**Corequisite:** CH 0212.

This lab emphasizes investigative experiments, more complex synthesis, and qualitative organic analysis.

**CH 0222 Chemical Analysis****3 Credits****Attributes:** EVME Environmental Studies Major Elective**Corequisite:** CH 0222L.**Prerequisite:** CH 0112.

This course provides the theoretical basis for the required laboratory.

Topics include statistics, chemical equilibria and their analytical applications (acid-base, oxidation-reduction, complex formation, precipitation), electroanalytical chemistry, spectroanalytical chemistry, and chemical separations.

**CH 0222L Chemical Analysis Lab****1 Credit****Fee:** \$60 Science Lab Fee**Corequisite:** CH 0222.

Students explore quantitative aspects of chemistry through the analysis of unknowns and the characterization of chemical equilibrium, and pursue classical and instrumental methods of analysis.

**CH 0261 Physical Chemistry I****3 Credits****Corequisite:** CH 0261L.**Prerequisites:** CH 0112, MA 0146 or higher, PS 0116.

This course is the first of a two-semester sequence, covering thermodynamics of gasses, pure liquids, and both electrolyte and non-electrolyte solutions. Additional topics include chemical equilibrium, transport phenomena, reaction kinetics, quantum mechanics, spectroscopy, and statistical mechanics and statistical thermodynamics.

**CH 0261L Physical Chemistry I Lab****1 Credit****Fee:** \$60 Science Lab Fee**Corequisite:** CH 0261.

This course demonstrates and verifies concepts covered in lecture courses CH 0261. Each lab meets weekly for three hours, during which students perform experiments with precision and care. The course incorporates current technology into each experiment and uses computers in data acquisition, reduction, and reporting. The course places special emphasis on data handling techniques and the accurate recording of observations.

**CH 0262 Physical Chemistry II****3 Credits****Corequisite:** CH 0262L.**Prerequisite:** CH 0261.

This course is the second of a two-semester sequence, covering thermodynamics of gasses, pure liquids, and both electrolyte and non-electrolyte solutions. Additional topics include chemical equilibrium, transport phenomena, reaction kinetics, quantum mechanics, spectroscopy, and statistical mechanics, and statistical thermodynamics.

**CH 0262L Physical Chemistry II Lab****1 Credit****Fee:** \$60 Science Lab Fee**Corequisite:** CH 0262.

This course demonstrates and verifies concepts covered in the lecture course CH 0262. Each lab meets weekly for three hours, during which students perform experiments with precision and care. The course incorporates current technology into each experiment and uses computers in data acquisition, reduction, and reporting. The course places special emphasis on data handling techniques and the accurate recording of observations.

**CH 0324 Biochemistry I****3 Credits****Prerequisite:** CH 0212.

This course will investigate the fundamentals of life - chemistry. The structures and functions of biomolecules, including proteins, DNA, RNA, lipids, and carbohydrates will be covered in depth. The concepts behind biological processes will be discussed, including enzyme kinetics and regulatory strategies, membrane functions, signal transduction, and an overview of metabolism.

**CH 0324L Biochemistry Lab****1 Credit****Fee:** \$60 Science Lab Fee**Corequisite:** BI 0324 or BI 0325 or CH 0324 or CH 0325.

This course will investigate classic and most current methodology used in biochemistry. A semester project will be used to introduce techniques used in biochemistry to investigate the structure and function of a protein. In characterizing this protein, the analysis of DNA, lipids and carbohydrates will also be covered.

**CH 0325 Biochemistry II****3 Credits****Prerequisites:** BI 0170, BI 0171, BI 0172, CH 0211, CH 0212.

This course focuses on the regulation of metabolic pathways involved in the synthesis, breakdown, and interconversion of biochemical intermediates that are fundamental to all life. Basic principles of biological thermodynamics will be highlighted in order to understand the processes by which living cells obtain and utilize energy. Students will develop an understanding of basic biomedical principles in the context of overall cell function. Formerly BI 0326.

**CH 0325L Biochemistry Lab****1 Credit****Fee:** \$60 Science Lab Fee**Corequisite:** BI 0324 or BI 0325 or CH 0324 or CH 0325.

This course will investigate classic and most current methodology used in biochemistry. A semester project will be used to introduce techniques used in biochemistry to investigate the structure and function of a protein. In characterizing this protein, the analysis of DNA, lipids and carbohydrates will also be covered.

**CH 0326 Chemical Instrumentation****3 Credits****Attributes:** EVME Environmental Studies Major Elective**Prerequisite:** CH 0222.

Students study chemical analysis in detail, using modern instrumentation. Students explore current methods of analysis, theory of transduction, implementation of instrumental principles, and physical theory of chemical systems in the context of the goals of the analytical problem and consider examples of applications.

**CH 0326L Instrumental-Analytical Chemistry Lab****3 Credits****Attributes:** EVME Environmental Studies Major Elective**Fee:** \$60 Science Lab Fee**Prerequisites:** CH 0222, CH 0326.

This course exposes students who have already been introduced to the theory of classical (CH 0222) and instrumental (CH 0326) methods of analysis to problem solving using a variety of physical and chemical methods. The early portion of this course consolidates the classroom principles of analytical chemistry into a holistic understanding of analytical chemistry, giving students a further appreciation of the general considerations made when designing an approach to problem solving in analysis. Students receive hands-on exposure to the following aspects of analytical chemistry: basic electronics as appropriate to common instrumentation, methodology involved in equipment maintenance and troubleshooting, exposure to solving real-world analytical problems, and use of small computers and interfaces in the lab. The course emphasizes oral communication of results among all lab participants.

**CH 0341 Advanced Inorganic Chemistry****3 Credits****Corequisites:** CH 0261, CH 0341L.

This course introduces students to the interdependence of chemical bonding, spectroscopic characteristics, and reactivity properties of coordination compounds and complexes using the fundamental concept of symmetry. The principles of coordination chemistry will be introduced after reviewing atomic structure, the chemical bond, and molecular structure. A basic familiarity with symmetry will be formalized by an introduction to the elements of symmetry and group theory. The students will use symmetry and group theory approaches to understand central atom hybridization, ligand group orbitals, and the construction of qualitative molecular orbital (MO) energy diagrams including both sigma and pi bonding contributions. The students will continue to utilize their understanding of group theory during an introduction of electronic spectroscopy and the use of correlation and Tanabe-Sugano diagrams. MO diagrams will then be used as a starting point for understanding the reactivity properties of coordination complexes.

**CH 0341L Advanced Inorganic Chemistry Lab** **2 Credits****Fee:** \$60 Science Lab Fee**Corequisite:** CH 0341.

This lab is a synthetic inorganic lab with an emphasis placed on characterization. In the laboratory, students will have the opportunity to synthesize, characterize, and investigate the physical and reactive properties of coordination, organometallic, and air-sensitive complexes. Students will utilize the following instrumental methods to characterize their compounds: UV-Visible spectroscopy, magnetic susceptibility, polarimetry, infrared spectroscopy, and NMR spectroscopy. Students write formal laboratory reports for every experiment.

**CH 0363 Advanced Topics** **1-3 Credits****CH 0398 Research and Seminar** **1-3 Credits**

Students undertake a research project in conjunction with a faculty member and present two seminars: one pertaining to a literature topic, the other focused on their research. Enrollment by departmental permission only.

**CH 0399 Independent Study** **1-3 Credits****Prerequisite:** CH 0262.

This course, designed for students seeking an in-depth examination of a pre-specified area under the close direction of a faculty member(s) presents topics not routinely encountered in the normal course sequence.