CHEMISTRY (CHEM)

CHEM 1010 Chemistry: Sights and Insights 3 Credits
This course 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.

CHEM 1033 Chemistry of Nutrition 3 Credits
Course Tags: Educational Studies Cognate, 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. Students may take either CHEM 1033 or CHEM 1072 as a core science requirement, but not both.

CHEM 1072 Philosophy and Biochemistry of Food and Eating Practices 3 Credits
Prerequisite(s): PHIL 1101.
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 CHEM 1033 or CHEM 1072 as a core science requirement, but not both. Crosslisted with PHIL 2218.

CHEM 1073 Culinary Chemistry 3 Credits
This course explores the chemical transformations underlying common culinary processes. Students will gain a molecular-level appreciation of culinary context (salt, fat, acid, heat) and execution (grilling, baking, braising, fermentation). Special attention will be given to data collection, analysis, and interpretation. Students will explore course concepts through hands-on homework. Because cooking is shared across cultures, this class will also devote time to questions of food access, security, and human health. Note: This course counts as a science core course but does not satisfy the requirements for the chemistry major or minor.

CHEM 1076 Environmental Science 3 Credits
Course Tags: Environmental Studies Elective, Environmental Studies Major Elective, Environmental Studies: Natural Science, Magis Core: Interdisciplinary
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. Crosslisted with BIOL 1076.

CHEM 1077 Introduction to Forensic Science 3 Credits
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.

CHEM 1083 Survey of Chemistry 3 Credits
This 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.

CHEM 1085 Chemistry, Energy, and the Environment 3 Credits
Course Tags: Educational Studies Cognate, Environmental Studies Elective, Environmental Studies Major Elective, Environmental Studies: Natural Science, Magis Core: Interdisciplinary
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.

CHEM 1086 Chemistry and Art 3 Credits
Course Tags: 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.

CHEM 1087 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.

CHEM 1171 General Chemistry I 3 Credits
Corequisite(s): CHEM 1171L.
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.

CHEM 1171L General Chemistry I Lab 1 Credit
Fee: $130 Chemistry Lab Fee
Corequisite(s): CHEM 1171.
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.

CHEM 1172 General Chemistry II 3 Credits
Course Tags: Health Studies: Science and Technology
Corequisite(s): CHEM 1172L.
Prerequisite(s): CHEM 1171, CHEM 1171L.
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.

CHEM 1172L General Chemistry II Lab 1 Credit
Fee: $130 Chemistry Lab Fee
Corequisite(s): CHEM 1172.
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.

CHEM 1184 General Chemistry for Health Science 0-3 Credits
Course Tags: Health Studies: Science and Technology
Corequisite(s): CHEM 1184L.
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.

CHEM 1184L General Chemistry for Health Science Lab 1 Credit
Fee: $130 Chemistry Lab Fee
Corequisite(s): CHEM 1184.
This lab illustrates lecture concepts of CHEM 1184 and allows students to observe relevant physical systems.

CHEM 2271 Organic Chemistry I 3 Credits
Corequisite(s): CHEM 2271L.
Prerequisite(s): CHEM 1172 and CHEM 1172L.
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..

CHEM 2271L Organic Chemistry I Lab 1 Credit
Fee: $130 Chemistry Lab Fee
Corequisite(s): CHEM 2271.
This lab emphasizes the manipulative techniques of separation, purification, analysis, and simple syntheses.

CHEM 2272 Organic Chemistry II 3 Credits
Corequisite(s): CHEM 2272L.
Prerequisite(s): CHEM 2271.
This course 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.

CHEM 2272L Organic Chemistry II Lab 1 Credit
Fee: $130 Chemistry Lab Fee
Corequisite(s): CHEM 2272.
This lab emphasizes investigative experiments, more complex synthesis, and qualitative organic analysis.

CHEM 2282 Chemical Analysis 3 Credits
Course Tags: Environmental Studies Major Elective, Environmental Studies: Natural Science
Corequisite(s): CHEM 2282L.
Prerequisite(s): CHEM 1172.and CHEM 1172L.
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.

CHEM 2282L Chemical Analysis Lab 1 Credit
Course Tags: Environmental Studies Elective, Environmental Studies: Natural Science
Fee: $130 Chemistry Lab Fee
Corequisite(s): CHEM 2282.
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.

CHEM 2291 Chemistry and Social Justice 3 Credits
Prerequisite(s): CHEM 2272.
In this course, students will learn about and reflect on the systematic racism and sexism that exist in STEM, and specifically in the chemistry/biochemistry fields. Students will learn historically important scientific discoveries made by Black chemists and research (and celebrate!) contemporary scientists from traditionally underrepresented groups. Students will also learn about technological, industrial, and medical advances and reflect on how these advances can have adverse, and inequitable, effects. The course will explore how principles of green chemistry are being applied in current research programs to solve social justice related issues, like reducing our dependance on non-renewable natural resources.

CHEM 3311 Forensic Science in the Health Care Setting 3 Credits
Course Tags: Health Studies: Traditions, Delivery, and Ethics
Prerequisite(s): CHEM 2272, CHEM 2272L.
This course explores forensic science and its intersection with health care by discussing the interdisciplinary team working to serve patients who may also be victims of crime. From a health care perspective, students learn types of violent crimes, victimology, prevalent population based health issues, trauma-informed care, and forensic healthcare interventions. From a forensic scientific perspective, students explore the scientific techniques used to analyze physical or chemical evidence collected in a health care setting. Students put their learning into practice by participating in caring for victims of mock crimes in simulated clinical rooms, and analyzing collected evidence in the laboratory.

CHEM 3323L Biochemistry Lab 1 Credit
Fee: $130 Chemistry Lab Fee
Corequisite(s): BIOL 3324 or BIOL 3325 or CHEM 3324 or CHEM 3325.
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.

CHEM 3324 Biochemistry I 3 Credits
Course Tags: Biology: Physiology/Morphology
Prerequisite(s): CHEM 2272.
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. Crosslisted with BIOL 3324.

CHEM 3325 Biochemistry II 3 Credits
Course Tags: Biology: Physiology/Morphology
Prerequisite(s): CHEM 2272 and CHEM 3324 or BIOL 3324.
This course will investigate how biochemists study and manipulate the molecular systems of life. Building on foundational knowledge of biomolecular structure and basic metabolism, we will explore experimental approaches to understanding information flow from DNA to proteins, molecular recognition and signaling networks, and the methods used to engineer biological systems. Students will learn to design experiments, interpret results from diverse biochemical techniques, and apply biochemical principles to complex biological problems. Crosslisted with BIOL 3325.

CHEM 3326 Chemical Instrumentation 3 Credits
Course Tags: Environmental Studies Elective, Environmental Studies Major Elective, Environmental Studies: Natural Science
Prerequisite(s): CHEM 2282.
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.

CHEM 3326L Instrumental-Analytical Chemistry Lab 3 Credits
Course Tags: Environmental Studies Elective, Environmental Studies Major Elective, Environmental Studies: Natural Science
Fee: $130 Chemistry Lab Fee
Prerequisite(s): CHEM 3326.
This course exposes students who have already been introduced to the theory of classical (CHEM 2282) and instrumental (CHEM 3326) 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.

CHEM 3341 Advanced Inorganic Chemistry 3 Credits
Corequisite(s): CHEM 3361.
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.

CHEM 3341L Advanced Inorganic Chemistry Lab 2 Credits
Fee: $130 Chemistry Lab Fee
Corequisite(s): CHEM 3341.
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.

CHEM 3361 Physical Chemistry I 3 Credits
Corequisite(s): CHEM 3361L.
Prerequisite(s): CHEM 1172 and CHEM 1172L and MATH 1142 or higher, and PHYS 1172.
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.

CHEM 3361L Physical Chemistry I Lab 1 Credit
Fee: $130 Chemistry Lab Fee
Corequisite(s): CHEM 3361.
This course demonstrates and verifies concepts covered in Physical Chemistry lecture courses. 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.

CHEM 3362 Physical Chemistry II 3 Credits
Corequisite(s): CHEM 3362L.
Prerequisite(s): CHEM 1172 and CHEM 1172L; MATH 1142 or higher, and PHYS 1172.
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.

CHEM 3362L Physical Chemistry II Lab 1 Credit
Fee: $130 Chemistry Lab Fee
Corequisite(s): CHEM 3362.
This course demonstrates and verifies concepts covered in Physical Chemistry lecture. 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.

CHEM 4971 Research and Seminar I 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 permission only.

CHEM 4972 Research and Seminar II 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 permission only.

CHEM 4973 Research and Seminar III 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 permission only.

CHEM 4974 Research and Seminar IV 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 permission only.

CHEM 4975 Research and Seminar V 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 permission only.

CHEM 4976 Research and Seminar VI 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 permission only.

CHEM 4977 Chemistry 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 permission only.

CHEM 4990 Independent Study 1-3 Credits
Prerequisite(s): CHEM 3362.
This course, designed for students seeking an in-depth examination of a pre-specified area under the close direction of a faculty member, presents topics not routinely encountered in the normal course sequence.