

# CHEMISTRY AND PHYSICS

Phone: 718.489.5453

## Department Mission

Within the context of a liberal education, the department provides courses that expose students to the information, knowledge, and methods used in the physical sciences. In general, the purpose of the major is to prepare students for graduate and professional schools as well as for careers in the chemical, biotechnical or pharmaceutical industries. The department encourages Chemistry majors to fully explore the chemical sciences and allied fields through participation in research, seminars, and science-based clubs and activities. Department advisors assist students in exploring career possibilities and in devising a personalized plan of study that will best prepare them for their career goals.

## Program Learning Objectives (PLO)

- PLO 1: Apply appropriate mathematical concepts to science.
- PLO 2: Explain the structure, properties, and reactions of chemicals and biomolecules.
- PLO 3: Apply appropriate safety principles when conducting scientific experiments.
- PLO 4: Evaluate orally and in written work scientific data obtained by experiment.
- PLO 5: Explain the various ways that science impacts our lives and the world around us.
- PLO 6: Explain different physical phenomena.

## Programs

- Chemistry Minor (<https://catalog.sfc.edu/catalogue/programs/chemistry-physics/chemistry-minor/>)
- Chemistry, BS (<https://catalog.sfc.edu/catalogue/programs/chemistry-physics/chemistry-bs/>)

## Courses

### CHE-1000 Chemistry in Society (3 Credits)

Designed for non-science majors. Chemical principles are developed and applied to a series of major societal/technological issues such as global warming, water quality, acid rain, food additives, alternate energy sources, etc. Three lecture hours per week. 3 credits. Every year; day and evening.

**Typically offered:** Fall Only

### CHE-1101 Chemistry and Life I (4 Credits)

**Requisite(s):** MAT-1101 or higher, CHE-1101L, CHE-1101R

Intended for non-science majors. Introduction to basic principles of chemistry; emphasis on application of these principles to living systems and their impact on present-day living. Two lecture, one recitation, and three lab hours per week. Lab fee.

**Fulfills General Education Requirement:** NPW

**Typically offered:** Fall Only

### CHE-1102 Chemistry and Life II (4 Credits)

**Requisite(s):** CHE-1101 or CHE-1201, CHE-1102L, CHE-1102R

Continuation of CHE 1101. Lab fee.

**Fulfills General Education Requirement:** NPW

**Typically offered:** Spring Only

### CHE-1105 Chemistry for Health Sciences (3 Credits)

**Requisite(s):** MAT 1105 or Higher (except MAT-2301), CHE-1105L

This course is intended to provide students with a descriptive background in general, organic and biochemistry so that subsequent courses taken such as, nutrition and pharmacology, can be appreciated on a molecular level. The first part of the course will focus on fundamentals of general chemistry dealing with the nature of atoms, atomic structure, bonding and role of nuclear chemistry in medicine. The second half of the course will focus on the structure and nomenclature of organic and biomolecules and their role in health-related systems.

**Typically offered:** Fall Only

### CHE-1105L Chemistry for Health Science Laboratory (1 Credit)

**Requisite(s):** MAT-1105 or Higher (except MAT-2301), CHE-1105

This course is a corequisite laboratory experience to CHE-1105. Students will conduct experiments that investigate a broad spectrum of chemistry, from general to organic and biological chemistry. You will investigate applications of chemistry to biological materials. This is a 3-hour lab.

**Typically offered:** Fall Only

### CHE-1201 General Chemistry I (4 Credits)

**Requisite(s):** MAT-1105 or Higher (Except MAT-2301), CHE-1201L

This course is intended for science majors with a strong emphasis on the quantitative aspects of chemistry. The course begins with an investigation of the ways in which we represent atoms and molecules symbolically, and their structures and spectroscopic signals. We then consider properties related to their physical states: gases, liquids, and solids. Finally, we scale up our investigation to explore how we relate the submicroscopic realm of atoms and molecules to the physically observable macroscopic world by considering such aspects as stoichiometry and moles.

**Typically offered:** All Sessions

### CHE-1201L General Chemistry I Lab (1 Credit)

**Requisite(s):** MAT-1105 or Higher (except MAT-2301), CHE-1201

This course is a corequisite laboratory experience to CHE-1201. Students will conduct experiments that investigate atomic structure, elemental and molecular properties, bonding and structure, and stoichiometry. Students will be evaluated on their practical and communication skills. This is a 3-hour lab.

**Typically offered:** Fall Only

### CHE-1202 General Chemistry II (4 Credits)

**Requisite(s):** MAT-1107 or Higher (except MAT-2301), CHE-1201, CHE-1201L, CHE-1202L

This course is a continuation of CHE 1201. The principles learned in CHE-1201 will be applied in a more systematic way. Students will discover the reasons why chemical reactions occur (thermodynamics), how fast they occur (kinetics), and what happens when reactions and processes seem to stop (equilibrium). We then apply these systematic approaches to two basic reaction types: Acid/Base reactions and Electrochemical reactions. Course materials will be covered using quantitative and qualitative approaches.

**Typically offered:** All Sessions

### CHE-1202L General Chemistry II Lab (1 Credit)

**Requisite(s):** CHE-1201, CHE-1201L, CHE-1202, MAT-1107 or Higher (except MAT-2301)

This course is a corequisite laboratory experience to CHE-1202. Students will conduct experiments that focus on a systematic approach-using principles of thermodynamics, kinetics, and equilibrium -to chemical and physical processes. These systematic approaches will be applied to acid/base chemistry and electrochemical reactions. This is a 3-hour lab.

**Typically offered:** Spring Only

**CHE-2050 Analytical Chemistry (3 Credits)****Requisite(s):** CHE-1202,CHE-1202L,CHE-2050L

Students will build on material covered in CHE-1201/02. The emphasis is on the quantitative aspects of chemistry. Students will apply quantitative methods to gravimetric and volumetric analysis, solubility products, acid-base reactions, oxidation-reduction reactions, and complex formation. Quantitative results will be assessed for precision and statistical relevance.

**Typically offered:** As Needed**CHE-2050L Analytical Chemistry Laboratory (1 Credit)****Requisite(s):** CHE-1202,CHE-1202L,CHE-2050

This course is a corequisite laboratory experience to CHE-2050. Students will conduct experiments that apply chemical principles to chemical reactions and quantitatively analyze the results. Students will also use statistical analysis to determine the accuracy and precision of their results. This is a 3-hour lab.

**Typically offered:** As Needed**CHE-2101 Organic Chemistry I (4 Credits)****Requisite(s):** CHE-1202,CHE-1202L,CHE-2101L

This course will prepare students to understand the role that organic chemistry plays in advanced chemistry and biology. You will learn about the different organic functional groups and how to systematically name them. The orientation of chemical groups is important and you will apply theories of symmetry to the naming and reactivity of the various functional groups.

**Typically offered:** All Sessions**CHE-2101L Organic Chemistry I Laboratory (1 Credit)****Requisite(s):** CHE-1202,CHE-1202L,CHE-2101

This course is a corequisite laboratory experience to CHE-2101. The course begins by demonstrating tools that allow students to differentiate between organic substances. Students will then apply their knowledge of stereochemistry to demonstrate an understanding of nomenclature. Most of the emphasis of the course involves developing skills that allow students to separate the compounds in a mixture, and some simple syntheses will be used to demonstrate understanding. This is a 4-hour lab.

**Typically offered:** Fall Only**CHE-2102 Organic Chemistry II (4 Credits)****Requisite(s):** CHE-2101,CHE-2101L,CHE-2102L

This course is the second in the organic chemistry sequence and is the continuation of CHE-2101. The course builds on the knowledge acquired in CHE-2101 and allows you to develop a deeper understanding of the chemistry of the various organic functional groups. The emphasis is placed on learning the principles behind reaction mechanisms and reagents. Furthermore, you will learn how to use spectroscopic techniques to identify the different functional group and molecular structures.

**Typically offered:** All Sessions**CHE-2102L Organic Chemistry II Laboratory (1 Credit)****Requisite(s):** CHE-2101,CHE-2101L,CHE-2102

This course is a corequisite laboratory experience to CHE-2102 that builds on the synthetic and separation techniques introduced in CHE-2101L. You will perform additional organic syntheses that broaden skills developed in CHE 2101L. You will strengthen your skills at separating mixtures and apply spectroscopic techniques to identify unknown products. This is a 4-hour lab.

**Typically offered:** Spring Only**CHE-2301 Inorganic Chemistry (3 Credits)****Requisite(s):** CHE-1202,CHE-1202L,CHE-2301L

Inorganic Chemistry is a vast subject comprising the chemistry of all 114 known elements and their compounds. Therefore, it is useful to understand the various principles that govern the chemistry of the elements so that memorization is minimized and critical analysis is maximized. The basic principles that will be addressed are: Electronic structure, size, acidity, redox, thermodynamics, bonding, and properties. This course will provide a basic understanding of inorganic chemistry that allows for many applications to environmental and biological systems.

**Typically offered:** As Needed**CHE-2301L Inorganic Chemistry Laboratory (1 Credit)****Requisite(s):** CHE-1202,CHE-1202L,CHE-2301

This course is a corequisite laboratory experience to CHE-2301. Students will conduct experiments that investigate thermodynamics, kinetics, equilibria, acid/base chemistry, and inorganic syntheses. This is a 3-hour lab.

**Typically offered:** Spring Only**CHE-3001 Biochemistry (3 Credits)****Requisite(s):** CHE-2102,CHE-2102L,CHE-3001L

Biochemistry applies basic principles of chemistry - thermodynamics, kinetics, equilibrium, acids/bases to biological processes. The course will cover course deals with the properties of important biological molecules in cell biology, metabolism, and molecular genetics. An emphasis is placed on structure-function relationships and biosynthesis.

**Typically offered:** All Sessions**CHE-3001L Biochemistry Laboratory (1 Credit)****Requisite(s):** CHE-2102,CHE-2102L,CHE-3001

Chemistry is the study of the nature of substances and their transformations. This course is designed to give you a glimpse of the general methods utilized in a biochemistry laboratory. You will perform techniques such as chromatography, SDS-PAGE gel electrophoresis, ion exchange chromatography, gel filtration, protein isolation, and enzyme kinetics. This is a 4-hour lab.

**Typically offered:** Spring Only**CHE-3002 Bio-Analytical Chemistry (4 Credits)****Requisite(s):** CHE-2102,CHE-3002L,PHY-2002

For biology majors only. Theoretical and practical knowledge of modern analytical chemistry including statistics, volumetric and gravimetric analysis, chemical and electrochemical equilibrium, acid-base, and chemistry. Introduction to instrumental methods of analysis including spectrophotometry, FT-IR, and Chromatography (HPLC, GC-MS, GC). Two lecture and five lab hours per week. Lab fee.

**Typically offered:** As Needed**CHE-4001 Physical Chemistry I (3 Credits)****Requisite(s):**

CHE-2102,CHE-2102L,MAT-2203,CHE-4001L,PHY-2002,PHY-2002L

Atomic, molecular and crystal structure; thermodynamics; solution properties; chemical kinetics; and electrochemistry.

**Typically offered:** As Needed**CHE-4001L Physical Chemistry I Laboratory (1 Credit)****Requisite(s):** CHE-2102,CHE-2102L,

MAT-2203,CHE-4001,PHY-2002,PHY-2002L

This course is a corequisite laboratory experience to CHE-4001.

Experiments that investigate Thermodynamics; solution properties; chemical kinetics; and electrochemistry will be conducted. This is a 4-hour lab.

**Typically offered:** As Needed

**CHE-4002 Physical Chemistry 2 (3 Credits)****Requisite(s):** CHE-4001,CHE-4001L,CHE-4002L

An in-depth exploration of topics relevant to physical chemistry including: Quantum chemistry; Atomic and molecular structure; Molecular spectroscopy.

**Typically offered:** As Needed**CHE-4002L Physical Chemistry 2 Laboratory (1 Credit)****Requisite(s):** CHE-4001,CHE-4001L,CHE-4002

This course is a corequisite laboratory experience to CHE-4002. Experiments that investigate Quantum chemistry, Atomic and molecular structure, Molecular spectroscopy will be conducted. This is a 4-hour lab.

**Typically offered:** As Needed**CHE-4050 Instrumental Methods of Analysis (3 Credits)****Requisite(s):** CHE-2050,CHE-2050L,CHE-4001,CHE-4001L,CHE-4050L

Understanding what instruments to use - and what information that they provide - is vital in chemistry. Instruments allow us to identify chemicals and to follow the progress of chemical reactions. By the end of this course, you will have gained an understanding and appreciation for the theory, basic design and applications of three categories of chemical instrumentation: (1) spectroscopic, (2) electrochemical (potentiometric only) and (3) instruments and methods used for chemical separations. Most of the emphasis of the material will be spectroscopy.

**Typically offered:** As Needed**CHE-4050L Instrumental Methods of Analysis Laboratory (1 Credit)****Requisite(s):** CHE-2050,CHE-2050L,CHE-4001,CHE-4001L,CHE-4050

This course is a corequisite laboratory experience to CHE-4050. You will apply theories of spectroscopy, chromatography, electroanalytical chemistry and mass spectrometry in the laboratory and gain experience in using modern chemical instrumentation. This is a 4-hour lab.

**Typically offered:** Fall Only**CHE-4990 Internship in Chemistry (1-2 Credits)**

Students may intern during the summer at approved research and development companies. The student must maintain a comprehensive daily log of work activities signed by their supervisor to be reported to the Chairperson when requested. Internships must be approved by the department Chairperson.

**Typically offered:** As Needed**CHE-4993 Chemical Research I (3 Credits)**

Independent laboratory research under faculty guidance.

**Typically offered:** As Needed**CHE-4994 Chemical Research II (3 Credits)****Requisite(s):** CHE-4993

Continuation of CHE 4993.

**Typically offered:** As Needed**CHE-4995 Independent Study in Chemistry (1-5 Credits)**

Individual research in an approved area. Library research, conferences, report, or special project. Approval of the department Chairperson is required.

**Typically offered:** As Needed**CHE-4996 Independent Study in Chemistry (1-4 Credits)**

Individual research in an approved area. Library research, conferences, report, or special project. Approval of the department Chairperson is required.

**Typically offered:** As Needed**CHE-4998 Senior Project (3 Credits)**

**Requisite(s):** Open to seniors in Chemistry majors  
Individual investigation in some special field of chemistry, may involve literature or laboratory research. Required of majors in senior year.

**Typically offered:** As Needed**CHE-5001 Honors Seminar: Understanding Our Environment (3 Credits)**

At the heart of the Franciscan tradition is a quest to live a more moral and authentic life where our role is to serve as custodians of the earth. As custodians it is vital that we acknowledge the current state of our environment and to act in ways that improve that status. To this end it is necessary to be able to evaluate information pertaining to the environment and to place that information in its proper perspective. This course will lead us in an investigation of the history of environmentalism, the speciation and toxicology of chemicals, health and quality of life issues, regulatory controls, the economy, and politics. We will then examine in greater depth a number of current and historical environmental cases. By the end of this course you should be able to critically evaluate issues of environmental concern and to determine the best way that we as individuals, and as a group, can be agents of positive change and, thereby proceed as custodians of the earth.

**Fulfills General Education Requirement:** HON,NPW,SEH**Typically offered:** As Needed**CHE-5002 A Short History of Nearly Everything Environment (3 Credits)**

Science is not, as you may imagine, a series of technically dense theories, with heavy calculations and mind-bending feats of logic. Oh no! Science is interspersed with humour, betrayal, sadness; the full range of human experience. and a series of technically dense theories with heavy calculations and mind-bending feats of logic. This course will not only provide you with an overview of the best scientific ideas of what we currently understand, but also the various trials and tribulations of the personalities of those individuals that brought us those ideas.

**Fulfills General Education Requirement:** HON**Typically offered:** As Needed**PHY-1001 Physics and the Modern World (3 Credits)**

This course is designed for non-science majors who desire a basic, practical understanding of physics. Subject areas include Newtonian physics, fluids and heat, electricity and magnetism, wave motion, optics, the atom and relativity. Contemporary issues of technology using physics are discussed, such as designing efficient, inexpensive computers, using charge-coupled devices (CCDs) in camcorders, television and medical imaging. Two lectures and two hours of laboratory each week. (Integrated class) Lab fee.

**Fulfills General Education Requirement:** NPW**Typically offered:** All Sessions**PHY-2001 General Physics I (3 Credits)****Requisite(s):** MAT-1107 or Higher (except MAT-2301),PHY-2001L

This course serves as an introduction to college-level-algebra-based physics and provides students with fundamental knowledge of physical processes. The course begins with the Laws of Motion and an investigation of dynamics. It then moves to a consideration of energy and the application of thermodynamic principles.

**Typically offered:** All Sessions**PHY-2001L General Physics I Laboratory (1 Credit)****Requisite(s):** MAT-1107 or Higher (except MAT-2301),PHY-2001

This course is a co-requisite laboratory experience to complement PHY-2001. Students will conduct experiments that investigate the fundamental laws and concepts of motion and dynamic processes. Students will further investigate and apply the laws of thermodynamics. This is a 2-hour lab.

**Typically offered:** Fall Only

**PHY-2002 General Physics II (3 Credits)****Requisite(s):** PHY-2001,PHY-2001L,PHY-2002L

This course is a continuation of PHY 2001. Students will be introduced to electricity, magnetism, and wave behavior. An emphasis is placed on quantitative methods.

**Typically offered:** All Sessions**PHY-2002L General Physics II Laboratory (1 Credit)****Requisite(s):** PHY-2001,PHY-2001L,PHY-2002

This course is a corequisite laboratory experience to complement PHY-2002. Students will conduct experiments that investigate the fundamental laws and concepts of sound, light, electricity, and magnetism. This is a 2-hour lab.

**PHY-4995 Independent Study in Physics (1-4 Credits)****Requisite(s):** #, Take 96 credits;

Individual research in an approved area. Library research, conferences, report, or special project. Approval of the department Chairperson is required.

**Typically offered:** As Needed**SCI-1301 Environmental Science (3 Credits)**

The ecology of natural systems; resources and energy; formation and consumption of fossil fuels, nuclear energy, and the environment; pollution; the problems associated with air and water pollution; solid waste; noise; legal and economic verifications of governmental policy towards pollution.

**Typically offered:** As Needed**SCI-5001 Religion and Science (3 Credits)**

Cross-listed with: REL-5350. An interdisciplinary, team-taught honors seminar that explores the dialogue that is occurring between scientists and theologians. It examines the historical context of the methods of inquiry used in the sciences and those used in religion and the similarities and differences between them. Included are varied case studies where scientists and theologians are engaged in dialogue.

**Fulfills General Education Requirement:** HON**Typically offered:** As Needed**SCI-5002 Honors Sem: Understanding Our Environmen (3 Credits)**

At the heart of the Franciscan tradition is a quest to live a more moral and authentic life where our role is to serve as custodians of the earth. As custodians it is vital that we acknowledge the current state of our environment and to act in ways that improve that status. To this end it is necessary to be able to evaluate information pertaining to the environment and to place that information in its proper perspective. This course will lead us in an investigation of the history of environmentalism, Global Warming, Energy, Water Availability, and Biodiversity. By the end of this course you should be able to critically evaluate issues of environmental concern and to determine the best way that we as individuals, and as a group, can be agents of positive change and, thereby proceed as custodians of the earth.

**Fulfills General Education Requirement:** HON**Typically offered:** As Needed**SCI-5003 Short History for Nearly Everything Honors Sem: Understanding Our Environmen (3 Credits)**

Science is not, as you may imagine, a series of technically dense theories, with heavy calculations and mind-bending feats of logic. Oh no! Science is interspersed with humour, betrayal, sadness; the full range of human experience. and a series of technically dense theories with heavy calculations and mind-bending feats of logic. This course will not only provide you with an overview of the best scientific ideas of what we currently understand, but also the various trials and tribulations of the personalities of those individuals that brought us those ideas.

**Fulfills General Education Requirement:** HON**Typically offered:** As Needed

## Faculty Chairperson

Dr. Gerard Davidson

## Professor

Califano

Wolfe

## Associate Professor

Davidson

Helburn

## Lab Instructor

Chowdhury

## Director of Laboratory

Kovenat

## Adjuncts

Adebayo-Olojo

Bass

Busic

Chowdhury

Ghatak

Kahanda

Khajo

Nguyen

Telting-Diaz