

# DEPARTMENT OF CHEMISTRY

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*The Department of Chemistry is approved by the American Chemical Society.*

**Chair:** Donovan C. Haines (haines@shsu.edu) (936) 294-1530

**Website:** Department of Chemistry (<http://www.shsu.edu/~chemistry/>)

## Mission

The Department of Chemistry is committed to providing an educational environment conducive to scholarship, intellectual development, and the acquisition of a foundation of knowledge and techniques required of professional chemists. This goal requires the effective representation of the fundamental areas of chemistry, a dedicated and creative faculty, and support for the many functions of the department.

## Academic Programs

For a listing of programs offered within the Department of Chemistry, please, reference the **Programs** tab on this page.

The Department of Chemistry is approved by the American Chemical Society. Chemistry majors may pursue the Bachelor of Science for professional chemists that leads to American Chemical Society certification and prepares students for graduate studies in traditional chemical fields. Students interested in professional schools, chemistry-associated industries, or secondary education may pursue this Bachelor of Science degree for other technical careers. The Bachelor of Science degree in Chemistry with emphasis in Biochemistry-Biotechnology prepares students for careers in biotech companies in the Houston area and across the state and nation. The growing interest in Forensic Science has prompted the Department of Chemistry to offer a Bachelor of Science in Forensic Chemistry that is designed to prepare students for careers combining a knowledge of chemistry and the legal system. Students completing this degree can pursue opportunities in various forensic labs across the country, or can continue their education either in the graduate program in Forensic Science, or in graduate programs that are more traditional.

## Highlights

- The Department of Chemistry has a study abroad program in Germany in which students carry out summer undergraduate research in a German University and can experience the culture and approach to chemical education in Europe.
- Chemistry majors work with faculty on state of the art research in the Chemistry and Forensic Science Building research laboratories.

## Career Opportunities

Everything around you is composed of chemicals. We live in a world of chemicals and life would not be possible without them. An understanding of the fundamentals of chemistry is important for everyone in today's society. Professional chemists are working to enhance our quality of life by improvements in food, medicine, clothing, building supplies, products for recreation, and a whole range of consumer products.

Virtually every industry or business that makes or sells a product is involved in chemistry. It is no wonder that the various areas of chemical and biochemical technology offer the largest field of employment in the physical sciences. Chemists are employed in fields such as:

- Environmental Analysis
- Agriculture
- Biotechnology
- Pharmaceutical Research
- Waste Management
- Energy Production
- Forensic Science
- Petrochemical Industry

Chemistry graduates will find many applications for their training in the fields of education, business, industry, law, government, and medicine.

## Suggested Minors

A variety of minors can complement a major in chemistry. Some of the more popular minors in recent years have been biology, criminal justice, general business, mathematics, and physics. Others have included history, political science, and psychology.

## Curriculum

Chemistry students learn how to critically examine and analyze observations, to use chemical understanding to propose solutions to problems of a quantitative or qualitative nature that may arise in industry, in academia, or in various careers associated with chemistry. Students majoring in Chemistry have the opportunity for hands-on experience in working with atomic absorption, gas chromatography, high performance liquid

chromatography, ultraviolet and visible spectroscopy, x-ray diffraction, 60 MHz and 300 MHz nuclear magnetic resonance spectroscopy, mass spectrometry, ion chromatography, capillary electrophoresis, and other standard instrumentation in chemistry.

- Bachelor of Science, Major in Chemistry/Chemical Engineering (<http://catalog.shsu.edu/archives/2022-2023/undergraduate/colleges-academic-departments/science-and-engineering-technology/chemistry/bs-chemistry-chemical-engineering/>)
- Bachelor of Science, Major in Chemistry for Other Technical Careers (<http://catalog.shsu.edu/archives/2022-2023/undergraduate/colleges-academic-departments/science-and-engineering-technology/chemistry/bs-chemistry-technical-careers/>)
- Bachelor of Science, Major in Chemistry for Professional Chemists (<http://catalog.shsu.edu/archives/2022-2023/undergraduate/colleges-academic-departments/science-and-engineering-technology/chemistry/bs-chemistry-professional-chemists/>)
- Bachelor of Science, Major in Forensic Chemistry (<http://catalog.shsu.edu/archives/2022-2023/undergraduate/colleges-academic-departments/science-and-engineering-technology/chemistry/bs-forensic-chemistry/>)
- Minor in Chemistry (<http://catalog.shsu.edu/archives/2022-2023/undergraduate/colleges-academic-departments/science-and-engineering-technology/chemistry/minor-chemistry/>)

## Student Organizations

Chemistry Club - The Chemistry Club is an active organization which encourages student interactions in a social atmosphere and which supports student travel to professional meetings.

## Scholarships

Scholarships are available from the Department in Chemistry and from the University to support students' studies. For further information, contact the Chair, Department of Chemistry, or visit Department of Chemistry (<http://www.shsu.edu/academics/chemistry/>). Information on University scholarships may be obtained at Office of Academic Scholarships (<http://www.shsu.edu/dept/financial-aid/scholarships/>) or telephone (936) 294-1774.

### **CHEM 1105. Chemistry in Context Lab. 1 Hour. [TCCN: CHEM 1105]**

Laboratory for CHEM 1305. Concurrent enrollment in CHEM 1305 is recommended.

### **CHEM 1305. Applying Chemistry to Society. 3 Hours. [TCCN: CHEM 1305]**

Chemical phenomena, concepts and principles are explored within the context of the role of science and technology in society. A life-centered approach rather than a subject-centered one has been employed in the development of course curriculum. This course is specifically designed to satisfy the natural science core requirement of students who are not specializing in science. Concurrent enrollment in CHEM 1105 is recommended.

### **CHEM 1406. Inorganic & Envir Chemistry. 4 Hours. [TCCN: CHEM 1406]**

The elements and their compounds are considered from a non-technical standpoint with emphasis placed on more familiar materials. Two-hour laboratory. This course is for non-science majors.

### **CHEM 1407. Intro Organic and Biochemistry. 4 Hours. [TCCN: CHEM 1407]**

An orientation in organic chemistry is given in the first part of the course to allow treatment of the chemistry of nutrition and other biochemical aspects given in the last part. Two-hour laboratory. This course is for non-science majors.

**Prerequisite:** CHEM 1406, CHEM 1411, or completion of a high school chemistry course.

### **CHEM 1411. General Chemistry I. 4 Hours. [TCCN: CHEM 1411]**

The following topics are studied: chemical changes and laws governing them; nomenclature; introduction to thermodynamics; reactions involving oxygen, hydrogen, acids, bases, and salts; ionization; metathesis; the periodic table, and atomic and molecular structure. Three-hour laboratory. This course is for chemistry and other science majors. Fall, Spring, Summer I.

**Prerequisite:** Minimum grade of C in MATH 1410, MATH 1314, MATH 1324 or equivalent, or a minimum Math score of 23 on the ACT or 560 on the SAT (580 on new SAT) or equivalent.

### **CHEM 1412. General Chemistry II. 4 Hours. [TCCN: CHEM 1412]**

Descriptive chemistry, gas laws, equilibria, kinetics, thermodynamics, electrochemistry, and oxidation-reduction reactions are presented. Three-hour laboratory. Fall, Spring, Summer II.

**Prerequisite:** A minimum grade of C in CHEM 1411.

### **CHEM 2123. Organic Chemistry I Lab. 1 Hour. [TCCN: CHEM 2123]**

Laboratory for CHEM 2323. Fall, Spring, Summer I.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, and prior credit for or concurrent enrollment in CHEM 2323.

### **CHEM 2125. Organic Chemistry II: Lab. 1 Hour. [TCCN: CHEM 2125]**

Laboratory for CHEM 2325. Fall, Spring, Summer II.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2123, CHEM 2323, and prior credit for or concurrent enrollment in CHEM 2325.

**CHEM 2323. Organic Chemistry I: Lecture. 3 Hours. [TCCN: CHEM 2323]**

A study of chemical bonding and structure of organic molecules is made. Functional group reactions and syntheses are emphasized. Reaction mechanisms, nomenclature and isomerism are studied. Fall, Spring, Summer I.

**Prerequisite:** A minimum grade of C in CHEM 1411 and CHEM 1412.

**CHEM 2325. Organic Chemistry II: Lecture. 3 Hours. [TCCN: CHEM 2325]**

The general plan of CHEM 2323 is continued. Fall, Spring, Summer II.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2323, and CHEM 2123.

**CHEM 2401. Quantitative Analysis. 4 Hours.**

The fundamental principles of quantitative analysis are emphasized. Acid-base, complexometric, precipitation, and redox titrations, solution equilibria and spectrophotometric analysis are discussed. Laboratory exercises involve all types of volumetric procedures and colorimetric analysis. Four-hour laboratory. Fall, Spring.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412.

**CHEM 3339. Biochemistry II. 3 Hours.**

This course is a study of the bioenergetics associated with the metabolic pathways and processes. The metabolism of carbohydrates, lipids, proteins, and nucleic acids; the interrelationship of the metabolic pathways; and the regulation of metabolism are emphasized. Spring.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2323, CHEM 2123, CHEM 2325, CHEM 2125 and CHEM 3438.

**CHEM 3361. Discoveries In Chm & Textiles. 3 Hours.**

Attention will be focused on early scientists, the times in which they worked, important aspects of their efforts, and how their research continues to impact us today. Lectures will occur in the geographical areas where their work took place. Odd years during the Spring/Summer I break.

**Prerequisite:** CHEM 1406 or CHEM 1411, junior standing, and permission of the instructor.

**CHEM 3367. Intro Inorganic Chemistry. 3 Hours.**

General principles of inorganic chemistry are presented with a descriptive and practical rather than mathematical approach. Periodic relationships of elements and bonding, reactions and synthesis of inorganic compounds, acid-base chemistry are studied. Fall.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2323.

**CHEM 3368. Environmental Chemistry. 3 Hours.**

The chemical principles underlying the effects of air, water, and soil pollution are covered. Specific attention is paid to gas phase radical reactions, light absorption characteristics of atmospheric components, solution chemistry of fresh and salt water systems, and the mobility and chemistry of metal components of soil systems. Spring even years.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2401, CHEM 2323 and CHEM 2325 (or concurrent enrollment in CHEM 2325).

**CHEM 3438. Biochemistry I. 4 Hours.**

The chemistry and functions of carbohydrates, lipids, proteins, enzymes, nucleic acids and vitamins; enzyme kinetics; the processes of and mechanisms of digestion and absorption; and biological buffers are studied. Four-hour laboratory. Fall, Spring, Summer 10-week.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2323, CHEM 2123, CHEM 2325, CHEM 2125.

**CHEM 4001. Directed Study In Chemistry. 1 Hour.**

A directed study for undergraduates. This course is designed to allow independent study by advanced students. Instruction is on an individual basis. Variable Credit (1-3).

**Prerequisite:** A minimum grade of C in CHEM 2325 and approval of department chair.

**CHEM 4088. Special Topics. 1-4 Hours.**

Students explore an identified area of chemistry not covered in detail by other upper-level courses. This course may be repeated for credit if the topics vary. Variable Credit (1 to 4).

**Prerequisite:** Approval of department chair.

**CHEM 4100. Chemical Literature Seminar. 1 Hour.**

Methods of searching the literature in chemistry are presented. Emphasis is placed on the use of Chemical Abstracts, Beilstein, chemical patent literature, journals, and reference collections in the several specialties of chemistry. Fall, Spring.

**Prerequisite:** Junior standing in chemistry.

**CHEM 4260. Advanced Integrated Laboratory. 2 Hours.**

This course will involve in-depth experiments that require the use of sophisticated synthetic and analytical procedures in the areas of organic, inorganic or analytical chemistry. Spring.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2323, CHEM 2123, CHEM 2325, CHEM 2125, CHEM 2401, CHEM 4448, and CHEM 4440.

**CHEM 4327. Polymer Chemistry. 3 Hours.**

Students examine reactions, synthesis, and mechanisms of polymerization processes as well as molecular weight distributions and structure/property relationships of polymers.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2323, CHEM 2123, CHEM 2325 and CHEM 2125.

**CHEM 4367. Advanced Inorganic Chemistry. 3 Hours.**

Properties of atoms and ions, bonding theory and structure, acid-base theory, reactions of inorganic compounds, nonaqueous solvents, and coordination chemistry are studied. Emphasis is on the underlying theoretical concepts involved. Spring.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2323, CHEM 2123, CHEM 2325, CHEM 2125, CHEM 4448.

**CHEM 4380. Forensic Chemistry. 3 Hours.**

This is a one semester course focused on surveying important aspects of chemistry to forensic inquiries. Focus will be on the validity of results. Techniques and methods for selecting proper techniques to answer various questions will be discussed. Spring.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2323, CHEM 2123, CHEM 2325, CHEM 2125, CHEM 4440 and CHEM 4367 (or concurrent enrollment in CHEM 4367); MATH 1420.

**CHEM 4395. Undergrad Research In Chem. 3 Hours.**

This course acquaints the senior student with techniques used in simple research problems. May be repeated for an additional three semester hours by those students having a definite project to complete. This course may be taken for Academic Distinction Credit. See Academic Distinction Program in this catalog.

**Prerequisite:** Student must have a minimum of 20 semester hours in chemistry and consent of the Department Chair.

**CHEM 4440. Instrumental Analytical Chem. 4 Hours.**

Spectrophotometry, separation techniques and mass spectrometry are discussed. Specific topics include the computer's use in the modern laboratory, ultraviolet and visible absorption, atomic absorption, flame emission, and inductively coupled plasma spectroscopy, infrared absorption, and gas and liquid chromatography. Instruments for these techniques are used in the laboratory work. Four-hour laboratory. Fall.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2323, CHEM 2325, CHEM 2401, and CHEM 4448.

**CHEM 4441. Mthds-Envir/Industrl Analyses. 4 Hours.**

Students covers the philosophy of modern instrumental methods used for environmental and industrial analyses. The topics to be covered may include quality control and quality assurance good laboratory practices, waste minimization and elimination, safe laboratory operation, ISO standards, EPA methodology, and statistical data analysis. Spring. Spring.

**Prerequisite:** A minimum grade of C in CHEM 2401, CHEM 2323 and CHEM 2325, and CHEM 3368.

**CHEM 4442. Air Quality. 4 Hours.**

An in-depth study of the sources of air pollution is made. Sampling procedures and the chemical analyses required for identification of pollutants are studied. Control methods for the restriction of air pollution are outlined. Four-hour laboratory. Spring odd years.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2401, CHEM 2323 and CHEM 2325.

**CHEM 4443. Structural Spectroscopic Methd. 4 Hours.**

This course is a survey of the spectroscopic and spectrometric methods for elucidation of structural information for chemical compounds with emphasis on the structural identification of unknowns. The methods of ultraviolet-visible spectrophotometry, Fourier-transform infrared spectroscopy, mass spectrometry, and both one- and two-dimensional nuclear magnetic resonance spectroscopy will be covered. Their relative strengths, complementary nature, and utility will be discussed. The focus will be the determination of chemical structures by spectroscopic/spectrometric methods. Spring even years. Spring even years.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2323, CHEM 2123, CHEM 2325, CHEM 2125.

**CHEM 4448. Physical Chemistry I. 4 Hours.**

The foundations of thermodynamics and spectroscopic methods (radio-frequency, microwave, infrared, Raman, UV-visible, and X-ray) are developed from first principles with an atomistic point of view. Four-hour laboratory. Fall.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2323, CHEM 2123, CHEM 2325, CHEM 2125, MATH 1420, MATH 1430 and one year of physics.

**CHEM 4449. Physical Chemistry II. 4 Hours.**

The developments of thermochemistry, phase diagrams, equilibria, and kinetics are traced from the statistical mechanics of quantum states to the macroscopic observations of thermodynamics. Four-hour laboratory. Spring.

**Prerequisite:** A minimum grade of C in CHEM 1411, CHEM 1412, CHEM 2323, CHEM 2123, CHEM 2325, CHEM 2125, CHEM 4448.

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