

# Department of Chemistry

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## Purpose and Goals

The Bachelor of Science in Chemistry program is designed to provide a deep understanding of scientific processes and principles, which will enable students to develop intellectually, culturally, socially, and morally. It is further intended to provide a comprehensive foundation in all the major areas of Chemistry while offering a good measure of flexibility. Through the execution of its function, the department prepares students for careers in teaching, research, industry, and pre-professional training in Medicine, Dentistry, and Allied health professions.

In July 2013, Texas Higher Educational Coordinating Board (THECB) approved a joint Bachelor of Science (BS) degree in Physics (CIP 40.0801.00) as part of the Texas Physics Consortium (TPC) for the following universities: Prairie View A&M University, Tarleton State University, Texas A&M University-Corpus Christi, Texas A&M University-Kingsville, West Texas A&M University, Texas Southern University, and Mid Western State University. This consortium undergraduate BS program in Physics provides a broad and solid background in fundamental physics from introductory to advanced course work. It also provides specialized educational preparation and training in several disciplines.

## Academic Standards

Students must earn a minimum grade of a "C" in all classes taken in their major disciplines and a minimum grade of a "C" in all classes taken in their minor disciplines (if applicable).

## Concentrations

The Department of Chemistry offers a Bachelor of Science Degree with the following concentrations:

**Traditional Chemistry:** This program is designed for students who plan to be professional chemists, and to pursue graduate studies in chemistry.

**Biomedical Science:** This program is designed for students who plan additional study toward the MD, DDS, or DVM. degrees. It is also suitable for students interested in medical or biomedical research as well as for those who plan to pursue a graduate degree in the biochemical or biomedical areas.

**Forensic Science:** This program is for students interested in careers in crime laboratories, drug enforcement agencies, food and drug administration, and other related agencies.

## Requirements for Chemistry as a Minor

Students who select Chemistry as a minor must complete 24 semester credit hours from the following courses with a minimum grade of a "C":

### Requirements for Chemistry Minors

24

CHEM 1203	General Chemistry Lab
CHEM 1303	General Inorganic Chemistry I
CHEM 1204	General Inorganic Chemistry Laboratory II
CHEM 1304	General Inorganic Chemistry II
CHEM 2201	Quantitative Analysis
CHEM 2211	Quantitative Analysis Lab
CHEM 2203	Organic Chemistry Lab I
CHEM 2303	General Organic Chemistry I
CHEM 2204	Organic Chemistry Lab II
CHEM 2304	General Organic Chemistry II
CHEM 3341	Physical Chemistry
CHEM 3342	Physical Chemistry
CHEM 4100	Journal Reading and Chemical Literature
CHEM 4303	Biochemistry
CHEM 4204	Biochemistry Laboratory
CHEM 4105	Research

### Total Hours

24

## Honor Societies, Clubs, and Service Organizations

The William E. Reid Student Chapter of the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCCHE) introduces students to the chemical professional environment in business, industry, government, and academia with special emphasis on the role of the minority chemist.

The Student Affiliate Chapter of the American Chemical Society (ACS/SA) serves the dual role as departmental club and the avenue of participation to the chemical community. Chemistry majors and minors may become members of the ACS/SA upon recommendations of a member of the ACS.

Students who have had at least one course in physics above the lower division level, and whose grade point averages are B or better, are eligible for membership in Sigma Pi Sigma, the physics honor society. Students having an interest in physics may also join the Society of Physics Students, an organization dedicated to the promotion and advancement of physics throughout society.

## Courses

### ***CHEM 1106 General Chemistry Lab: 1 semester hour.***

A laboratory course in general chemistry for students in the health sciences.

Prerequisites: CHEM 1306 (may be taken concurrently) or CHEM 1053 (may be taken concurrently).

### ***CHEM 1111 General Chemistry Lab I: 1 semester hour.***

A general laboratory course covering aspects of qualitative and quantitative analysis and determination of chemical and physical properties.

Prerequisites: (CHEM 1311 or CHEM 1013) or (CHEM 1303 or CHEM 1033) or (MATH 1314 or MATH 1113).

### ***CHEM 1112 General Chemistry Lab II: 1 semester hour.***

The second semester continuation of CHEM 1111. A general laboratory course covering aspects of qualitative and quantitative analysis and determination of chemical and physical properties.

Prerequisites: ((MATH 1314 or MATH 1113) or (MATH 1511 or MATH 1115)) and ((CHEM 1403 (may be taken concurrently) or CHEM 1034 (may be taken concurrently)) or (CHEM 1304 (may be taken concurrently) or CHEM 1043 (may be taken concurrently))).

### ***CHEM 1203 General Chemistry Lab: 2 semester hours.***

For students majoring or minoring in chemistry. A general laboratory course covering aspects of volumetric and gravimetric analysis, qualitative analysis, determination of chemical and physical properties, and chemical synthesis.

Prerequisites: ((MATH 1314 (may be taken concurrently) or MATH 1113 (may be taken concurrently)) or (MATH 1511 (may be taken concurrently) or MATH 1115 (may be taken concurrently))) and (CHEM 1303 or CHEM 1033).

### ***CHEM 1204 General Inorganic Chemistry Laboratory II: 2 semester hours.***

For students majoring or minoring in chemistry. A continuation of CHEM 1032. General laboratory course covering aspects of volumetric, gravimetric and qualitative analyses; determination of chemical and physical properties, and chemical synthesis.

Prerequisites: ((MATH 1113 or MATH 1314) or (MATH 1511 or MATH 1115)) and (CHEM 1043 or CHEM 1304).

### ***CHEM 1303 General Inorganic Chemistry I: 3 semester hours.***

For students majoring or minoring in chemistry. Theory of matter and concepts of measurement, atoms, molecules and ions. Stoichiometry and chemical calculations, reactions in aqueous solutions, kinetics of gases, thermo-chemistry, atomic structure, electron configurations and chemical bonds.

Prerequisites: (MATH 1314 or MATH 1113) or (MATH 1511 or MATH 1115).

### ***CHEM 1304 General Inorganic Chemistry II: 3 semester hours.***

For students majoring or minoring in chemistry. A continuation of CHEM 1033. Bonding theory and molecular structure, intermolecular forces properties of solutions, chemical kinetics, chemical equilibrium, acid-based equilibria, thermodynamics, electrochemistry and nuclear chemistry and introduction to organic chemistry.

Prerequisites: (MATH 1314 or MATH 1113) or (CHEM 1303 or CHEM 1033).

### ***CHEM 1306 Introductory Chemistry I: 3 semester hours.***

An introductory course to essential chemical principles including atoms, atomic structure, molecules, compounds, elementary stoichiometry, and calculations, type of chemical reactions and fundamental principles. The interpretation and evaluation of case studies to develop fundamental knowledge and skills. This course will require a fair amount of writing and teamwork. For health science and nonmajors.

### ***CHEM 1311 General Chemistry I: 3 semester hours.***

This course is designed for non-majors and non-minors. This first semester course entails exploration of the fundamental concepts, laws and theory of chemistry through study of the states of matter. A descriptive view of the periodic chart, chemical properties, reactions, and chemical bonding theories and stoichiometry.

Prerequisites: MATH 1314 or MATH 1113.

Co-requisite: MATH 1314.

### ***CHEM 1403 Chemistry for Engineers: 4 semester hours.***

Fundamental and Physical principles in chemistry, bonding, thermodynamics and kinetics with emphasis to engineering applications.

Prerequisites: (CHEM 1303 or CHEM 1033) or (CHEM 1311 or CHEM 1013).

**CHEM 2201 Quantitative Analysis: 2 semester hours.**

Introduction to the principles and techniques of volumetric and gravimetric analysis employing modern instrumentation. Techniques include potentiometric, spectral-photometric, precipitation, electrochemical, and separation methods.

Prerequisites: (CHEM 1303 or CHEM 1033) and (CHEM 1204 or CHEM 1042) and (CHEM 1304 or CHEM 1043).

**CHEM 2203 Organic Chemistry Lab I: 2 semester hours.**

A laboratory course including qualitative and quantitative investigations focusing on preparation and characterization of organic compounds.

Prerequisites: CHEM 2303 (may be taken concurrently) or CHEM 2033 (may be taken concurrently).

**CHEM 2204 Organic Chemistry Lab II: 2 semester hours.**

This is a continuation of CHEM 2203.

Prerequisites: CHEM 2304 (may be taken concurrently) or CHEM 2043 (may be taken concurrently).

**CHEM 2211 Quantitative Analysis Lab: 2 semester hours.**

This course is a continuation of the CHEM 2201.

Prerequisites: (CHEM 1204 or CHEM 1042) and (CHEM 2201 (may be taken concurrently) or CHEM 2012 (may be taken concurrently)).

**CHEM 2303 General Organic Chemistry I: 3 semester hours.**

For chemistry majors and minors, chemical engineering, and science majors. Electronic structure and bonding, introduction to organic compounds, reactions of alkenes, stereochemistry, reactions of alkynes, electron delocalization and resonance, reaction of dienes, substitution and elimination reactions.

Prerequisites: CHEM 1304 or CHEM 1043.

**CHEM 2304 General Organic Chemistry II: 3 semester hours.**

For chemistry majors and minors, chemical engineering, and science majors. A continuation of CHEM 2303. Substitution and elimination reactions, spectroscopic identification of organic compounds, reactions of substituted benzenes, reactions of carbonyl compounds, bioorganic compounds and special topics in organic chemistry.

Prerequisites: CHEM 2303 or CHEM 2033.

**CHEM 3242 Physical Chemistry Lab: 2 semester hours.**

A laboratory course including experimental studies in chemical thermodynamics, equilibria, chemical kinetics, transport properties, spectroscopy, and molecular structure.

Prerequisites: CHEM 3341 (may be taken concurrently) or CHEM 3413.

Co-requisite: CHEM 3341.

**CHEM 3243 Physical Chemistry Lab: 2 semester hours.**

This course is a continuation of CHEM 3242.

Co-requisite: CHEM 3342.

**CHEM 3341 Physical Chemistry: 3 semester hours.**

A rigorous treatment of thermodynamics (Laws), thermo-chemistry, application of thermodynamic laws to gases (ideal and real), chemical equilibria, ionic equilibria, and electrochemistry.

Prerequisites: (CHEM 1304 or CHEM 1403) and (MATH 2413 or MATH 1124).

**CHEM 3342 Physical Chemistry: 3 semester hours.**

A continuation of CHEM 3413. Rate processes, kinetic theory and transport properties of gasses and liquids. An introduction to the Fundamentals of Quantum mechanics and spectroscopy. Atomic and molecular structure. Electric and magnetic properties of molecules.

Prerequisites: MATH 2320 or MATH 2043 and (CHEM 3341 or CHEM 3413).

**CHEM 3350 Introduction to Cosmetic Chemistry: 3 semester hours.**

This class is for students majoring in a science or health field. A lecture course covering introductory aspects of Cosmetic Chemistry, including Classification of Cosmetics, Dosage Forms of Cosmetics, Manufacturing Practices, Labeling Cosmetics, Current Rules and Regulations for Cosmetics.

Prerequisites: BIOL 1501 or BIOL 1015 or BIOL 1308 or BIOL 1113 and (CHEM 1303 or CHEM 1033 or CHEM 1306 or CHEM 1053 or CHEM 1311 or CHEM 1013).

**CHEM 3351 Introduction to Green and Sustainable Chemistry Principles: 3 semester hours.**

Introduction to Green and Sustainable Chemistry Principles. This course will explore the fundamentals of chemistry, how chemistry can help address global human health and environmental issues. It introduces the foundational principles of chemistry, including atoms, molecules, chemical reactions, stoichiometry, chemical/physical properties, and periodic table trends. This knowledge is then related to various environmental and human health issues. It develops the appropriate solutions using green chemistry approaches covered in the course.

Prerequisites: CHEM 1033 or CHEM 1303 and (CHEM 2303 or CHEM 2033).

**CHEM 4100 Journal Reading and Chemical Literature: 1 semester hour.**

Initial instruction in the methodology and practice of efficient use of the chemical literature. Detailed study of recent developments in chemistry. Designed to develop and stimulate research attitudes.

**CHEM 4105 Research: 1 semester hour.**

Library and laboratory work on selected problems.

**CHEM 4106 Research: 1 semester hour.**

Library and laboratory work on selected problems.

**CHEM 4203 Forensic Chemistry Lab: 2 semester hours.**

Drug identification and confirmatory tests using spectroscopic techniques that include HPLC, GC, ICP/ AES, FTIR. Sample handling and storage.

Prerequisites: CHEM 4305 or CHEM 4053.

**CHEM 4204 Biochemistry Laboratory: 2 semester hours.**

Experiments in basic methodology for the isolation, purification and characterization of carbohydrates, lipids, proteins, nucleic acids and enzymes from natural products.

Prerequisites: CHEM 4303 (may be taken concurrently) or CHEM 4033 (may be taken concurrently).

Co-requisite: CHEM 4303.

**CHEM 4205 Instrumental Analysis Lab: 2 semester hours.**

Laboratory course that includes experimental applications of spectroscopy, electro-analytical methods, and chromatography.

Co-requisite: CHEM 4305.

**CHEM 4302 Forensic Chemistry: 3 semester hours.**

Introduction to forensic science, chemical evidence handling, analysis and drug classification. Sampling techniques in forensic chemistry.

Prerequisites: CHEM 2304 or CHEM 2043.

Co-requisite: CHEM 4303.

**CHEM 4303 Biochemistry: 3 semester hours.**

A study of the chemistry of biological molecules: proteins, lipids, carbohydrates and nucleic acids. Enzyme catalysis, Bioenergetics, Metabolism of carbohydrates, fats and proteins. Interrelationship of the metabolic pathways.

Prerequisites: CHEM 2303 or CHEM 2033 and CHEM 2304 or CHEM 2043.

**CHEM 4305 Instrumental Analysis: 3 semester hours.**

An introduction to the theory and application of modern instrumentation and techniques to the analysis of chemical systems. Includes interpretive spectroscopy, computer-assigned experimentation, and the use of the chemical literature.

Prerequisites: CHEM 3341 or CHEM 3413.

**CHEM 4306 Inorganic Chemistry: 3 semester hours.**

Modern atomic theory and the Periodic System, valence and bonding. The constitution of inorganic compounds; coordination chemistry and ligand field theory. The chemistry of nonmetals including polyacids, peracids and hydrides. Reactions in non-aqueous systems. Some interstitial and nonstoichiometric compounds. Radioactivity and atomic integration.

Prerequisites: CHEM 3341 or CHEM 3413.

**CHEM 4399 Independent Study: 1-3 semester hour.**

Readings, research, and/or field work on selected topics.

**CHEM 5232 Instrumental Lab: 2 semester hours.**

An integrated laboratory that uses modern instrumentation to analyze complex chemical systems. Theories and principles encountered in CHEM 5313 (5331) and CHEM 5323(5332) will provide the basis for bulk, surface, and interfacial analysis at the atomic and molecular levels.

Prerequisites: CHEM 5331 or CHEM 5313 and (CHEM 5332 or CHEM 5323).

**CHEM 5240 Advanced Organic Chemistry: 2 semester hours.**

A review of elementary Organic Chemistry with an extension of more advanced topics. Includes assigned subject materials.

**CHEM 5301 Research: 3 semester hours.**

Problems for investigation may be selected from one of the following fields of Chemistry: 1. Analytical; 2. Biochemistry; 3. Inorganic; 4. Organic; and 5. Physical.

**CHEM 5302 Research: 3 semester hours.**

Problems for investigation may be selected from one of the following fields of Chemistry: 1. Analytical; 2. Biochemistry; 3. Inorganic; 4. Organic; and 5. Physical.

**CHEM 5321 Polymer Chemistry: 3 semester hours.**

Mechanisms of polymerization reactions of monomers and molecular weight distributions of products; principles, limitations and advantages of most important methods of molecular weight determination; relationship of physical properties to structure and composition; correlations of applications with chemical constitution.

Prerequisites: CHEM 2303 or CHEM 2033.

**CHEM 5331 Advanced Analytical Chemistry: 3 semester hours.**

Fundamental principles and investigation of chemical reactions as they relate to application of classical and modern instrumental methods. Focuses on the processes occurring in sampling, separation and quantitative measurement emphasizing chemical concepts.

Prerequisites: CHEM 5378 or CHEM 5738.

**CHEM 5332 Instrumental Analysis: 3 semester hours.**

Fundamental principles and theories underlying modern instrumental methods and techniques for analysis of complex systems. Atomic and molecular level characterization of surfaces, interfaces, and bulk systems will be emphasized.

Prerequisites: CHEM 5378 or CHEM 5783.

**CHEM 5361 Advanced Inorganic Chemistry: 3 semester hours.**

Consideration of important aspects of modern inorganic chemistry. Application of thermodynamics and kinetics in inorganic chemistry; practical and potential applications of inorganic systems.

**CHEM 5378 Advanced Physical Chemistry: 3 semester hours.**

A lecture course dealing with advanced topics of special interest in modern physical chemistry in areas including experimental and theoretical thermodynamics, chemical kinetics, collision and transition state theories, atomic and molecular spectra, quantum mechanical systems, photochemistry, structure of crystals and liquids, surface chemistry, macro-molecules, and gas phase reactions.

**CHEM 5399 Independent Study: 1-3 semester hour.**

Individual studies in advanced chemistry, reading, literature research/analysis/problem solving/writing research reports on selected topics in advanced chemistry.

**CHEM 5441 Identification of Organic Compounds: 4 semester hours.**

The separation and identification of pure organic compounds and mixtures.

**CHEM 5453 General Biochemistry: 4 semester hours.**

A basic and extension course designed for graduate students planning to major or minor in Biochemistry or related fields and who require more than an elementary knowledge of the subject.

**CHEM 5499 Independent Study: 1-4 semester hour.**

Individual studies in advanced chemistry, reading, literature research/analysis/problem solving/writing research reports on selected topics in advanced chemistry.

**CHEM 5602 Research: 6 semester hours.**

Problems for investigation may be selected from one of the following fields of chemistry: 1. Analytical; 2. Biochemistry; 3. Inorganic; 4. Organic; and 5. Physical.