

# CHEMISTRY (CHEM)

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## CHEM 1111 General Chemistry Lab I

**Credit:** 1 (0-1-0)

This is the accompanying laboratory for CHEM 1311-General Chemistry I. The first semester of a two-semester sequence, the lab introduces many chemical concepts, problems, and calculations. Topics range from taking measurements, calibration, and statistical analysis, densities of solids through linear least squares analysis, verification of Boyle's Law, Charles' Law and Avogadro's Law, empirical formula of compounds, introduction to calorimetry, heat of chemical reactions introduction to Acid-Base Chemistry, introduction to pH, and gravimetric analysis. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** MATH 1314.

**Corequisites:** CHEM 1311.

**Restrictions:** Graduate level students may not enroll.

## CHEM 1112 General Chemistry Lab II

**Credit:** 1 (0-1-0)

This is the accompanying laboratory for CHEM 1312-General Chemistry II. The second semester of a two-semester sequence, the lecture and required lab introduces many chemical concepts, problems, and calculations. Topics range from kinetics, colligative properties, buffers, thermodynamics, and electrochemistry.

**Prerequisites:** CHEM 1311 and CHEM 1111 with a grade of "C" or better.

**Corequisites:** CHEM 1312. TSI Restriction(s): Reading, Math, and Writing

**Restrictions:** Graduate level students may not enroll.

## CHEM 1305 Introductory Chemistry I

**Credits:** 3 (3-0-0)

This course is designed for non-science majors. Chemistry is the relationship between energy, matter, and its interactions. Topics include the scientific method, atoms, molecules, chemical bonding, molecular structure, solutions, acid-based relations, and redox reactions. This course satisfies the Life and Physical Sciences category of courses under the core curriculum. TSI Restriction(s): Reading, Math, and Writing

**Restrictions:** Graduate level students may not enroll.

## CHEM 1311 General Chemistry I

**Credits:** 3 (3-0-0)

The first semester of a two-semester sequence, the course introduces many chemical concepts, problems, and calculations. Principles and quantitative relationships in chemistry that will be introduced include stoichiometry, chemical equilibrium, acid-base chemistry, thermochemistry, rates and mechanism of reactions, changes of state, solution behavior, atomic structure, periodic relationships, chemical bonding. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** MATH 1314.

**Corequisites:** CHEM 1111;

**Restrictions:** Graduate level students may not enroll.

## CHEM 1312 General Chemistry II

**Credits:** 3 (3-0-0)

This is the second foundation course in chemistry. The course involves applications of the concept of chemical bonds and chemical equilibria to understand molecular structure and chemical reactions. How complex chemical structures and their corresponding properties arise from simple concepts of atomic structure and the chemical bond will be the theme of the course that threads the various topics. The process of scientific discovery will be elucidated by examining the questions chemists confront through theorizing and experimentation.

**Prerequisites:** CHEM 1311 and CHEM 1111 – both with a grade of "C" or better.

**Corequisites:** CHEM 1112. TSI Restriction(s): Reading, Math, and Writing

**Restrictions:** Graduate level students may not enroll.

## CHEM 2123 Organic Chemistry I Lab

**Credit:** 1 (0-1-0)

Organic chemistry laboratory experiments designed to accompany CHEM 2323. Introduction to laboratory practices and procedures with emphasis on hydrocarbon chemistry. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** CHEM 1312 and CHEM 1112.

**Corequisites:** CHEM 2323.

**Restrictions:** Graduate level students may not enroll.

## CHEM 2125 Organic Chemistry II Lab

**Credit:** 1 (0-1-0)

Organic chemistry laboratory experiments designed to accompany CHEM 2325. Introduction to laboratory practices and procedures with emphasis on syntheses and spectroscopy. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** CHEM 2323 and CHEM 2123.

**Corequisites:** CHEM 2325.

**Restrictions:** Graduate level students may not enroll.

## CHEM 2171 Water & Wastewater Lab

**Credit:** 1 (0-1-0)

Provides instruction in chemical and microbiological analysis for nonstandard water and wastewater samples following typical laboratory procedures according to local, state and federal environmental regulatory guidelines. Students will learn to perform on-stream analysis for the measurement of inorganic and organic compounds, ions, particles and microorganisms. Students learn to conduct basic water sample testing in a lab environment. Students are provided with Texas Commission on Environmental Quality (TCEQ) industry standards and best practice protocols for establishing and maintaining a safe laboratory environment and proper equipment use in a lab setting. As projects students will conduct field experience and conduct a water analysis of a local water body.

**Prerequisites:** CHEM 1111, CHEM 1112, CHEM 1311, CHEM 1312 TSI Restriction(s): Reading, Math, and Writing

**Restrictions:** Enrollment is limited to Undergraduate level students.

**CHEM 2314 Selected Topics-Chemistry****Credits:** 3 (3-0-0)

A course in chemistry in areas of specialization of the faculty, with emphasis on current developments. Specific topics will be changed from semester to semester, so a student may take the course for credit more than once. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** permission of the instructor.**Restrictions:** Enrollment is limited to Undergraduate level students.**Repeat Status:** Course may be repeated 1 time(s).**CHEM 2323 Organic Chemistry I****Credits:** 3 (3-0-0)

The first half of the organic chemistry sequence intended for science majors. A study of the structures, syntheses and reactions of organic compounds. TSI Restriction(s): , Math

**Prerequisites:** A grade of 'C' or better in CHEM 1312.**Corequisites:** CHEM 2123.**Restrictions:** Graduate level students may not enroll.**CHEM 2325 Organic Chemistry II****Credits:** 3 (3-0-0)

The second half of the organic chemistry sequence intended for science majors. A study of the structures, syntheses and reactions of organic compounds. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** A grade of 'C' or better in CHEM 2323.**Corequisites:** CHEM 2125.**Restrictions:** Graduate level students may not enroll.**CHEM 2371 Water & Wastewater Chemistry****Credits:** 3 (3-0-0)

Provides instruction on the principles and practice of chemical and microbiological analysis for nonstandard water and wastewaters. Chemical and biological testing requirements of governmental regulatory agencies are examined. This course also provides an overview of the theory, processes, and technologies used in common membrane water treatment systems. Content includes micro-filtration, ultra-filtration, electrode-ionization, nano-filtration and reverse osmosis membrane technologies. Students will also examine system design considerations and membrane integration into water treatment systems. Students will also learn the theory and technologies to perform on-stream analysis for the measurement of inorganic and organic compounds, ions, particles, and microorganisms. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** CHEM 1311, CHEM 1111, CHEM 1312, and CHEM 1112.**Restrictions:** Enrollment is limited to Undergraduate level students.**CHEM 3100 Physical Chem for Life Sci Lab****Credit:** 1 (0-1-0)

This is the co-requisite laboratory for CHEM 4300: Physical Chemistry for Life Sciences. The laboratory investigations complement the theory introduced in the lectures.

**Prerequisites:** MATH 2313, PHYS 1302, and CHEM 2325 with a C or better.**Corequisites:** CHEM 3300.**Restrictions:** Graduate level students may not enroll.**CHEM 3131 Quantitative Analysis Lab****Credit:** 1 (0-1-0)

This is the corequisite laboratory for CHEM 3331- Quantitative Analysis.

**Prerequisites:** A grade of C or better in CHEM 2323/2123 and MATH 1314.**Corequisites:** CHEM 3331.**Restrictions:** Graduate level students may not enroll.**CHEM 3156 Topics in Chemistry Laboratory****Credit:** 1 (0-1-0)

Experimental and computational investigations on selected topics in chemistry. May be repeated for credit under a different topic. It is a laboratory course that supports CHEM 3156 for certain topics, as decided by the instructor.

**Restrictions:** Graduate level students may not enroll.**CHEM 3300 Physical Chem for Life Sci****Credits:** 3 (3-0-0)

Fundamental principles of physical chemistry applied to biological systems; thermodynamics, equilibrium and bioenergetics, ionic equilibria, pH, buffers, ionic strength, and electrical properties of amino acids and proteins; kinetics, enzyme catalysis and inhibition; physical properties of biological macromolecules and transport properties in living systems.

**Prerequisites:** MATH 2313, PHYS 1302, CHEM 2325 with a C or better.**Corequisites:** CHEM 3100.**Restrictions:** Graduate level students may not enroll.**CHEM 3304 Research in Chemistry****Credits:** 1-3 (1-1-0)

This course provides an independent research opportunity that will allow undergraduates majoring in chemistry to make an original intellectual contribution to the discipline. Research will be conducted in collaboration with a faculty mentor. Variable credit, may be repeated for credit, for a total of 6 credits maximum.

**Restrictions:** Graduate level students may not enroll.**Repeat Status:** Course may be repeated 3 time(s).**CHEM 3315 History of Chemistry/Study Abr****Credits:** 3 (3-0-0)

The history of discoveries in chemistry is often one of intrigue, competition, and excitement. In this course, students visit historical locations of interest associated with discoveries in chemistry. Sites may include homes, laboratories, hospitals, and other locations relevant to these discoveries, including travel over significant distances. Through these experiences, with guidance by faculty and expertise provided by other professionals at remote locations, students will gain an understanding of the implications of chemistry's impact in modern times and in our everyday lives. Together, we will make chemistry come alive by rediscovering locations where scientific advances actually occurred. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** Instructor approval.**Restrictions:**

**CHEM 3331 Quantitative Analysis****Credits:** 3 (3-0-0)

Theory and application of gravimetric methods; acid-base, precipitation, and complexometric volumetric titrations; analytical separations, spectrophotometric and electroanalytical techniques; statistical and computer tools.

**Prerequisites:** A grade of C or better in CHEM 2321/2123 and MATH 1314.**Corequisites:** CHEM 3131.**Restrictions:** Graduate level students may not enroll.**CHEM 3350 Advanced Organic Chemistry****Credits:** 3 (3-0-0)

Survey of Molecular structure, reaction mechanisms, thermodynamic and kinetic data, linear free energy relationships, isotope effects, organic synthesis, and reactive intermediates including cations, anions, carbenes, and radicals.

**Prerequisites:** CHEM 2325 with a C or better.**Restrictions:** Graduate level students may not enroll.**CHEM 3365 Internship in Chemistry****Credits:** 1-3 (0-1-0)

This is a course aimed at providing professional working experience in the field of chemistry. The internship sites will be local and may be affiliated with the government, military, or private industry. The student will be required to be a model employee and an exemplary ambassador of Texas A&M University-San Antonio. Students will be supervised by a site manager and by a faculty member. Students will be evaluated based on their work performance and a reflection paper describing their experience.

**Prerequisites:** CHEM 2325.**Restrictions:** Graduate level students may not enroll.**Repeat Status:** Course may be repeated 3 time(s).**CHEM 3420 Computational Chemistry****Credits:** 4 (3-2-0)

The different computational methods used in chemistry, such as molecular mechanics, ab initio methods, semi-empirical methods, DFT and electron correlation methods are presented. Computations are performed using a variety of computing and visualization software packages. The laboratory component involves hands-on computations to solve chemical problems.

**Prerequisites:** CHEM 2325, PHYS 2326, MATH 2314 with a C or better.**Restrictions:** Graduate level students may not enroll.**CHEM 3451 Environmental Chemistry****Credits:** 3 (3-0-0)

Sources and causes of land, water and air pollution; the methods of measurement and abatement. May not be counted as part of the minimum requirements for a major in chemistry. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** CHEM 1112, CHEM 1312 and two additional 3- or 4-credit hour courses in either biology or geology or more advanced chemistry.**Restrictions:** Graduate level students may not enroll.**CHEM 4101 Physical Chemistry I Lab****Credit:** 1 (0-1-0)

This is the co-requisite laboratory for CHEM 4301: Physical Chemistry I. The laboratory investigations complement the theory introduced in the lectures.

**Prerequisites:** CHEM 2325, PHYS 2326, MATH 2314 with a C or better.**Restrictions:****CHEM 4102 Physical Chemistry II Lab****Credit:** 1 (0-1-0)

This is the co-requisite laboratory for CHEM 4302: Physical Chemistry II. The laboratory investigations complement the theory introduced in the lectures.

**Prerequisites:** CHEM 4101 and CHEM 4301 with a C or better or instructor approval.**Restrictions:****CHEM 4131 Instrumental Analysis Lab****Credit:** 1 (0-1-0)

This course is a corequisite laboratory for CHEM 4331 Instrumental Analysis.

**Prerequisites:** A grade of C or better in CHEM 3331/3131.**Restrictions:****CHEM 4141 Biochemistry Laboratory****Credit:** 1 (0-1-0)

This course covers experiments designed to reinforce topics covered in the lecture. Topics include column purification, polymerase chain reaction, gel electrophoresis analysis, and enzyme activity.

**Prerequisites:** CHEM 2325.**Corequisites:** CHEM 4341.**Restrictions:****CHEM 4190 Inorganic Chemistry Laboratory****Credit:** 1 (0-1-0)

This is the co-requisite laboratory for CHEM 4390: Inorganic Chemistry. The laboratory investigations complement the theory introduced in the lectures.

**Prerequisites:** CHEM 2325, PHYS 1302 or PHYS 2326 with a C or better.**Corequisites:** CHEM 4390.**Restrictions:** Graduate level students may not enroll.**CHEM 4301 Physical Chemistry I****Credits:** 3 (3-0-0)

Physical chemistry provides the fundamental concepts and organizing principles that underlie all aspects of chemistry and related fields. It develops rigorous and detailed explanations of central, unifying concepts in chemistry and contains mathematical models that provide quantitative predictions. Topics covered include thermodynamics, kinetic theory, solutions and phase equilibria, chemical equilibrium, photochemistry, chemical kinetics and atomic and molecular structures.

**Prerequisites:** CHEM 2325, PHYS 2326, MATH 2314 with a C or better.**Corequisites:** CHEM 4201.**Restrictions:** Graduate level students may not enroll.

**CHEM 4302 Physical Chemistry II****Credits:** 3 (3-0-0)

This is the sequel to Physical Chemistry I. The course contents provide foundational explanations of atomic and molecular phenomena that underpin all of chemistry. Topics covered include quantum mechanics: atomic structure and molecular orbital theory. Spectroscopy: microwave, infrared, electronic, photoelectron, electron spin and NMR.

**Prerequisites:** CHEM 4301 with a "C" or better or instructor approval.**Corequisites:** CHEM 4202.**Restrictions:** Graduate level students may not enroll.**CHEM 4329 Selected Topics-Organic****Credits:** 3 (3-0-0)

A course in organic chemistry in areas of specialization of the faculty, with emphasis on current developments. Specific topics will be changed from semester to semester, so a student may take the course for credit more than once. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** permission of the instructor.**Restrictions:****Repeat Status:** Course may be repeated 1 time(s).**CHEM 4331 Instrumental Analysis****Credits:** 3 (3-0-0)

Theory and application of instrumental techniques; spectroscopy, electrochemistry and chromatography. Instrumentation electronics signals and noise Scientific computing hardware, software, and programming.

**Prerequisites:** A grade of C or better in CHEM 3331/3131.**Restrictions:****CHEM 4339 Selected Topics-Analytical****Credits:** 3 (3-0-0)

A course in analytical chemistry, in areas of specialization of the faculty, with emphasis on current developments. Specific topics will be changed from semester to semester, so a student may take the course for credit more than once (Maximum 6 hours).

**Prerequisites:** permission of the instructor TSI Restriction(s): Reading, and Writing**Restrictions:****Repeat Status:** Course may be repeated 1 time(s).**CHEM 4341 Biochemistry I****Credits:** 3 (3-0-0)

Introduction to the important concepts, nomenclature and compounds of biochemistry with special emphasis on the chemical interpretation of the structures and function of biological macromolecules. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** CHEM 2325.**Restrictions:** Graduate level students may not enroll.**CHEM 4342 Biochemistry II****Credits:** 3 (3-0-0)

An introduction to the major biochemical cycles and pathways in living organisms, including reaction steps, regulation, and mechanisms. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** CHEM 4341.**Restrictions:** Graduate level students may not enroll.**CHEM 4349 Selected Topics-Biochemistry****Credits:** 3 (3-0-0)

A course in biochemistry, in areas of specialization of the faculty, with emphasis on current developments. Specific topics will be changed from semester to semester, so a student may take the course for credit more than once (Maximum 6 hours).

**Prerequisites:** permission of the instructor TSI Restriction(s): Reading, Math, and Writing**Restrictions:****Repeat Status:** Course may be repeated 1 time(s).**CHEM 4356 Topics in Chemistry****Credits:** 3 (3-0-0)

Lectures in selected topics in chemistry. May be repeated for credit under a different topic.

**Prerequisites:** CHEM 2325.**Restrictions:** Graduate level students may not enroll.**Repeat Status:** Course may be repeated 3 time(s).**CHEM 4359 Selected Topics-Computational****Credits:** 3 (3-0-0)

A course in computational chemistry, in areas of specialization of the faculty, with emphasis on current developments. Specific topics will be changed from semester to semester, so a student may take the course for credit more than once. TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** permission of the instructor.**Restrictions:****Repeat Status:** Course may be repeated 1 time(s).**CHEM 4360 Separation Science****Credits:** 3 (3-0-0)

This course will explore modern techniques for preparative and analytical separations in terms of basic theory, instrumentation and practical applications. Current research in this field will also be discussed.

**Prerequisites:** CHEM 3331.**Restrictions:** Graduate level students may not enroll.**CHEM 4370 Enzymology****Credits:** 3 (3-0-0)

This course provides an introduction to the fundamental concepts in enzyme mechanisms and kinetics. Common methods for studying enzymes and current research in the field of enzymes will also be discussed.

**Prerequisites:** CHEM 4341.**Restrictions:** Graduate level students may not enroll.

**CHEM 4379 Selected Topics-Environ/Toxic**

**Credits:** 3 (3-0-0)

A course in environmental/toxicology, in areas of specialization of the faculty, with emphasis on current developments. Specific topics will be changed from semester to semester, so a student may take the course for credit more than once (Maximum 6 hours). TSI Restriction(s): Reading, Math, and Writing

**Prerequisites:** permission of the instructor.

**Restrictions:**

**Repeat Status:** Course may be repeated 1 time(s).

**CHEM 4390 Inorganic Chemistry**

**Credits:** 3 (3-0-0)

Inorganic chemistry is one of the four fundamental areas of chemistry. Concepts related to the structure, bonding and properties of elements and inorganic compounds are presented and studied. Topics include preparation and characterization of inorganic and organometallic compounds by modern techniques.

**Prerequisites:** CHEM 2325, PHYS 1302/2326, with a C or better.

**Corequisites:** CHEM 4190.

**Restrictions:** Graduate level students may not enroll.

**CHEM 4420 Computational Chemistry**

**Credits:** 4 (3-1-0)

**Restrictions:**