

CHEMISTRY



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Administered by the Department of Physical Sciences within the College of Arts and Sciences.

Chemistry is a central science that provides a basic understanding needed to deal with many of society's needs. It is a critical field for man's attempt to feed and clothe the world population, to tap new sources of energy, to improve health, and to protect our environment. All life processes are manifestations of chemical change. Understanding chemical reactivity is necessary for our understanding of life and the world around us. Modern chemical instrumental techniques furnish a crucial dimension. They account for the recent acceleration of progress that now promises especially high return from the investment of additional resources in the field of chemistry. The chemical industry of the U.S. employs over a million people. There is no basic science that offers greater security for investment in the future than chemistry.

The Chemistry program leading to the Bachelor of Science degree at U. T. Permian Basin follows the guidelines of the American Chemical Society for a Bachelor of Science in Chemistry. This degree is appropriate for a student who wishes to pursue a professional career in chemistry or biochemistry. It is equally appropriate for one who desires a strong background in this central science as preparation for medical, dental, and veterinary schools, pharmacy, medical technology, technical sales, technical patent law, and teaching.

Degree Requirements

The total semester credit hours required for a B. S. in Chemistry is **120**.

General Education

49 semester credit hours

Complete the requirements shown in the General Education Requirements section on pages 64-65 of this catalog including the following specific courses.

Mathematics	MATH 2413, 2414	8 sch
Physics	2325/2125, 2326/2126 or 1301/1101, 1302/1102	8 sch
Computers	COSC 1335	3 sch

Chemistry Major and Minor Requirements

Students may complete the requirements for a B. S. degree in Chemistry through either of two plans. Plan A (36 upper level sch), for professionals, requires a minor. Plan B (24 upper level sch) requires a second major instead of a minor.

		B. S. Plan A:	B. S. Plan B:
CHEM 1311-1111, 1312-1112	General CHEM	8	8
CHEM 3411-3113, 3412-3114	Organic CHEM	10	10
CHEM 3324-3225	Analytical CHEM	5	5
CHEM 3695	CHEM Research	2	1
CHEM 4301-4103, 4302-4104	Physical CHEM	8	4
CHEM 4330-4131	NMR Spect.	4*	
CHEM 4374-4174	Adv. Inorganic CHEM	4	4*
CHEM 4340	Medicinal CHEM	3*	
Total:		44 sch	32 sch

Minor or Second Major Requirements

Plan A: Minor - 18 semester credit hours or

Plan B: 2nd Major - 30 semester credit hours

*Other CHEM 4xxx including Biochemistry courses and CHEM 3695 may be substituted.

Chemistry Minor

The Chemistry minor provides an appropriate supporting background particularly suited for students typically pursuing a major in another area of science or math. This plan furnishes some knowledge about inorganic, organic, and biochemistry and provides the essential analytical tools for other areas of study.

Minor Requirements

The total semester credit hour requirement for a minor in Chemistry is **23** with at least **12** sch at the upper level.

Required Courses

Courses	Description	Credit Hours
CHEM 1311-1111, 1312-1112	General Chemistry	8
CHEM 3411-3113, 3412-3114	Organic Chemistry	10
CHEM 3324-3225	Analytical Chemistry	<u>5</u>
	Total:	23

Chemistry as a Teaching Field

Requirements

A teaching field in Chemistry requires the completion of at least the 32 sch major (Plan B).

Substitution of any courses must be cleared through the Chemistry faculty.

TEExES Requirements

Candidates for TEExES tests in 8-12 Physical Science must have completed the courses listed for each area below or equivalent courses.

- **8-12 Physical Sciences:** CHEM 1311/1111, 1312/1112, 3324/3225, 3411/3113, 3412/3114, 4301/4103; PHYS 2425, 2426; NTSC 4311; 3 hours of science electives.

Candidates for TEExES tests in 8-12 Life Sciences must have completed the courses listed for each area below or equivalent courses.

- **8-12 Life Sciences:** BIOL 1306/1106, 1307/1107, 3300/3101 or 3324/3215, 3372, 4340, 4342; CHEM 1311/1111, 1312/1112, 3411/3113; NTSC 4311; 4 hours biology electives.

Candidates for TEExES tests in 8-12 Science must have completed the courses listed for each area below or equivalent courses.

- **8-12 Science:** BIOL 1306/1106, 1307/1107, 4340, 4342; BIOL 3372 or 3230/3231; BIOL 3300/3101 or 3324/3125; CHEM 1311/1111, 1312/1112, 3411/3113; GEOL 1301/1101, 1302/1102; PHYS 1301/1101 and 1302/1102 or PHYS 2425 and 2426; NTSC 4311; 3-4 hours of science electives.

Candidates for TEExES tests in 4-8 Science must have completed the courses listed for each area below or equivalent courses.

- **4-8 Science:** BIOL 1306/1106, 1307/1107, 4340; BIOL 3372 or 3230/3231; CHEM 1311/1111, 1312/1112; GEOL 1301/1101, 1302/1102; PHYS 1301/1101; NTSC 4311; and 9-12 hours of science electives.

Candidates for TEExES tests in 4-8 Math/Science Composite must have completed the courses listed for each area below or equivalent courses.

- **4-8 Math/Science Composite:** MATH 2350 or 2412, 2413, 2414, 3301, 3305, 3308, 3350; BIOL 1306/1106, 1307/1107; BIOL 3372 or 3230/3231; CHEM 1311/1111; GEOL 1301/1101; PHYS 1301/1101 or GEOL 1402; NTSC 4311; 6 hours of science electives.

Course Listing

CHEM 1301 Chemistry in Context (3)[†]

This course will introduce non-science majors to fundamental principles of chemistry using a topics approach. Chemistry concepts will be introduced and developed as needed for the understanding of contemporary societal-technological issues such as the ozone layer; global warming; energy; acid rain; nuclear fission; polymers; drugs; and nutrition. This course is designed to better prepare students to be well-informed citizens. Corequisite: CHEM 1103. FS

CHEM 1103 Chemistry in Context Lab (1)[†]

This course provides lab experiences that reflect the significant broad societal implications of the specific science and technology issues addressed in the lecture course. Hands on experiences are crucial to an understanding of scientific method and the role that Chemistry plays in addressing these issues. The focus is on exploration and data gathering rather than traditional lab techniques. Corequisite: CHEM 1301. FS

CHEM 1305 Introductory Chemistry (3)[†]

This course is a survey of the fundamentals of chemistry with applications to environmental science, allied health occupations, and food science. It will require critical thinking skills and problem solving ability, in addition to learning of factual material. Students with a weak background in Chemistry should take this course prior to enrolling in the General Chemistry sequence, i.e., CHEM 1311. FS

CHEM 1311 General Chemistry I (3)[†]

An introduction to chemistry, fundamentals of atomic structure and bonding, periodic chart, chemical nomenclature, equations and reactions. Prerequisite: high school chemistry. Corequisite: math at college algebra level or better. FS

CHEM 1111 General Chemistry Lab I (1)[†]

Experiments related to principles and topics covered in CHEM 1311. Corequisite: CHEM 1311. FS

CHEM 1312 General Chemistry II (3)[†]

Continuation of Chem 1311. Kinetics, equilibria, thermodynamics, electrochemistry, environmental chemistry, nuclear chemistry, and organic chemistry. Prerequisite: CHEM 1311 and 1111 both with C grade or higher. S, Summer

CHEM 1112 General Chemistry Lab II (1)[†]

Experiments related to principles and topics covered in CHEM 1312. Prerequisite: CHEM 1311 and 1111 both with C grade or higher. Corequisite: CHEM 1312. S, Summer

CHEM 3411 Organic Chemistry I (4)

Organic functional groups. Emphasizes synthesis and mechanisms. For chemistry, pre-professional and other science majors. Prerequisite: CHEM 1312-1112 with C grade or higher. Corequisite: CHEM 3113. FS

CHEM 3113 Experimental Organic I (1)

Techniques of separation, purification and synthesis of organic compounds. FS

CHEM 3412 Organic Chemistry II (4)

Continuation of CHEM 3411 including an introduction to naturally occurring and biologically important compounds. Prerequisite: CHEM 3411 and 3113 with C grade or higher. Corequisite: CHEM 3114. SSm

CHEM 3114 Experimental Organic II (1)

Continuation of CHEM 3113; qualitative analysis, spectral interpretation (IR, NMR, MS), and instrument usage. Prerequisites: CHEM 3411 and 3113 with C grade or higher. Corequisite: CHEM 3412. SSm

CHEM 3324 Analytical Chemistry I (3)

Analytical techniques and methods (emphasis on instrumentation) common to all areas of chemistry, medicine and the biological sciences. Corequisite: CHEM 3225. F

CHEM 3225 Analytical Chemistry Lab I (2)

Laboratory experience with instruments and methods presented in CHEM 3324. Corequisite: CHEM 3324. F

CHEM 3695 Intro to Research (Available for up to 6 credit hours)

Laboratory work on some aspect of a Chemistry research problem. Prerequisite: consultation with chemistry faculty and permission of research advisor. May be repeated for credit. F, S, Summer

CHEM 4301 Physical Chemistry I (3)

Kinetic molecular theory, molecular thermodynamics and an introduction to molecular energies. Prerequisites: one year of physics and one year of calculus. Corequisite: CHEM 4103. Prerequisite: CHEM 3324 and 3225. F

CHEM 4103 Experimental Physical Chemistry I (1)

Thermodynamic, kinetic and spectroscopic measurements. High-vacuum techniques and the use of sophisticated equipment in measuring molecular parameters. Corequisite: CHEM 4301. F

CHEM 4302 Physical Chemistry II (3)

Kinetics, quantum mechanics, bonding and molecular spectroscopy. Prerequisite: CHEM 4301. S

CHEM 4104 Experimental Physical Chemistry II (1)

Continuation of CHEM 4103. Prerequisite: CHEM 4103. Corequisite or prerequisite: CHEM 4302. S

CHEM 4321 Biochemistry I (3)

Beyond Organic Chemistry, this course covers the structure and function of proteins and enzymes. Fundamental metabolic pathways of the chemical reactions of carbohydrates and basic thermodynamic principles that drive these chemical reactions of life processes are also covered. Prerequisite: CHEM 3412 and 3114, both with grade \geq C. F

CHEM 4322 Biochemistry II (3)

The second half of this sequence covers photosynthesis and carbon fixation, bases that are incorporated into nucleic acids, the polymers of nucleic acids, lipids and membranes. Prerequisites: CHEM 4321; Co-requisite: CHEM 4223. S

CHEM 4223 Biochemistry Techniques (2)

This course surveys the most common laboratory techniques and applications used to investigate bio-molecules and their structure, isolation, purification and activity. Many experiments have to be done on a timely basis and may take several lab periods. Co-requisite: CHEM 4321. S

CHEM 4330 NMR Spectroscopy (3)

The Nuclear Magnetic Resonance phenomenon is reviewed and basic concepts of modern pulsed multinuclear NMR methods are presented. Focus will be on 1-D and 2-D techniques that are most useful today. 2-D techniques will then be covered as to their most effective use. The latter part of the course uses multiple spectra problem sets to gain proficiency in structure determination by NMR. Prerequisites: CHEM 3412 and 3114. Co-requisite 4131. F

CHEM 4131 NMR Spectr. Lab (3)

Basic NMR experiments on a modern superconducting magnet - pulsed multinuclear NMR is followed by more advanced 2-D NMR techniques used presently to determine chemical structure. Use of unknowns for most experiments is followed by more advanced special projects at the end of the semester. Prerequisites: CHEM 3412 and 3114. F

CHEM 4340 Medicinal Chemistry (3)

A brief historical development of medicinal chemistry and pharmacognosy is followed by a detailed look at most drug classes. Emphasis will be on relating chemical structure with bioactivity. Commonly used methods of drug design are interspersed. Prerequisite: CHEM 3412. S

CHEM 4374 Inorganic Chemistry (3)

Modern bonding theories at a level appropriate to understanding structure and chemical properties. Periodic relationships applied to families of elements. Prerequisite: CHEM 3324, 3225; CHEM 4301 and 4302 are desirable. S

CHEM 4174 Experimental Inorganic Chemistry (1)

Experiments which illustrate the descriptive nature of chemistry as well as techniques in the synthesis and identification of inorganic compounds. Prerequisite: CHEM 3324, 3225. S

CHEM 4389 Selected Topics (3)

Undergraduate courses which will be offered only once or will be offered infrequently or which are being developed before a regular listing in the catalog and may be acceptable for graduate credit. FS

CHEM 4391 Contract Study (3)

Advanced independent study or research. These courses will not count for graduate credit.

† Course fulfills general education requirements.

DEGREE PLAN: BS IN CHEMISTRY-Plan A

	Lower Level	Upper Level
GENERAL EDUCATION REQUIREMENTS:		
___ ___ English Composition: ENGL 1301 & 1302	6	
___ ___ U.S. History: HIST 1301 & 1302	6	
___ ___ U.S. & State Government: PLSC 2305 & 2306	6	
___ Literature: ENGL 2322, 2323, 2327, or 2328	3	
___ Social Science: PSYC, SOCI 1301, ECON 2301	3	
___ Communication: COMM 1315	3	
___ Fine Arts: ARTS 1301, MUSI 1306, DRAM 2301	3	
COMMON CORE & CHEMISTRY REQUIREMENTS:		
___ ___ MATH 2413 & MATH 2414 (Calculus I & II)	8	
___ ___ PHYS 2325/2125 & 2326/2126 (or 1301/1101, 1302/1102)	8	
DEPARTMENT CORE REQUIREMENTS:		
___ COSC 1301 or 1335 (Computer Science)	3	
___ NTSC 4311 (Capstone)		3
MAJOR CHEMISTRY COURSES: 44 sch total, 26 sch upper		
___ ___ CHEM 1311/1111 & 1312/1112, General Chemistry	8	
___ ___ CHEM 3411/3113 & 3412/3114 Organic Chemistry		10
___ CHEM 3324/3225 Analytical Chemistry		5
___ ___ CHEM 4301/4103 & 4302/4104 Physical Chemistry		8
___ CHEM 3695 Research		1
ADVANCED CHEMISTRY ELECTIVES (12sch):*		
___ CHEM 4340, Medicinal Chemistry		3
___ CHEM 4330/4131 NMR Spectroscopy		4
___ CHEM 3695 Research		1
___ CHEM 4374/4175 Advanced Inorganic Chemistry		4
*Biochemistry courses may also be used as advanced CHEM electives.		
MINOR: _____ (18 total, 12 upper level)		
In general, a minor consists of 18 sch of which 12 sch must be upper level. Please refer to the catalog for specific requirements for each individual minor.		
_____ / _____	8	
_____ / _____		12
_____ / _____		
_____ / _____		
TRANSFER or OTHER SCH Not Listed Above		
Lower level: _____		
Upper level: _____		4
TOTAL SCH (PLAN: 120 SCH With 54 Upper Level)	65	55

DEGREE PLAN: BS IN CHEMISTRY-Plan B

	Lower Level	Upper Level
GENERAL EDUCATION REQUIREMENTS:		
___ ___ English Composition: ENGL 1301 & 1302	6	
___ ___ U.S. History: HIST 1301 & 1302	6	
___ ___ U.S. & State Government: PLSC 2305 & 2306	6	
___ Literature: ENGL 2322, 2323, 2327, or 2328	3	
___ Social Science: PSYC, SOCI 1301, ECON 2301	3	
___ Communication: COMM 1315	3	
___ Fine Arts: ARTS 1301, MUSI 1306, DRAM 2301	3	
COMMON CORE & CHEMISTRY REQUIREMENTS:		
___ ___ MATH 2413 & MATH 2414 (Calculus I & II)	8	
___ ___ PHYS 2325/2125 & 2326/2126(or 1301/1101, 1302/1102)	8	
DEPARTMENT CORE REQUIREMENTS:		
___ COSC 1301 or 1335 (Computer Science)	3	
___ NTSC 4311 (Capstone)	3	
MAJOR CHEMISTRY COURSES: 32 sch total, 24 sch upper		
___ ___ CHEM 1311/1111 & 1312/1112, General Chemistry	8	
___ ___ CHEM 3411/3113 & 3412/3114 Organic Chemistry		10
___ CHEM 3324/3225 Analytical Chemistry		5
___ CHEM 4301/4103 Physical Chemistry		4
___ CHEM 3695 Research		1
ADVANCED CHEM ELECTIVES (4 SCH)		
___ _____		4
2ND MAJOR: _____ 30 total, 22 upper level (approx)		
___ / _____	8	
___ / _____		22
___ / _____		
___ / _____		
___ / _____		
EDUCATION: _____		
TRANSFER or OTHER SCH Not Listed Above		
Lower level: _____		
Upper level: _____		6
TOTAL SCH (PLAN: 120 SCH With 54 Upper Level)	65	55

PRE-PHARMACY (~3 yr) PLAN:

	Lower Level	Upper Level
GENERAL EDUCATION REQUIREMENTS:		
English Composition: ENGL 1301 & 1302	6	
U.S. History: HIST 1301 & 1302	6	
U.S. & State Govt: PLSC 2305 & 2306	6	
Literature: ENGL 2322	3	
Social Science: PSYC 1301, SOCI 1301, ECON 2301*	3	
Communication: COMM 1315*	3	
Fine Arts: ARTS 1301, MUSI 1306, DRAM 2301	3	
COMMON CORE REQUIREMENTS (19 sch):		
Calculus I & II: MATH 2413*, 2414	8	
Physics I & II: PHYS 1301/1101* & 1302/1102 or 2325/2125* & 2326/2126	8	
Computer Science: COSC 1335	3	
Required CHEM/BIOL/PSYC COURSES (35 sch):*		
General Chemistry I & II with lab: CHEM 1311/1111, 1312/1112	8	
Organic Chemistry I & II with lab: CHEM 3411/3113, 3412/3114		10
General Biology I & II with lab: BIOL 1306/1106, 1307/1107		8
Microbiology with lab: BIOL 3300/3101		4
Intro to Statistics: PSYC 3301		3
Recommended Courses:		
Analytical Chemistry: CHEM 3324/3225		5
Medicinal Chemistry: CHEM 4340		3
Biochemistry: CHEM 4321		3
TOTAL SCH:	65	28

* Used in calculation of Pre-Pharmacy grade point average (PPGPA) at TTHSC