

CHEMISTRY

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Chemistry is the study of matter from the macroscopic to the molecular to the atomic and is important to intellectual debates and technological advances in many areas. The Austin College Chemistry Department serves a wide variety of students from chemistry and biochemistry majors interested in advanced study to students needing the foundation of chemistry courses for other areas of study to non-science majors who are taking courses to obtain a broad liberal arts education. Undergraduate research is vital to the education of chemistry majors and provides students with opportunities to integrate and reinforce chemistry knowledge from their formal course work, develop their scientific and professional skills, and create new scientific knowledge. Finally, the Austin College Chemistry Department is approved by the American Chemical Society, which requires that departments have an energetic and accomplished faculty, a modern and well-maintained infrastructure, and a coherent chemistry curriculum that incorporates modern pedagogical approaches.

The Chemistry Department program has been recognized by the American Chemical Society as meeting national standards for the training of chemists.

Prerequisites for chemistry courses must be passed with grades of at least a grade of C- or better.

Degrees Offered in Chemistry

Major in Chemistry

Major in Biochemistry

Minor in Chemistry

CHEMISTRY

A **major in chemistry** consists of:

Introduction Courses (2 courses)

_____ CHEM 111 or 211**

_____ CHEM 112

Foundation Courses (5 courses)

_____ CHEM 221

_____ CHEM 222

_____ CHEM 332

_____ CHEM 341

_____ CHEM 342

Advanced Chemistry Courses (1 course)

_____ CHEM 400 Level**

Inorganic Chemistry Course (Requirement can be met in Introductory or Advanced Chemistry courses)**

_____ CHEM 211

_____ CHEM 412

Elective Course (1 Course)

_____ CHEM 200 level or higher

Research Requirement - A chemistry activity beyond the required coursework which includes: directed research on or off-campus, an internship in an industrial setting or methods-development laboratory, or employment in an industrial laboratory.

_____ CHEM 480 (zero-credit hour course but requirement to complete the chemistry degree)

Supporting Requirements for the Major

_____ PHY 106 or 112*

_____ MATH 152

_____ BIOL 116 or MATH 251/252 or PHY 211 or CS 110/111

*The recommended courses

Other Considerations When Planning for the Major:

- Students majoring in chemistry must take all their major courses for a letter grade.

- Prerequisites for chemistry courses must be passed with grades of at least a grade of C- or better.

Total Credits Requirement = 9 course credits

An ACS certified degree comprises a rigorous series of courses that stresses both breadth and depth of knowledge in chemistry above the normal major. Students seeking this degree should consult with a chemistry faculty member early in their freshman year. The courses required for an ACS certified degree are Chemistry 111 (or equivalent), 112 (or equivalent), 211, 221, 222, 332, 341, 342, 351, 480, two electives from Chemistry 352, 412, 421, or 460, plus a total of one full credit of research (130 hours). To receive a certified degree, students are required to complete Mathematics 152, Biology 116, and Physics 106 or 112. Mathematics 252 is recommended.

BIOCHEMISTRY

A **major in biochemistry** consists of:

Introduction Courses (2 courses)

_____ CHEM 111 or 211

_____ CHEM 112

Foundation Courses (4 courses)

_____ CHEM 221

_____ CHEM 222

_____ CHEM 351

_____ CHEM 352

Elective Chemistry Courses (2 courses)

_____ CHEM 332

_____ CHEM 341

_____ CHEM 342

_____ CHEM 412

_____ CHEM 421

Elective Biology Courses (2 courses)

_____ BIOL 228

_____ BIOL 230

_____ BIOL 248

_____ BIOL 343

_____ BIOL 344

_____ BIOL 345

Research Requirement - A chemistry activity beyond the required coursework that includes: directed research on or off-campus, an internship in an industrial setting or methods-development laboratory, or employment in an industrial laboratory.

_____ CHEM 480 (zero-credit hour course but requirement to complete the chemistry degree)

Supporting Requirements for the Major

_____ PHY 106 or 112*

_____ MATH 152

_____ BIOL 116

*The recommended course

Other Considerations When Planning for the Major:

- Students majoring in chemistry must take all their major courses for a letter grade.
- Prerequisites for chemistry courses must be passed with grades of at least a grade of C- or better.

Total Credits Requirement = 10 course credits

A **minor in chemistry** consists of:

Introduction Courses (1 course)

_____ CHEM 112

Foundation Courses (select 2 courses)

_____ CHEM 211

_____ CHEM 221

_____ CHEM 222

Advanced Courses (select 2 courses from 2 different columns) One must have a lab (L)

Analytical	Biochemistry	Inorganic	Organic	Physical
__CHEM 332(L)	__CHEM 351(L)	__CHEM 412(L)	__CHEM 421	__CHEM 341
	__CHEM 352(L)			__CHEM 342(L)

Other Considerations When Planning for the Minor:

- Prerequisites for chemistry courses must be passed with grades of at least a grade of C- or better.
- Students are strongly encouraged to take all their minor courses for a letter grade.

Total Credits Requirement = 5 course credits

Students with a strong high school chemistry background or with AP/IB credit for Chemistry 111 are advised to start in Chemistry 211 in the fall of their freshman year. Students with credit for Chemistry 112 may start in Chemistry 221, but should consult a chemistry faculty member.

COURSES

CHEM 101 Chemistry for Non-Science Majors

Introductory courses intended for the general student, not normally counted as prerequisite for other chemistry courses or satisfy requirements for chemistry majors. These courses introduce students to chemical principles and chemical practice in the laboratory. Title and emphasis announced in term schedule of courses. Past topics have included: chemistry and the environment, chemistry and nutrition, chemistry and art, drugs and our society, energy and fuel, and forensic chemistry. Requirements met: Sciences Breadth. (Each fall or spring)

CHEM 111 General Chemistry I

Basic concepts, principles, and practices of chemistry, typically including: mass and energy relations in chemical reactions, electronic structure and chemical bonding, the periodic table, and solids, liquids and solutions. Includes one three-hour lab per week. Requirements met: Sciences Breadth and Quantitative Competency. (Each fall)

CHEM 112 General Chemistry II

Quantitative aspects of elementary chemical thermodynamics, the rates of chemical reactions, and of systems in equilibrium, typically including acid-base chemistry, oxidation-reduction reactions, and electrochemistry. Includes one three-hour lab per week. PREQ: Chemistry 111 or

Chemistry 211 with a grade of C- or higher. Requirements met: Sciences Breadth and Quantitative Competency. (Each spring)

CHEM 211 Inorganic Chemistry

An overview of the fundamentals of inorganic chemistry. The course covers such topics as atomic properties, molecular bonding, materials, descriptive chemistry of the elements, acid-base chemistry, coordination chemistry, organometallic chemistry, and bioinorganic chemistry. Includes one three-hour lab per week. Requirements met: Sciences Breadth.

CHEM 221 Organic Chemistry I

Fundamental concepts of organic chemistry utilizing laboratory, lecture, and peer group discussions. Covers general types of mechanisms, stereochemistry, infrared spectroscopy, and reaction energetics. Includes one three-hour lab per week. PREQ: Chemistry 112 with a grade of C- or higher. Requirements met: Sciences Breadth. (Each fall)

CHEM 222 Organic Chemistry II

Application of general principles of organic chemistry to problems of organic synthesis and structure determination. Includes topics of aromatic substitution reactions, carbonyl and active methylene chemistry, and nuclear magnetic resonance. Includes one three-hour lab per week. PREQ: Chemistry 221 with a grade of C- or higher. Requirements met: Sciences Breadth. (Each spring)

CHEM 250 Intermediate Topics in Chemistry

A study of selected topics for beginning students based on faculty and student interests. Offered on an occasional basis. Course may be repeated when topic varies. 1 course credit.

CHEM 260 Intermediate Directed Study

Student investigation of topic of interest working in collaboration with a faculty member resulting in significant oral and written work. See On-Campus Learning Opportunities for more information. PREQ: Freshman January term or Sophomore standing. Special permission required. Offered in variable course credit from 0.25-1.00.

CHEM 294 Intermediate Student Research

Intended for less experienced students to develop and execute a research project related to chemistry, beyond the constraints of the normal classroom, suitable for public dissemination on or off campus under mentorship of a faculty member. Typically, this work results in a formal presentation, written work, or creative works. Course credit varies from 0-1.00. PREQ: Instructor permission required.

CHEM 332 Analytical Chemistry

Principles and applications of wet and instrumental methods for chemical analysis. Design of chemical analyses. Statistics and regression for treating chemical data. Laboratory experiments to develop excellent lab techniques and skill in using instrumentation. Includes one three-hour lab per week. PREQ: Chemistry 221 with a grade of C- or higher. Requirements met: Sciences Breadth and Half Writing Competency. (Each spring)

CHEM 341 Quantum Chemistry

A semester-long introduction to quantum mechanics, including history and applications. The course will start with the fundamentals of quantum mechanics and progress to topics in molecular spectroscopy and the principles of chemical bonding. The course will also include an overview of current topics in experimental and computational physical chemistry. Note: CHEM 341 and CHEM 342 may be taken in any order. PREQ: Chemistry 112 with a grade of C- or higher, Mathematics 152, and either Physics 106 or 112. Requirements met: Sciences Breadth. (Each fall)

CHEM 342 Thermodynamics and Kinetics

This course will introduce key concepts in statistical mechanics, thermodynamics, kinetics, and reaction dynamics. The course will also include an overview of current topics in experimental and computational physical chemistry. Includes one three-hour lab per week. Note: CHEM 341 and CHEM 342 may be taken in any order. PREQ: Chemistry 112 with a grade of C- or higher, Mathematics 152, and either Physics 106 or 112. Requirements met: Sciences Breadth. (Each spring)

CHEM 351 Introduction to Biochemistry

The structures and general reactions of carbohydrates, lipids, proteins, and nucleic acids. Includes one three-hour lab per week. PREQ: Chemistry 222 and Biology 116 with grades of C- or higher. Requirements met: Sciences Breadth. (Each fall)

CHEM 352 Biochemical Metabolism

The enzymatic anabolism and catabolism of the groups of substances studied in Chemistry 351. PREQ: Chemistry 351 with a grade of C- or higher. Includes one three-hour lab per week. Requirements met: Sciences Breadth. (Each spring)

CHEM 412 Advanced Inorganic Chemistry

A thorough study of inorganic chemistry. Topics include atomic properties, modern bonding theories, molecular symmetry and spectra, descriptive chemistry of the elements, acid-base chemistry, coordination and organometallic chemistry, environmental and bioinorganic chemistry, and solid state chemistry. Includes one three-hour lab per week. PREQ: Chemistry 342 and Chemistry 211 with grades of C- or higher, or instructor permission. Requirements met: Sciences Breadth. (Each spring)

CHEM 421 Advanced Organic Chemistry

Advanced theory and current topics in organic chemistry. Emphasis on theoretical and empirical generalizations (including spectroscopy) most applicable to organic reaction mechanisms and synthesis. PREQ: Chemistry 222 with a grade of C- or higher. Requirements met: Sciences Breadth. (Each fall)

CHEM 450 Advanced Topics in Chemistry

An investigation of selected topics for more advanced students based on faculty and student interests. Offered on an occasional basis. Course may be repeated when topic varies. Prerequisites vary. 1 course credit.

CHEM 460 Advanced Directed Study

Student investigation of topic of interest related to the major or minor working in collaboration with a faculty member resulting in significant oral and written work. See On-Campus Learning Opportunities for more information. PREQ: Junior or Senior standing. Special permission required. Offered for variable course credit from 0.25-1.00.

CHEM 464 Teaching/Learning Participation

An individualized study that includes sharing in the instructional process for a particular chemistry course under the supervision of the faculty member teaching the course. Open only to certain highly qualified juniors and seniors by invitation. See On-Campus Learning Opportunities. (Offered as needed)

CHEM 470 Becoming a Chemical Professional

In this course, students will gain a greater understanding of how the discipline of chemistry works and the expectations of professional chemists. In the first part of the course, students will learn about how chemistry graduate school works, the application process, and what to think about in choosing a program. Students will also develop their application materials with guided feedback from the instructors and explore careers in chemistry. In the second part of the course, students will delve into various ethical issues that can/have come up in scientific research in order to better prepare them for becoming a member of the broader scientific community. PREQ: Instructor permission. (Fall only)

CHEM 480 Experience in Chemistry

All chemistry and biochemistry majors must participate in a chemistry activity beyond the required coursework to obtain a degree in chemistry. Activities such as directed research on or off-campus, an internship in an industrial setting or methods-development laboratory, or employment in an industrial laboratory will satisfy this requirement. Chemistry majors should register for Chemistry 480 during the semester that they will give their public presentation. Zero course credit units.

CHEM 491 Honors Thesis in Chemistry

Extensive independent study in the major in a topic of special interest culminating in a bachelor's thesis with oral examination by thesis committee resulting in a bachelor's degree with Honors upon completion. See Departmental Honors Program for more information. Completed in last three semesters before graduation. Offered for variable course credit from 1.00-2.00.

CHEM 492 Independent Study Off-Campus/NSOC

Student-driven independent study in a topic related to the major completed at an off-campus site. See Off-Campus Learning Opportunities for more information. PREQ: Junior or Senior standing. Special permission required. Offered in variable course credit from 0.25-1.00.

CHEM 494 Advanced Student Research

Intended for advanced students to develop and execute a research project related to chemistry suitable for public dissemination under mentorship of a faculty member. Students are expected to present the results of their research in a public forum. Typically, this work results in a formal

presentation, written work, or creative works. Course credit varies from 0-1.00. PREQ: Instructor permission required.