Faculty

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Degrees and Programs

The *Chemistry Department* serves students with a primary interest in chemical science as well as students in other fields for which chemistry is an important foundation. The department has the following objectives:

- To give a thorough grounding in the principles of chemistry, both in theory and in practical experience with instrumentation currently in use.
- To help the student develop problem-solving abilities through a careful analysis of problems and the application of chemical principles.
- To provide an atmosphere where Christian values are integrated into the learning experience.

The department offers several degree options. For students intending to enter a graduate chemistry program or directly enter the profession, both the B.S. in Chemistry and the B.S. in Biochemistry are suitable programs. Students who intend to enter a professional program in one of the medical sciences will find the B.S. in Biochemistry provides a very good preparation. Students are encouraged to work closely with their major advisor to select suitable electives regardless of their career choice. Students whose interests include the liberal arts and languages as well as chemistry may choose the B.A. in Chemistry.

Major in Chemistry, B.S.

A minimum of 93.5 hours (47.5 upper-division hours)

➤ ***Required Core Courses (60.5 hours):***

CHEM 111+12+13+L	General Chemistry I, II, III+L	5+5+5
CHEM 225	Chemical Modeling	2
CHEM 324+324L	Analytical Chemistry I + Lab	3+1
CHEM 325	Analytical Chemistry II	3
CHEM 371+72+73+L	Organic Chemistry I, II, III+L	4+4+4
CHEM 397	Chemistry Seminar	0.5
CHEM 414	Inorganic Chemistry	3
CHEM 426L	Integrated Chemistry Lab (x4)	1+1+1+1
CHEM 451+452	Thermodynamics	4
CHEM 452	Kinetics	2
CHEM 453	Quantum Mechanics	3
CHEM 481	Biochemistry I	4
CHEM 490	Senior Capstone	1
CHEM 499	Independent Research (2 qtrs.)	1+1
SCIE 290	Sophomore Seminar	1

➤ ***Required Core Electives (5 hours):***

At least 5 hours from the following: 5

Additional upper-division CHEM courses

➤ ***Required Cognate Courses (28 hours):***

MATH 131+132	Calculus I, II	4+4
PHYS 111+112+113	General Physics I, II, III	4+4+4

At least two of the following courses: 8

INFS 115	Intro to Computer Programming (4)
MATH 265	Elementary Linear Algebra (4)
MATH 269	Elementary Differential Equations (4)

Major in Chemistry, B.A.

A minimum of 70.5 hours (34.5 upper-division hours)

➤ ***Required Core Courses (50.5 hours):***

CHEM 111+12+13+L	General Chemistry I, II, III+L	5+5+5
CHEM 324+324L	Analytical Chemistry I + Lab	3+1
CHEM 325	Analytical Chemistry II	3
CHEM 371+72+73+L	Organic Chemistry I, II, III+L	4+4+4
CHEM 397	Chemistry Seminar	0.5
CHEM 414	Inorganic Chemistry	3
CHEM 451	Thermodynamics	4
CHEM 452	Kinetics	2
CHEM 490	Senior Capstone	3
SCIE 290	Sophomore Seminar	1
At least three credits from the following:		3
CHEM 426L	Integrated Chemistry Lab (2-3)	
CHEM 483L	Biochemistry III Lab (2)	

➤ ***Required Cognate Courses (20 hours):***

MATH 131+132	Calculus I, II	4+4
PHYS 111+112+113	General Physics I, II, III	4+4+4

Major in Biochemistry, B.S.

A minimum of 102.5-103.5 hours (49.5-52.5 upper-division hours)

➤ ***Required Core Courses (57.5-58.5 hours):***

CHEM 111+12+13+L	General Chemistry I, II, III+L	5+5+5
CHEM 324+324L	Analytical Chemistry I + Lab	3+1
CHEM 371+72+73+L	Organic Chemistry I, II, III+L	4+4+4
CHEM 397	Chemistry Seminar	0.5
CHEM 426L	Integrated Chemistry Lab (x3)	1+1+1
CHEM 451	Thermodynamics	4
CHEM 452	Kinetics	2
CHEM 481	Biochemistry I	4
CHEM 482	Biochemistry II	4
CHEM 483+483L	Biochemistry III + Lab	3+2
CHEM 490	Senior Capstone	1
SCIE 290	Sophomore Seminar	1
At least one of the following courses:		2-3
CHEM 225	Chemical Modeling (2)	
CHEM 325	Analytical Chemistry II (3)	

➤ ***Required Core Electives (6 hours):***

At least 6 hours from the following: 6
Additional upper-division CHEM courses

➤ ***Required Cognate Courses (39 hours):***

BIOL 121+122+123	Biological Foundations I, II, III	5+5+5
MATH 131+132	Calculus I, II	4+4
PHYS 111+112+113	General Physics I, II, III	4+4+4
At least one of the following courses:		4
BIOL 320	Cell & Molecular Biology (4)	
BIOL 354	Genetics (4)	
BIOL 469	Immunology (4)	

Pre-medical and pre-dental students:
See advisor for recommended cognates.

Teaching Credential

Students desiring to enter a program of studies leading to a California teaching credential in science with a concentration in chemistry may take the any of the Chemistry baccalaureate degrees. Students will need to pass the science (chemistry concentration) portion of the CSET exam one quarter prior to doing full-time student teaching. Students are invited to discuss the program with their major advisor in the Chemistry Department.

Those who plan to teach on the secondary level should consult with the credential analyst in the Education Department and should become acquainted with the specific requirements for admission to and successful completion of the Teacher Education Program as outlined in the section entitled "Education" in this catalog.

Minor in Chemistry

A minimum of 30 hours (15 upper-division hours)

Take at least 30 hours (15 upper-division) chosen from any non-service CHEM courses.

Chemistry

Service Courses:

(Not applicable to a major or minor in this department)

CHEM 101 4 F, W
Introductory Chemistry

An elementary introduction to fundamental principles of chemistry. Primarily for students preparing to enter an allied health or related field or to enroll in CHEM 102 and 111. Three lectures and one laboratory per week. Prerequisite: High school Algebra I or MATH 095.

CHEM 104 5 S
Survey of Biological Chemistry

An introduction to the structure and function of biochemical molecules and the chemistry of metabolic pathways in the cell. Prerequisite: High school chemistry or CHEM 101.

Lower-Division Courses:

CHEM 111+112+113 4+4+4 F+W+S
General Chemistry I, II, III

A complete introduction to the fundamental principles of chemistry including atomic and molecular structure, bonding theories, intermolecular forces, phases of matter, stoichiometry, kinetics, thermodynamics, acid/base equilibria, and electrochemistry. Includes the following topics: Atomic and molecular orbital theory, stoichiometry, gas laws, thermodynamics, kinetics, chemical equilibrium, acid-base theory, pH and introductions to nuclear, inorganic, and organic chemistry. Intended for chemistry majors and preprofessional students in medicine, dentistry, and other technical fields. Must be taken in sequence. Prerequisites: Algebra II, Integrated Math III, or MATH 096. An ACT Math score of 19 (or SAT Math score of 500) is expected. Secondary school chemistry and physics are highly recommended. Corequisite: CHEM 111L, 112L, 113L.

CHEM 111L+112L+113L 1+1+1 F+W+S
General Chemistry Lab I, II, III

Laboratory activities exploring aspects of the fundamental principles of chemistry. Corequisite: CHEM 111, 112, 113.

CHEM 210L 1 S
Laboratory Glassblowing

Introduction to laboratory glassblowing. Includes basic seals, annealing and glass repair. One laboratory per week.

CHEM 225 2 S
Chemical Modeling

Introduction to computers in chemistry. Software solutions to mathematically model chemical processes and for modeling chemical structures and reactions will be explored. Prerequisite: CHEM 111.

Upper-Division Courses:

CHEM 324 3 F
Analytical Chemistry I

An introduction to analytical chemistry. Emphasis is on gravimetric analysis, ions in solution, acid-base equilibria, complex formation, and titrations. Data recording and processing methods, including error analysis and statistics. Prerequisite: CHEM 113.

CHEM 324L 1 F
Analytical Chemistry I Laboratory

A series of laboratory experiments to determine unknown quantities of selected chemical substances. Prerequisite or corequisite: CHEM 324.

CHEM 325 3 W
Analytical Chemistry II

The theoretical basis of chemical analysis using electrochemical and spectroscopic analysis with an introduction to principles of operation of current analytical instrumentation. Prerequisite: CHEM 324L.

CHEM 371+372+373 3+3+3 F+W+S
Organic Chemistry I, II, III

The physical and chemical properties of compounds of carbon. A mechanistic approach to the study of organic reactions with an emphasis on spectroscopic methods of analysis. Must be taken in sequence. Prerequisite: CHEM 113. Corequisite: CHEM 371L, 372L, 373L.

CHEM 371L+372L+373L 1+1+1 F+W+S
Organic Chemistry Lab I, II, III

Laboratory activities exploring the physical and chemical properties of compounds of carbon. Corequisite: CHEM 371, 372, 373.

CHEM 397 0.5 S
Chemistry Seminar

Introduction to chemical literature searching, the anatomy of a scientific paper, and critiques of scientific communication. Also includes talks on current topics in science. Prerequisite: CHEM 373. Graded S/F.

CHEM 414 3 S
Inorganic Chemistry

A systematic study of inorganic chemistry with emphasis on chemical theory and bonding, the descriptive chemistry of the elements, and transition-metal chemistry. Prerequisite: CHEM 113. Odd years.

CHEM 426L 1-4 W, S
Integrated Chemistry Laboratory

A laboratory course that integrates material from the major areas of chemistry including Analytical, Biochemistry, Inorganic, Organic, and Physical. Experiments will vary from quarter to quarter. Repeatable up to 4 times. Prerequisite: CHEM 324L.

CHEM 451 **4 F**
Thermodynamics
(See also PHYS 445.)
A classical and statistical treatment of energy and entropy concepts used to predict the direction and extent of changes in chemical and physical systems. Prerequisites: CHEM 113, MATH 132, and PHYS 111.

CHEM 452 **2 W**
Kinetics
Kinetic theory, chemical kinetics, including enzyme kinetics, transport properties. Prerequisites: CHEM 112, MATH 132, and PHYS 111.

CHEM 453 **3 S**
Quantum Mechanics
(See also PHYS 461.)
An introduction to the Schrödinger wave equation and its solutions, the variational method, operator methods, angular momentum, atomic structure, and the chemical bond. Prerequisites: CHEM 111, MATH 132, and PHYS 111.

CHEM 481 **4 F**
Biochemistry I
Structure-function studies of biomolecules, enzyme kinetics, and bioenergetics. Prerequisite: CHEM 373.

CHEM 482 **4 W**
Biochemistry II
Cellular metabolism of carbohydrates, lipids, and proteins. Signal transduction and hormonal integration of metabolism. Prerequisite: CHEM 481.

CHEM 483 **3 S**
Biochemistry III
Information pathways of DNA, RNA, protein metabolism, & regulation of gene expression. Prerequisite: CHEM 482.

CHEM 483L **2 S**
Biochemistry III Laboratory
Laboratory discussions and activities introducing the basic experimental techniques of protein biochemistry. One lecture and one laboratory per week. Prerequisite: CHEM 482. *Previously CHEM 484L.*

CHEM 485 **3 Arr**
Topics in Biochemistry
Study of an advanced topic in biochemistry. Topics may include biophysical chemistry, pharmaceutical chemistry, nucleic acid enzymology, signal transduction, or macromolecular structure and function. Repeatable for credit under different subtitles. Prerequisite: CHEM 482 or BIOL 320.

CHEM 486 **3 Arr**
Topics in Chemistry
Study of an advanced topic in chemistry. Topics may include advanced organic synthesis or mechanisms, organometallic chemistry, materials chemistry, or statistical thermodynamics. Repeatable for credit under different subtitles. Prerequisite: CHEM 373.

CHEM 490 **1 W**
Senior Capstone
Topics of current interest in chemistry. Under supervision of department faculty, each student prepares and presents a paper on a topic of interest in chemistry. Prerequisite: SCIE 290, 397.

CHEM 495 **1-3 Arr**
Independent Study
Offers the advanced student opportunity to pursue investigation in a field of special interest under the direction of department faculty.

CHEM 499 **1-2 F, W, S**
Independent Research
An independent research project undertaken with direction from a faculty member. Arrangements should be made before the beginning of the quarter. Repeatable to a maximum of 4 credits in Bachelor of Science curricula.

Science

Lower-Division Course:

SCIE 290 **1 W**
Preparation of math and science students for successful pursuit of internship/research, graduate school, and career opportunities. Discussions of discipline-specific career options and skills needed for obtaining a job or success at the next level of education. Includes resume writing and portfolio preparation. Relevant topics of interest presented by guest speakers. 1 credit S/F.