

CHEMISTRY

The Department of Chemistry, which is approved by the American Chemical Society (ACS), offers both Bachelor of Science (B.S.) and Bachelor of Arts (B.A.) degrees. Students can choose among three B.S. degree options. The B.S. degree in Chemistry is designed for majors planning to be industrial or government chemists, planning to pursue a graduate degree in chemistry or biochemistry, or considering professional degrees in fields such as medicine. The B.S. degree with Concentration in Medicinal Chemistry is designed for students interested in health fields, graduate programs in life sciences or professional study such as pharmacy or medicine. The B.S. degree with Concentration in Education is designed for students planning to teach high school chemistry or plan to teach at a more advanced level and want to develop their teaching skills as part of their undergraduate education. The B.A. degree is appropriate for chemical technologists and pre-professional students, particularly fields other than the health sciences.

Other Information

Students working toward a degree in Chemistry or a Chemistry minor must earn a grade of "C-" or better in all courses used to fulfill Chemistry major or minor requirements. A GPA of 2.0 or higher in chemistry and cognate courses is required to graduate with a Chemistry major or minor.

The department highly encourages students to engage in undergraduate research with a faculty mentor. Students can start undergraduate research with CHEM 2950 or CHEM 4950 depending on their background and the needs of their faculty supervisor.

To make room for students making regular academic progress, those students who have been enrolled in a course three or more times: 1) will not be allowed to enroll prior to the first week of classes; and 2) will need permission of the instructor to enroll.

High school students who have successfully completed advanced high school chemistry courses (AP and/or IB) and are considering a modified course of study should consult with the department.

Chemistry and double majors, minors

Pharmaceutical Sciences majors

- may not add a Chemistry minor
- may add a Chemistry major or dual degree (BA Chemistry; BS Pharmaceutical Sciences), without overlapping restrictions.

Molecular and Biomedical Biology and Chemistry

- MBB majors may add a Chemistry minor or double major (no concentration) without overlapping restrictions
- MBB and Chemistry-Medicinal Chemistry as double majors may not count CHEM 4660-4664 Biochemistry II Lecture and Lab toward both majors.
- Chemistry-Medicinal Chemistry majors may add a Molecular and Biomedical Biology minor without overlapping restrictions

Biology and Chemistry

- Dual degrees with Biology and Chemistry (one being the BA, the other a BS) may not use the same 3000-4000 level Chemistry course toward both programs.
- One degree (BA or BS) with two majors (double major) of Biology and Chemistry may count the same 3000-4000 level Chemistry courses toward both programs.
- A Chemistry major and Biology minor may overlap 3000-4000 level Chemistry courses.
- A Biology major and Chemistry minor may overlap 3000-4000 level Chemistry courses.

Student Groups

The Department of Chemistry has an active student led Chemistry Club. Please visit our dedicated student organizations website ([https://](https://www.unomaha.edu/college-of-arts-and-sciences/chemistry/student-opportunities/student-organizations.php)

www.unomaha.edu/college-of-arts-and-sciences/chemistry/student-opportunities/student-organizations.php) for more information.

Contact Information

337 Durham Science Center
402.554.2651

Website (<http://www.unomaha.edu/college-of-arts-and-sciences/chemistry/>)

Degrees Offered

- Chemistry, Bachelor of Arts (<http://catalog.unomaha.edu/undergraduate/college-arts-sciences/chemistry/chemistry-ba/>)
- Chemistry, Bachelor of Science (<http://catalog.unomaha.edu/undergraduate/college-arts-sciences/chemistry/chemistry-bs/>)
- Chemistry, Bachelor of Science with a Concentration in Medicinal Chemistry (<http://catalog.unomaha.edu/undergraduate/college-arts-sciences/chemistry/concentration-medical-chemistry/>)
- Chemistry, Bachelor of Science with a Concentration in Chemistry Education (<http://catalog.unomaha.edu/undergraduate/college-arts-sciences/chemistry/concentration-chemistry-education/>)

Writing in the Discipline

All students are required to take a writing in the discipline course within their discipline. For the chemistry major, this is NSCI 3940 along with any two of the following courses: CHEM 3354, CHEM 3364, CHEM 4654, CHEM 4664, or another approved course.

Minors Offered

- Chemistry Minor (<http://catalog.unomaha.edu/undergraduate/college-arts-sciences/chemistry/chemistry-minor/>)

Love chemistry? Take the challenge and become a chemistry major! A career in chemistry is exciting. Most of our graduate majors go to professional schools (medical, dental, pharmacy schools, and other health related careers), some pursue graduate schools, and the rest land a job in industry. Companies that hire chemists include pharmaceutical companies, bulk commodity chemical companies, food manufacturers, personal, and household care product companies, and some of our students enjoy teaching in the K-12 schools!

Career options include, but are not limited to

- Healthcare professional (medical doctor, nurse, pharmacist, and dentist);*
- Professor after graduate schools;*
- Lab chemist
- Lab technician
- Quality assurance specialist
- Science teacher

*Advanced Degree Required

CHEM 1010 CHEMISTRY IN THE ENVIRONMENT AND SOCIETY (3 credits)

An introduction to 1) the environment's impact on each of us, 2) our impacts on the environment, and 3) the chemistry needed to understand it. Is it in your lungs?...in your food?...on your skin? What are the sources of your electricity and why does it matter? Are your choices sustainable? Those and related questions will be addressed as you explore air quality, climate change, fossil fuel combustion (and its alternatives), polymers, medicine, nutrition, and more in the context of their social, political and economic connections. (Fall, spring) Fulfills a University General Education Natural/Physical Science Requirement.

Prerequisite(s): MATH 1220 or MATH 1300 or MATH 1320 or higher with a grade of C- or better or equivalent.

Distribution: Natural/Physical Sci General Education lecture

CHEM 1014 CHEMISTRY IN THE ENVIRONMENT AND SOCIETY LABORATORY (1 credit)

Laboratory for CHEM 1010, a survey of the relationship of chemistry to current problems in environmental control, medicine, technology and energy production. (Fall, Spring)

Prerequisite(s): CHEM 1010 to be taken concurrently or completed previously with grade of C- or better.

Distribution: Natural/Physical Sci General Education lab course

CHEM 1140 FUNDAMENTALS OF COLLEGE CHEMISTRY (4 credits)

A comprehensive introduction to the basic principles of chemistry. This course is intended for all students needing a one-semester introductory course with laboratory including allied health students continuing to CHEM 2210, or those seeking a stronger background before enrollment in CHEM 1180. (Fall, spring, possibly summer). Fulfills a University General Education Natural/Physical Science Requirement.

Prerequisite(s): MATH 1220, MATH 1300, MATH 1320 or equivalent/higher (C- or better) or ACT Math subscore 23+ or ALEKS/Accuplacer score 4+ or SAT Math subscore 540+ or SAT2016 Math subscore 570+. CHEM 1144 must be taken concurrently or prior (C- or higher)

Distribution: Natural/Physical Sci General Education lecture

CHEM 1144 FUNDAMENTALS OF COLLEGE CHEMISTRY LABORATORY (1 credit)

Laboratory explorations of chemical measurements, modeling, reactions and analyses. To be taken with CHEM 1140. (Fall, spring, possibly summer).

Prerequisite(s): CHEM 1140 concurrent or prior with C- or better.

Distribution: Natural/Physical Sci General Education lab course

CHEM 1170 GENERAL CHEMISTRY I-II (5 credits)

Intended for students with significant backgrounds in chemistry, the course is a combination of CHEM 1180 and CHEM 1190 completed in one semester. This course also includes a lab section. During lecture, the following topics will be covered: introductory quantum theory, electronic structures, bonding theory, gas laws, solution properties and reactions, acid-base theory, ionic equilibria, complexation, oxidation-reduction, thermodynamics and kinetics. The laboratory will include the introduction of basic laboratory skills and scientific experimental design.

Prerequisite(s): MATH 1330 or equivalent in the last two years (C- or better); OR ACT Math subscore of 26 in the last two years; OR ALEKS/Accuplacer score of at least 6 in the last two years; AND AP chemistry exam score 3 or greater; OR instructor permission.

Distribution: Natural/Physical Sci General Education lecture&lab

CHEM 1180 GENERAL CHEMISTRY I (3 credits)

A comprehensive survey of chemical principles; the first course in a two-semester sequence primarily for majors and those in the sciences. It is assumed that students will have a good background in elementary chemical principles. CHEM 1184 normally to be taken concurrently. (Fall, Spring, Summer) Fulfills a University General Education Natural/Physical Science Requirement.

Prerequisite(s): Minimum grade of C- in: MATH 1300; 1320; 1330; 1340; 1930; 1940; 1950; OR Math proficiency via ACT Math Subscore 25+; ALEKS/Accuplacer score 5+; SAT Math Subscore 570+; OR SAT2016 Math Subscore 590+; or CHEM 1140. CHEM 1184 concurrent/prior required.

Distribution: Natural/Physical Sci General Education lecture

CHEM 1184 GENERAL CHEMISTRY I LABORATORY (1 credit)

A laboratory program designed to enhance laboratory skills and illustrate chemical principles. (Fall, Spring, Summer) Fulfills a University General Education Natural/Physical Science requirement.

Prerequisite(s): CHEM 1180 concurrent or prior with a grade of C- or better.

Distribution: Natural/Physical Sci General Education lab course

CHEM 1190 GENERAL CHEMISTRY II (3 credits)

A study of acid-base theory, ionic equilibria, complexation, oxidation-reduction, thermodynamics and kinetics. CHEM 1194 to be taken concurrently. (Fall, Spring, Summer)

Prerequisite(s): Minimum grade of C- in CHEM 1180, CHEM 1184, & MATH 1300; 1320; 1330; 1340; 1930; 1940; 1950 (or approved higher level course) or ACT Math 25+ or SAT Math 570+ or SAT2016 Math 590+ or ALEKS/Accuplacer 5+. Required: CHEM 1194 concurrent

CHEM 1194 GENERAL CHEMISTRY II LABORATORY (1 credit)

A laboratory study of quantitative analysis and solution equilibria. Includes statistics applied to quantitative analysis. (Fall, Spring, Summer)

Prerequisite(s): CHEM 1180 and 1184 with a grade of C- or better or department recommendation of advanced placement. Prereq or coreq: CHEM 1190 (if prereq must be with a grade of C- or better).

CHEM 2210 FUNDAMENTALS OF ORGANIC CHEMISTRY (4 credits)

Chemistry 2210 is a course on basic organic chemistry, a one-semester course designed primarily for students in biology, elementary science education, and allied health fields.

Prerequisite(s): CHEM 1140 and CHEM 1144, or CHEM 1190 and CHEM 1194 with a grade of C- or better in each. CHEM 2214 to be taken concurrently.

CHEM 2214 FUNDAMENTALS OF ORGANIC CHEMISTRY LABORATORY (1 credit)

Elementary organic chemistry laboratory to be taken concurrently with CHEM 2210. This course is for students in biology (non-premed tracks), elementary education and allied health majors.

Prerequisite(s): CHEM 1140 and CHEM 1144, or CHEM 1190 and CHEM 1194 with a grade of C- or better in each. CHEM 2210 to be taken concurrently.

CHEM 2250 ORGANIC CHEMISTRY I (3 credits)

The fundamental chemistry of carbon compounds. (Fall, Spring, Summer)

Prerequisite(s): CHEM 1190 and CHEM 1194 with a grade of C- or better. CHEM 1194 may be taken concurrently.

CHEM 2260 ORGANIC CHEMISTRY II (3 credits)

A continuation of the foundational study of the compounds of carbon. (Fall, Spring)

Prerequisite(s): CHEM 2250 with a grade of C- or better. Taking CHEM 2274 concurrently is recommended. Students are encouraged to take CHEM 2260 within 12 months of completing CHEM 2250.

CHEM 2274 ORGANIC CHEMISTRY LABORATORY (2 credits)

A laboratory course in the skills and techniques of experimentation in organic chemistry. (Fall, Spring, Summer)

Prerequisite(s): Minimum grades of C- or better in both CHEM 2250 and CHEM 1194. Students are encouraged to enroll in CHEM 2260 concurrently.

CHEM 2400 QUANTITATIVE ANALYSIS (3 credits)

Theory of quantitative analysis applied to gravimetric and volumetric analysis; theory of error and evaluation of analytical data; introduction to instrumental analysis and separation methods. (Fall)

Prerequisite(s): CHEM 1190 and CHEM 1194 with a grade of C- or better or equivalent. CHEM 2404 to be taken concurrently.

CHEM 2404 QUANTITATIVE ANALYSIS LAB (1 credit)

Laboratory application of principles of quantitative analysis and experience with sample preparations, titrations, and instrumental methods of analysis. Use of reaction chemistry, separations, and spectrophotometry in determinations. Introduction to quality control. (Fall)

Prerequisite(s): CHEM 1190 and CHEM 1194 with a grade of C- or better or equivalent. CHEM 2400 to be taken concurrently.

CHEM 2500 INTRODUCTION TO INORGANIC CHEMISTRY (3 credits)

A survey of the inorganic chemistry of metallic and nonmetallic species, including atomic, molecular and crystal structures, composition, properties and reactivities. (Spring)

Prerequisite(s): CHEM1190 with a grade of C- or better.

CHEM 2910 APPLIED TOPICS IN CHEMISTRY (1 credit)

More thorough examination of a chemistry topic than in the regular curriculum. Content (e.g., polymers, forensics, brewing and cooking, chemical industry, historical chemistry, art and chemistry, glassblowing) will vary with offering.

Prerequisite(s): Completion of 4 credit hours of university chemistry with grade(s) of C+ or better, or 8 credit hours of chemistry with grades of C or better.

CHEM 2930 APPLIED TOPICS IN CHEMISTRY (3 credits)

More thorough examination of a chemistry topic than in the regular curriculum. Content (e.g. polymers, forensics, brewing and cooking, chemical industry, historical chemistry, art and chemistry, glassblowing) will vary with offering.

Prerequisite(s): Completion 4 credit hours of university chemistry with grade(s) of C+ or better, or 8 CH of chemistry with grades of C or better.

CHEM 2950 INTRODUCTION TO RESEARCH IN CHEMISTRY (1 credit)

This course is intended to give students, possessing at least a high school background in chemistry, the opportunity to work with faculty and/or advanced students on an established research project. The creativity and communication expectations of these students will be less than for students enrolled in the 4000 level research courses. Guided laboratory/library work on an established research project.

Prerequisite(s): Permission of instructor. Not open to non-degree graduate students.

CHEM 3030 ENVIRONMENTAL CHEMISTRY (3 credits)

This course connects fundamental chemical principles to processes observed in the environment. The environmental processes studied may or may not be anthropogenic in nature and will include every environmental domain (air, water, soil/minerals/rocks) and interactions between domains.

Prerequisite(s): CHEM 1180 and CHEM 1184, CHEM 1190 and CHEM 1194, CHEM 2400 and CHEM 2404, or consent of the instructor

CHEM 3210 INTRODUCTION TO MOLECULAR MODELING (3 credits)

The course covers the advantages and limitations of current modeling systems, the criteria for choosing the appropriate modeling system to best solve a given problem and the computer resources needed to conduct the modeling experiments. Following an introduction to the theory behind a variety of modeling systems, students model organic and bioorganic compounds in projects designed to mimic real world applications. (Alternate Spring semesters). (Cross-listed with CHEM 8215).

Prerequisite(s): CHEM 2260 and CHEM 2274 with a grade of C- or better.

CHEM 3350 PHYSICAL CHEMISTRY I (3 credits)

A presentation of selected topics from the laws of thermodynamics, chemical and physical equilibria, phase diagrams, thermodynamics of solutions, electrochemistry and kinetics. (Fall) (Cross-listed with CHEM 8355).

Prerequisite(s): CHEM 2260, CHEM 2274, CHEM 2400, CHEM 2404, PHYS 1120 or PHYS 2120; MATH 1960. (Chemistry courses must be with a grade of C or better). Concurrent enrollment in CHEM 3354.

CHEM 3354 PHYSICAL CHEMISTRY I LABORATORY (1 credit)

Physical chemistry laboratory covering topics in thermodynamics, kinetics and electrochemistry, to be taken concurrently with CHEM 3350/8355.

Instruction and practice in scientific writing is also an emphasis of the course. Fulfills the third writing course requirement for students majoring in chemistry when NSCI 3940 and another approved laboratory course have been completed with a C- or better. Offered in Fall. (Cross-listed with CHEM 8359)

Prerequisite(s): CHEM 2404, CHEM 2274; Coreq: CHEM 3350.

Distribution: Writing in the Discipline Sequenced Course

CHEM 3360 PHYSICAL CHEMISTRY II (3 credits)

A presentation of selected topics from the areas of quantum mechanics, spectroscopy, kinetics and statistical mechanics. (Cross-listed with CHEM 8365).

Prerequisite(s): CHEM 3350 and CHEM 3354 with a grade of C- or better.

CHEM 3364 PHYSICAL CHEMISTRY II LABORATORY (1 credit)

Physical chemistry laboratory covering topics in quantum mechanics, computational chemistry, spectroscopy, and kinetics, to be taken concurrently with CHEM 3360. Fulfills the third writing course requirement for students majoring in chemistry when NSCI 3940 and another approved laboratory course have been completed with a C- or better. Offered in Spring. (Cross-listed with CHEM 8369).

Prerequisite(s): CHEM 3350 and 3354 with a grade of C- or better, to be taken concurrently with CHEM 3360.

Distribution: Writing in the Discipline Sequenced Course

CHEM 3424 SPECTROMETRIC CHARACTERIZATIONS (1 credit)

A laboratory course intended to further develop the ability to determine chemical structure from focused spectrometric data especially IR, MS, 1D and 2D (proton and carbon) NMR. Lab time focuses on the spectrochemical data collection and interpretation. (Cross-listed with CHEM 8425).

Prerequisite(s): CHEM 2260, CHEM 2274, CHEM 2400 and CHEM 2404 with a grade of C or better.

CHEM 3514 INORGANIC PREPARATIONS (1 credit)

Laboratory preparation and characterization of representative types of inorganic compounds by various standard and special techniques. (Spring)

Prerequisite(s): CHEM 2274, CHEM 2400, CHEM 2404, CHEM 2500 with a grade of C- or better.

CHEM 3610 PRINCIPLES OF BIOCHEMISTRY FOR THE HEALTH SCIENCES (3 credits)

This course covers the introduction of biochemistry, biomolecules, and metabolism. It is primarily intended for students entering allied health fields.

Prerequisite(s): CHEM 2210 or CHEM 2260 with a C- or better. Not open to non-degree graduate students.

CHEM 3650 FUNDAMENTALS OF BIOCHEMISTRY (3 credits)

A survey of biochemistry emphasizing: cell structure, energy, and water; amino acid and protein structure/function, enzymes, and protein isolation; carbohydrates and carbohydrate metabolism (glycolysis, glycogen metabolism); aerobic metabolism (citric acid cycle and oxidative phosphorylation); lipids, membranes, transport, cholesterol, and lipid metabolism; and nucleic acids. (Fall, Spring)

Prerequisite(s): CHEM 2210 and CHEM 2214 or CHEM 2260 and CHEM 2274 with a grade of C- or better. Other comparable courses taken at accredited colleges or universities are acceptable. CHEM 3654 must be taken concurrently.

CHEM 3654 FUNDAMENTALS OF BIOCHEMISTRY LABORATORY (1 credit)

A laboratory course to help integrate the concepts learned in the fundamentals of biochemistry lecture with the development of biochemical laboratory skills including data analysis. (Fall, Spring)

Prerequisite(s): CHEM 2210 and CHEM 2214 or CHEM 2260 and CHEM 2274 with a grade of C- or better. Other comparable courses taken at accredited colleges or universities are acceptable. CHEM 3650 must be taken concurrently.

CHEM 3710 ESSENTIALS OF MEDICINAL CHEMISTRY (3 credits)

This course is an introduction to human drug discovery, mechanism of action, metabolism, and drug-drug interaction, while demonstrating the interdisciplinary nature of medicinal chemistry. An emphasis is placed on drug design, drug structure, and the relationship of structure to drug action and metabolism. (Spring)

Prerequisite(s): ENGL 1160 and CHEM 2260/CHEM 2274 with a grade of C- or better.

CHEM 3720 CHEMISTRY TEACHING STRATEGIES (3 credits)

A course exploring the pedagogical problems that chemistry teachers face and potential solutions to these problems. The purpose of the course is two-fold. To help with the professional development of chemistry teachers within the context of how people learn. To help students interested in chemical education research develop educational research ideas within the context of how people learn.

Prerequisite(s): CHEM 2250 or CHEM 2400 or by instructor consent.

CHEM 4230 ADVANCED ORGANIC CHEMISTRY - SYNTHESIS (3 credits)

An advanced lecture course in modern theories and organic reactions with application to synthesis. (Alternate Fall semesters) (Cross-listed with CHEM 8236).

Prerequisite(s): CHEM 2260 with a grade of C- or better.

CHEM 4240 ADVANCED ORGANIC CHEMISTRY - MECHANISM (3 credits)

An advanced lecture course in organic chemical reactions. (Cross-listed with CHEM 8246).

Prerequisite(s): CHEM 2260 and CHEM 2400 with a C- or better

CHEM 4244 ADVANCED ORGANIC CHEMISTRY-MOLECULAR MODELING LABORATORY (1 credit)

The use of molecular modeling software as means to predict structure, relative stabilities and reaction thermodynamics are covered in a hands-on environment. The course will survey various modeling methods and show its relevance to organic reactions and mechanisms therein. Students will learn how to use commercial software to obtain/supplement experimental data in a manner suitable for peer-review publication. (Cross-listed with CHEM 8276).

Prerequisite(s): CHEM 2260 and CHEM 2400 with a C- or better

CHEM 4250 ADVANCED ORGANIC CHEMISTRY: MECHANISMS AND MODELING (4 credits)

Presentation of advanced topics in organic chemistry focused on structure, bonding and reaction mechanisms. The use of molecular modeling software as means to predict structure, relative stabilities and reaction thermodynamics are covered in a hands-on environment. The course will survey various modeling methods and show its relevance to molecular orbital theory. The basic methodologies used to explore organic mechanisms are presented and then used to study mechanistic details of various reaction types. Students cannot count both Chem 4250 and Chem 4240 toward their degree. (Cross-listed with CHEM 8256).

Prerequisite(s): CHEM 2260 and CHEM 2274 with a C- or better

CHEM 4310 POLYMER CHEMISTRY (3 credits)

An introduction to the chemical and physical properties of polymers. Emphasis will be on physical properties and structure/property relationships. Topics will include kinetics and synthesis. Students will gain an understanding of the characteristics of polymers and their applications.

Prerequisite(s): CHEM 2260 and CHEM 3350, each with a grade of C- or better, or instructor permission. Not open to non-degree graduate students.

CHEM 4320 NUCLEAR CHEMISTRY (3 credits)

An introduction to nuclear chemistry. Topics will include nuclear structure and changes, applications of nuclear radioactivity including radiometric dating, nuclear power, nuclear weapons, chemical properties of radioactive elements as well as applications in the chemical laboratory, industrial and medical applications.

Prerequisite(s): CHEM 3360 (or CHEM 2500, PHYS 1110 and MATH 1960 as a group). Any of the classes can be taken concurrently.

CHEM 4400 INSTRUMENTAL ANALYSIS (3 credits)

Study of instrumentation for use in chemical analysis and chemistry research. Advanced instrumental methods and data analysis techniques are included. (Cross-listed with CHEM 8406).

Prerequisite(s): CHEM 3350 and CHEM 3354 both with a C- or better; or CHEM 3360 and CHEM 3364 both with a C- or better; or instructor permission. Concurrent enrollment in CHEM 4404.

CHEM 4404 INSTRUMENTAL ANALYSIS LABORATORY (1 credit)

Use of instrumentation in quantitative and trace analysis. Advanced instrumental methods and electronics for instrumentation are included. (Spring) (Cross-listed with CHEM 8409).

Prerequisite(s): CHEM 3360, CHEM 3364, CHEM 3414 with a grade of C or better. Concurrent enrollment in CHEM 4400.

CHEM 4500 ADVANCED INORGANIC CHEMISTRY (3 credits)

The application of bonding models for understanding of the composition, structure, and reactions of inorganic molecules, including organometallic and bioinorganic complexes. (Cross-listed with CHEM 8506).

Prerequisite(s): CHEM 2500 and CHEM 3350 with a grade of C- or better. CHEM 3350 may be taken concurrently.

CHEM 4510 SOLID STATE INORGANIC CHEMISTRY (3 credits)

A study of the structural and electronic basis of materials properties in the solid state. Properties examined include electrical conductivity, ferromagnetism, ferroelectricity, and superconductivity. Some experimental work will be conducted.

Prerequisite(s): CHEM 2500 and CHEM 3350 with a grade of C- or better; or permission of instructor.

CHEM 4540 GEOCHEMISTRY (3 credits)

This course will cover the application of chemical principles to geologic systems. Specific topics covered will include the origin of elements and their distribution in the earth, geochronology, stable isotope systems, aqueous geochemistry and crystal chemistry. These topics will be integrated to the study of soils, igneous, metamorphic and sedimentary rocks and ore deposits. (Every third semester). (Cross-listed with GEOL 4540).

Prerequisite(s): GEOL 1170, MATH 1950, CHEM 1190 and GEOL 2750 or CHEM 2500 (chemistry courses must have a grade of C or better)

CHEM 4610 BIOCHEMISTRY OF METABOLISM (4 credits)

The course covers the structure-function relationships of proteins, carbohydrates, lipids and nucleotides, with an emphasis on the biochemistry of metabolism and molecules of metabolism. It is primarily intended to prepare students for health-related professional schools. (Spring)

Prerequisite(s): CHEM 2260 and CHEM 2274 with a grade of C- or better.

CHEM 4650 BIOCHEMISTRY I (3 credits)

A comprehensive introduction to biochemistry emphasizing: structure-function relationships for proteins, carbohydrates, lipids, and nucleic acids; protein purification; enzyme kinetics and mechanisms; membranes and membrane transport; carbohydrate metabolism including glycolysis, the citric acid cycle and oxidative phosphorylation; and important applications of thermodynamics and the properties of water to living systems. (Fall) (Cross-listed with BIOL 4650, BIOL 8656, CHEM 8656).

Prerequisite(s): CHEM 2260 and CHEM 2274; and either CHEM 2400 or BIOL 3020, all with a C- or better. Other comparable courses taken at accredited colleges or universities are acceptable. CHEM 4654 must be taken concurrently.

CHEM 4654 BIOCHEMISTRY I LABORATORY (1 credit)

A laboratory course to help integrate the concepts learned in biochemistry lecture with the development of biochemical laboratory skills including experimental design, data analysis, presentation of results and communication of scientific information, with a focus on formal instruction in journal-style writing and notebook skills. There is an emphasis on protein properties, including enzyme activity. Fulfills the third writing course requirement for students majoring in chemistry when NSCI 3940 and another approved laboratory course have been completed with a C- or better. (Fall) (Cross-listed with BIOL 4654, BIOL 8654, CHEM 8654).

Prerequisite(s): CHEM 2260 and CHEM 2274; and either CHEM 2400 or BIOL 3020, all with a C- or better. BIOL 4650 must be taken concurrently with BIOL 4654. CHEM 4650 must be taken concurrently with CHEM 4654.

Distribution: Writing in the Discipline Sequenced Course

CHEM 4660 BIOCHEMISTRY II (3 credits)

A continuation of the study of the structure and function of biomolecules and biochemical reactions with an emphasis on metabolism of carbohydrates, lipids, amino acids and nucleotides, and the chemistry of signal transduction and genetic information transfer. (Spring) (Cross-listed with BIOL 4660, BIOL 8666, CHEM 8666).

Prerequisite(s): CHEM 4650 and CHEM 4654 or BIOL 4650 and BIOL 4654. CHEM 4664 must be taken concurrently (Chemistry courses must have a grade of C- or better)

CHEM 4664 BIOCHEMISTRY II LABORATORY (1 credit)

A laboratory course to help integrate the concepts learned in Biochemistry II lecture with the development of biochemical laboratory skills, to gain practical experience in experimental design, data analysis, presentation of results and communication of scientific information, with a focus on formal instruction in journal-style writing and notebook skills. There is an emphasis on nucleic acid properties. Fulfills the third writing course requirement for students majoring in chemistry when NSCI 3940 and another approved laboratory course have been completed with a C- or better. (Spring) (Cross-listed with BIOL 4664, BIOL 8664, CHEM 8664).

Prerequisite(s): CHEM 4650 and CHEM 4654 or BIOL 4650 and BIOL 4654 with a C- or better. BIOL 4660 must be taken concurrently with BIOL 4664. CHEM 4660 must be taken concurrently with CHEM 4664.

Distribution: Writing in the Discipline Sequenced Course

CHEM 4670 PROTEIN PURIFICATION AND CHARACTERIZATION (2 credits)

This course is a study of protein biochemistry, protein purification techniques, and characterization strategies with an emphasis on chromatography and crystallography. The course has a significant laboratory component. (Cross-listed with CHEM 8676).

CHEM 4810 CHEMISTRY INTERNSHIP (1-6 credits)

Application of chemical skills in a non-academic laboratory or workplace through part-time employment or contracted work.

Prerequisite(s): CHEM 2260, CHEM 2274, CHEM 2400, CHEM 2404 with a grade of C- or better and permission of department chair.

CHEM 4930 SPECIAL TOPICS IN CHEMISTRY (1-3 credits)

Selected special topics in chemistry. (Cross-listed with CHEM 8936).

Prerequisite(s): CHEM 2260, CHEM 2400 with a grade of C or better. Some topics will require more advanced prerequisites and will be accepted for advanced course work in chemistry.

CHEM 4950 CHEMISTRY PROJECTS (1 credit)

Initiation of an independent student research project, and communication of the results.

Prerequisite(s): Depends on the project. Generally, junior standing.

CHEM 4960 CHEMISTRY PROBLEMS (1-3 credits)

Independent student research and communication of results. (Cross-listed with CHEM 8966).

Prerequisite(s): CHEM 4950 with a grade of C or better and permission of instructor.