

# CHEMISTRY (CHEM)

## CHEM 110 CAREERS IN SCIENCE1 Credit

Introduction for Physical Sciences majors to career options. Students will conduct independent research of selected firms or agencies. A required field trip to a major metropolitan area will provide knowledge of opportunities and challenges of the technical job market.

## CHEM 121 INTRODUCTORY CHEMISTRY3 Credits

Fundamental principles of chemistry focusing on the topics of matter and measurement, structure of atoms and use of the periodic table, chemical bonding and molecules, reaction stoichiometry, and energy.

**Requirements:** Required of students who have not taken high school chemistry who plan to enroll in CHEM 131 or CHEM 140.

## CHEM 131 COLLEGE CHEMISTRY I3 Credits

First of a two semester sequence of courses in General Chemistry for science majors. Detailed study of matter and measurement, structure of atoms molecules and ions, stoichiometric relationships, electronic structure of atoms, chemical periodicity, chemical bonding, thermochemistry, and properties of gases, liquids and solids.

**Prerequisites:** High school chemistry or CHEM 121 and high school algebra or MATH 142

**Co-requisites:** CHEM 131L

**Notes:** Enrollment in this course assumes competencies in math and chemistry equivalent to those accrued in high school algebra or MATH 142 and high school chemistry or CHEM 121.

## CHEM 131L COLLEGE CHEMISTRY I LABORATORY1 Credit

Laboratory experience in basic chemical concepts, including concentrations, reaction mechanisms, stoichiometric relationships, molecular structure, properties of gases, liquids, and solids, and spectroscopy.

**Co-requisites:** CHEM 131

## CHEM 132 COLLEGE CHEMISTRY II3 Credits

Second of a two semester sequence of courses in General Chemistry for science majors, with a focus on the topics of solution chemistry, chemical kinetics, principles and applications of equilibrium, chemical thermodynamics and electrochemistry.

**Prerequisites:** CHEM 131 and CHEM 131L

**Co-requisites:** CHEM 132L

## CHEM 132L COLLEGE CHEMISTRY II LABORATORY1 Credit

Laboratory experience focusing on studies of principles and applications of chemical kinetics, equilibrium, acid-base chemistry, thermodynamics and electrochemistry.

**Co-requisites:** CHEM 132

## CHEM 140 SURVEY OF CHEMISTRY3 Credits

Survey of chemistry principles and applications for science majors requiring a one semester freshman chemistry course. Topics covered include: matter and measurement, atoms ions and molecules, periodicity, chemical bonding, reaction stoichiometry, energy, phases of matter, solution chemistry, chemical kinetics, equilibrium, and electrochemistry.

**Prerequisites:** High school chemistry or CHEM 121 and high school algebra or MATH 142

**Co-requisites:** CHEM 140L

**Notes:** Does not duplicate CHEM 131 and is not a prerequisite for CHEM 132.

## CHEM 140L SURVEY OF CHEMISTRY LABORATORY1 Credit

Laboratory experiences in basic chemical processes and mechanisms. Basic chemistry laboratory operations.

**Co-requisites:** CHEM 140

## CHEM 200 INDEPENDENT STUDY OR RESEARCH1-3 Credits

Study or research in an area of special interest.

**Add Consent:** Department Consent

**Notes:** The number of credit hours is determined by the topic and the amount of work required.

**Requirements:** Approval of instructor, School Dean, and Academic Vice President.

## CHEM 231 SURVEY OF ORGANIC CHEMISTRY3 Credits

Survey of organic chemistry principles and applications for students requiring one semester of Organic Chemistry. The nomenclature, structure, physical and chemical properties and reactions of the principle families of organic compounds are covered. Carbohydrates, lipids, enzymes, amino acids and protein synthesis are also covered at an introductory level.

**Prerequisites:** CHEM 132 and CHEM 132L or CHEM 140 and CHEM 140L

**Co-requisites:** CHEM 231L

## CHEM 231L SURVEY OF ORGANIC CHEMISTRY LABORATORY1 Credit

Principle laboratory operations of organic chemistry, organic synthesis, and spectroscopy.

**Co-requisites:** CHEM 231

## CHEM 270 TOPICS (LD)1-3 Credits

Special topics in chemistry appropriate for lower division credit.

**Add Consent:** Instructor Consent

**Notes:** May be repeated with different emphases for up to six hours credit.

## CHEM 310 CAPSTONE I: RESEARCH SEMINAR1 Credit

The student will choose a topic for research and conduct a literature survey of that topic. Preliminary results and a plan for conducting further independent research on the topic will be presented in oral and written form during the semester.

**Prerequisites:** CHEM 132, 132L, and sophomore or above status

**Notes:** Normally taken during the student's Junior year.

## CHEM 313 QUANTITATIVE, ORGANIC, AND BIOLOGICAL CHEMISTRY FOR EDUCATORS3 Credits

This course will examine basic principles in quantitative, organic, and biochemistry with the aim of learning how to teach these subjects in a high school classroom. Lesson planning, activity development, scientific literacy, critical thinking skills, and active learning will be incorporated in the class.

**Prerequisites:** CHEM 131, 131L and CHEM 132, 132L

**Co-requisites:** CHEM 313L

## CHEM 313L QUANTITATIVE, ORGANIC, AND BIOLOGICAL CHEMISTRY FOR EDUCATORS LABORATORY1 Credit

The lab will be a mixture of inquiry-based lessons and direct instruction labs. Students will receive hands-on experience that guide them through concepts taught in lecture. Inquire-based learning labs will allow students to develop their own experiments that are safe to teach in a high school classroom.

**Prerequisites:** CHEM 131, 131L and 132, 132L

**Co-requisites:** CHEM 313

## CHEM 320 SUPERVISED STUDY IN LAB AND FIELD METHODS1-2 Credits

Students will prepare, supervise, and evaluate laboratory exercises under the direction of faculty members. Designed to give students practical experience teaching in the laboratory setting.

**Cross-Listed:** BIOL/CHEM/GEOS/PHYS320

**Prerequisites:** Sophomore or above status

**CHEM 333 ORGANIC CHEMISTRY I3 Credits**

An introduction to the structure, nomenclature, stereochemistry, properties, synthesis, and reactions of aliphatic and aromatic carbon compounds.

**Prerequisites:** CHEM 132, CHEM 132L, and Sophomore or above status

**Co-requisites:** CHEM 333L

**CHEM 333L ORGANIC CHEMISTRY I LABORATORY1 Credit**

Principle laboratory operations of organic chemistry, organic synthesis, and spectroscopy.

**Co-requisites:** CHEM 333

**CHEM 334 ORGANIC CHEMISTRY II3 Credits**

A continuation of Organic Chemistry I. Topics will include a systematic study of organic reactions by functional group, reaction mechanisms, and organic synthetic methods.

**Prerequisites:** CHEM 333, 333L and sophomore or above status

**Co-requisites:** CHEM 334L

**CHEM 334L ORGANIC CHEMISTRY II LABORATORY1 Credit**

An introduction to laboratory techniques and procedures of synthetic organic chemistry including analysis of organic compounds by infrared spectroscopy, mass spectrometry, and nuclear magnetic resonance spectroscopy.

**Prerequisites:** CHEM 333, 333L and sophomore or above status

**Co-requisites:** CHEM 334

**CHEM 335 BIOCHEMISTRY I3 Credits**

Introductory course covering the components and reactions of living matter. Topics include structure and function of major macromolecules including carbohydrates, lipids, proteins, and nucleic acids. The basics of enzyme functions and regulation will be studied. A brief introduction to metabolic pathways will be included.

**Prerequisites:** CHEM 231 and CHEM 231L or CHEM 333 and CHEM 333L and Sophomore or above status

**Notes:** Concurrent enrollment in CHEM 335L is recommended.

**CHEM 335L BIOCHEMISTRY LABORATORY1 Credit**

Laboratory experience in purification, quantitation, and characterization of biological molecules.

**Prerequisites:** CHEM 335

**Co-requisites:** CHEM 335 (can be taken as either a pre-requisite or a co-requisite)

**CHEM 336 BIOCHEMISTRY II3 Credits**

Fundamental concepts of the chemistry of proteins, carbohydrates, lipids, and nucleic acids with emphasis on metabolic pathways of these compounds. The interrelationship of these compounds in living systems will be presented through bioenergetics, reaction pathways, regulatory pathways, and chemical mechanisms.

**Prerequisites:** CHEM 335 and Sophomore or above status

**CHEM 341 QUANTITATIVE ANALYSIS3 Credits**

Detailed study of classical analytical chemistry with topics to include; measurement and uncertainty, statistical analysis of data, basics of chemical equilibrium, activity and systematic treatment of complex equilibrium systems, acid-base equilibrium and buffers, EDTA titrations, gravimetric analysis, combustion analysis, and spectrophotometry.

**Prerequisites:** CHEM 132 and CHEM 132L and Sophomore or above status

**Co-requisites:** CHEM 341L

**CHEM 341L QUANTITATIVE ANALYSIS LABORATORY1 Credit**

Laboratory experience designed to improve laboratory skills in the qualitative analysis of matter using gravimetric and volumetric techniques.

**Prerequisites:** Sophomore or above status

**Co-requisites:** CHEM 341

**CHEM 342 INSTRUMENTAL ANALYSIS3 Credits**

Examination of the function and use of chemical instrumentation to analyze samples with emphasis on the use of spectrophotometers (UV/vis, IR, AA, mass spec), chromatographs (HPLC, GC), electrodes and potentiometry, and electrophoretic systems.

**Prerequisites:** CHEM 132, 132L or consent of instructor

**Co-requisites:** CHEM 342L

**CHEM 342L INSTRUMENTAL ANALYSIS LABORATORY1 Credit**

Laboratory experience involving the set-up and use of quantitative instrumentation in support of the topics covered in the lecture section of the course (spectrophotometry, chromatography, pH and Ion Specific electrodes, and electrophoresis).

**Prerequisites:** Sophomore or above status

**Co-requisites:** CHEM 342

**CHEM 390 INTERNSHIP IN CHEMISTRY1-12 Credits**

Provides practical experience as a chemist in government, business or industry. Open to upper division students majoring in the area of chemistry.

**Add Consent:** Department Consent

**Notes:** Interested students should contact the Internship and Career Services office to secure application materials; application should be made prior to the semester the internship will be started; the amount of credit will be based on the availability of a suitable work position, the qualifications of the applicant, and the work hours.

**CHEM 400 INDEPENDENT STUDY OR RESEARCH1-3 Credits**

Study or research in an area of special interest.

**Add Consent:** Instructor Consent

**Notes:** The number of credit hours is determined by the topic and the amount of work required.

**Requirements:** Approval of instructor, Dean of Curriculum and Academic Advancement, and Academic Vice President is required.

**CHEM 401 CAPSTONE II: SENIOR RESEARCH1 Credit**

Independent research projects based on the results presented in CHEM 310. Data collection, analysis, and presentation of scientific papers.

**Prerequisites:** CHEM 310 and Junior or above status

**Notes:** May be repeated for a total of up to six hours of credit.

**CHEM 410 CAPSTONE III: SENIOR RESEARCH/THESIS1 Credit**

Research thesis is completed and presented at the Nebraska Academy of Sciences or other regional or national scientific forum approved by the faculty. Required field trip in late April.

**Prerequisites:** CHEM 401 and Junior or above status

**CHEM 417 TOPICS IN CHEMISTRY1-3 Credits**

Designed to meet the needs of students in a special area of interest. May be repeated for up to 6 hours.

**Add Consent:** Instructor Consent

**CHEM 430 INORGANIC CHEMISTRY3 Credits**

Advanced principles of inorganic chemistry. Structure, bonding, properties, and reactions of inorganic compounds with emphasis on the relationships and trends that are embodied in the periodic table of the elements.

**Prerequisites:** CHEM 132, CHEM 132L, and Junior or above status

**CHEM 433 ENVIRONMENTAL CHEMISTRY3 Credits**

Study of the chemical processes that influence the environment, including processes which affect the quality and use of land, water, and atmosphere, as well as influence of anthropogenic effects on them.

Focuses on topics of current concern.

**Prerequisites:** CHEM 132 and CHEM 132L or CHEM 140 and CHEM 140L

**CHEM 433L ENVIRONMENTAL CHEMISTRY LABORATORY1 Credit**

Laboratory experience in environmental chemical analysis of environmental samples.

**Prerequisites:** CHEM 433 (can be taken as either a pre-requisite or a co-requisite)

**CHEM 444 PHYSICAL CHEMISTRY3 Credits**

Statistical principles, kinetics, thermodynamics, and advanced equilibria and solution dynamics for chemical systems.

**Prerequisites:** CHEM 132 and CHEM 132L

**CHEM 444L PHYSICAL CHEMISTRY LABORATORY1 Credit**

Laboratory experience in thermodynamics and kinetics.

**Co-requisites:** CHEM 444

**CHEM 464 PHYSICAL CHEMISTRY II3 Credits**

Fundamental principles of kinetics, and quantum mechanics as related to chemical concepts.

**Prerequisites:** CHEM 444 and CHEM 444L