

DEPARTMENT OF CHEMISTRY

Department Objectives

- To prepare students to work as professional chemists;
- To prepare teachers in subject matter and in methods for the teaching of chemistry and related subjects;
- To give a background in chemistry for students in biology, physics, family and consumer sciences, earth science, and physical education;
- To furnish pre-professional work for those preparing for professional work in medicine, dentistry, nursing, engineering, medical technology and other allied health areas;
- To prepare students for graduate work in chemistry.

Chemistry Major

Four options are available in this major:

1. Professional Chemist's Comprehensive (<http://catalog.unk.edu/catalog-archive/2019-2020/undergraduate/departments-programs/chemistry/professional-chemists-comprehensive-bs>) - Bachelor of Science Degree
2. Chemistry (<http://catalog.unk.edu/catalog-archive/2019-2020/undergraduate/departments-programs/chemistry/chemistry-ba>) - Bachelor of Arts Degree
3. Chemistry Comprehensive (<http://catalog.unk.edu/catalog-archive/2019-2020/undergraduate/departments-programs/chemistry/chemistry-comprehensive-bs>) - Bachelor of Science Degree
 - Biochemistry Emphasis (<http://catalog.unk.edu/catalog-archive/2019-2020/undergraduate/departments-programs/chemistry/chemistry-comprehensive-bs/#bio>)
 - Business/Sales Emphasis (<http://catalog.unk.edu/catalog-archive/2019-2020/undergraduate/departments-programs/chemistry/chemistry-comprehensive-bs/#bus>)
 - Health Sciences Emphasis (<http://catalog.unk.edu/catalog-archive/2019-2020/undergraduate/departments-programs/chemistry/chemistry-comprehensive-bs/#hea>)
4. Chemistry 7-12 Teaching Subject Endorsement (<http://catalog.unk.edu/catalog-archive/2019-2020/undergraduate/departments-programs/chemistry/chemistry-7-12-teaching-subject-endorsement-bse>) - Bachelor of Science in Education Degree

The minors in Chemistry (<http://catalog.unk.edu/catalog-archive/2019-2020/undergraduate/departments-programs/chemistry/chemistry-minor>) and Environmental Science (<http://catalog.unk.edu/catalog-archive/2019-2020/undergraduate/departments-programs/chemistry/environmental-science-minor>) are available for students pursuing majors in other disciplines.

Scott Darveau (<http://aaunk.unk.edu/catalogs/current/fac/facultyd.asp#darveausc>), **Chair**

Professor: Haishi Cao, Scott Darveau, Christopher Exstrom, Frank Kovacs, Annette Moser

Associate Professor: Kristy Kounovsky-Shafer, Hector Palencia, Mahesh Pattabiraman, Allen Thomas

Assistant Professor: Michael Moxley

Senior Lecturer: Carla Kegley-Owen

Chemistry (CHEM)

CHEM 101 – Chemistry & Current Events 4 credit hours

This course offers an exploration of chemistry from the non-majors point of view with an emphasis on concepts and critical thinking and is designed for online-only students. It offers a fully hands-on laboratory experience using specialized kits at home with online lectures and discussion. This course may not be used toward requirements for a degree in chemistry.

CHEM 145 – Introductory Chemistry 4 credit hours

Introductory course in the fundamental laws and principles of chemistry including a study of the properties of elements and their compounds. Three lectures, one laboratory each week. Credit for this course may be obtained by examination.

Additional Course Fee Required

CHEM 150 – Introduction to Organic and Biochemistry 4 credit hours

An introduction to fundamental concepts of chemistry with special attention to organic and biological chemistry. Applications of chemistry concepts in materials, energy use, nutrition, health, drugs, and toxic substances are emphasized. Not applicable to a major or minor in chemistry. Three lectures, one lab per week.

Additional Course Fee Required

CHEM 160 – General Chemistry 3 credit hours

The first semester of a comprehensive year course in chemistry that includes the principles and theories of modern chemistry. This course is designed for students who need a sound introduction to the discipline of chemistry, and it is the prerequisite for advanced chemistry courses. A student should have high school chemistry and/or two years of high school algebra before enrolling in this course. If this is not the case, take CHEM 145 and/or MATH 102 to prepare for chemistry at this level. Three lectures each week. Credit for this course may be obtained by examination.

Prerequisite: MATH 102 or Math ACT score of 22 or above or permission of instructor.

Corequisite: CHEM 160L.

CHEM 160L – General Chemistry Laboratory 1 credit hour

Take concurrently with CHEM 160.

Corequisite: CHEM 160.

Additional Course Fee Required

CHEM 161 – General Chemistry 3 credit hours

Second semester of the comprehensive year course in chemistry. Three lectures each week.

Prerequisite: Grade of C or above in CHEM 160 and CHEM 160L or advanced placement.

Corequisite: CHEM 161L.

CHEM 161L – General Chemistry Laboratory 1 credit hour

Take concurrently with CHEM 161.

Corequisite: CHEM 161.

Additional Course Fee Required

CHEM 188 – GS Portal 3 credit hours

Students analyze critical issues confronting individuals and society in a global context as they pertain to the discipline in which the Portal course is taught. The Portal is intended to help students succeed in their university education by being mentored in process of thinking critically about important ideas and articulating their own conclusions. Students may take the Portal in any discipline, irrespective of their major or minor. Satisfies the General Studies Portal course requirement. Students may take their Portal course in any discipline. Students who transfer 24 or more hours of General Studies credit to UNK are exempt from taking a portal course.

Total Credits Allowed: 6.00

Prerequisite: First year freshman standing or sophomore standing only.

CHEM 250 – Elementary Organic Chemistry 4 credit hours

A survey of the field of organic chemistry designed primarily for students who do not expect to become chemists or chemical engineers. Covers the same topics as CHEM 360 and CHEM 361, but less rigorously. Four lectures, one lab per week. Counts toward chemistry minor.

Prerequisite: Grade of C or above in CHEM 161 and CHEM 161L or CHEM 180 and CHEM 180L or equivalent.

Corequisite: CHEM 250L.

CHEM 250L – Elementary Organic Chemistry Lab 1 credit hour

Corequisite: CHEM 250.

Additional Course Fee Required

CHEM 269 – Sophomore Seminar in Chemistry 1 credit hour

The first of three seminars for Chemistry majors. Includes an introduction to chemical safety and hygiene, research opportunities in the dept, possible careers in Chemistry, and an introduction to scientific literature resources. One hour per week.

Prerequisite: CHEM 161 and CHEM 161L OR CHEM 180 and CHEM 180L.

CHEM 280H – Special Topics 3 credit hours

A General Studies course for Honors students. Interdisciplinary course that examines the connections between disciplines.

CHEM 300 – Environmental Chemistry 3 credit hours

A study of the fate of chemicals in the air, water, and soil, and their impact on human health and the natural environment. Topics will include water pollution and water treatment, greenhouse gases and ozone-layer destruction, sources and management of hazardous wastes, and environmental toxicology of specific industrial and agricultural chemicals.

Total Credits Allowed: 4.00

Prerequisite: Grade of C or above in CHEM 161 and CHEM 161L

CHEM 301 – Analytical Chemistry 3 credit hours

Take concurrently with CHEM 301L. This will provide a short, engaging elementary introduction to modern analytical chemistry for students whose primary interests lie inside or outside of chemistry. The laboratory experiments in the accompanying laboratory (CHEM 301L) are designed to give students hands-on experience in the use of modern instruments, with emphasis on environmental and pharmaceutical samples. Three lectures per week.

Prerequisite: CHEM 161 and CHEM 161L OR CHEM 180 and CHEM 180L or equivalent.

Corequisite: CHEM 301L.

CHEM 301L – Analytical Chemistry Lab 1 credit hour

Corequisite: CHEM 301.

Additional Course Fee Required

CHEM 351 – Biochemistry 3 credit hours

A study of the structure and function of the fundamental biomolecules including proteins, nucleic acids, carbohydrates, lipids and vitamins. The course concludes with the chemistry and regulation of the metabolic pathways glycolysis, the citric acid cycle and oxidative phosphorylation. Three lectures per week; must be taken concurrently with CHEM 351L.

Prerequisite: Grade of C in CHEM 250 and CHEM 250L OR CHEM 360 and CHEM 360L.

Corequisite: CHEM 351L.

CHEM 351L – Biochemistry Lab 1 credit hour

Corequisite: CHEM 351.

Additional Course Fee Required

CHEM 352 – Biochemistry II 3 credit hours

This course is a continuation of CHEM 351 and begins with discussion of additional topics in metabolism such as carbohydrate biosynthesis in plants and bacteria as well as hormonal regulation of metabolism. Our discussion then turns to the biochemistry of biological information pathways. Three lectures per week.

Prerequisite: Grade of C or above in CHEM 351 and CHEM 351L

Corequisite: CHEM 352L.

CHEM 352L – Biochemistry II Lab 1 credit hour

Corequisite: CHEM 352.

Additional Course Fee Required

CHEM 360 – Organic Chemistry 4 credit hours

Taken primarily by chemistry majors and pre-professional students.

The foundation for understanding organic reactions is established with considerable emphasis being placed upon bonding, stereochemistry, kinetics, and reaction mechanisms. The chemistry of the alkanes, alkenes, and aromatic compounds is considered with a primary objective of understanding how these reactions occur. Four lectures per week.

Prerequisite: Grade of C or above in CHEM 161 and CHEM 161L or equivalent.

Corequisite: CHEM 360L.

CHEM 360L – Organic Chemistry Laboratory 1 credit hour

Take concurrently with CHEM 360.

Corequisite: CHEM 360.

Additional Course Fee Required

CHEM 361 – Organic Chemistry 4 credit hours

A continuation of CHEM 360. Four lectures per week.

Prerequisite: Grade of C or above in CHEM 360 and CHEM 360L.

Corequisite: CHEM 361L.

CHEM 361L – Organic Chemistry Laboratory 1 credit hour

Take concurrently with CHEM 361.

Corequisite: CHEM 361.

Additional Course Fee Required

CHEM 369 – Junior Seminar in Chemistry 1 credit hour

Second of three seminars for Chemistry majors including an introduction to analysis of scientific journals using both written and oral formats, and discussion of research and scientific ethics. One hour per week.

Prerequisite: Completion of or concurrent enrollment in CHEM 269.

CHEM 388 – GS Capstone 3 credit hours

An interdisciplinary experience where students apply the knowledge, cognitive abilities, and communication skills they have gained from General Studies in designing and completing an original project or paper. Students employ methods and interpretive means of two or more disciplines to integrate knowledge and synthesize their results. Satisfies the General Studies capstone course requirement. Students may take their Capstone course in any discipline.

Prerequisite: Junior or senior level standing or within 6 hours of completing general studies requirements.

CHEM 388L – GS Capstone Lab 1 credit hour

Corequisite: CHEM 388.

CHEM 399 – Chemistry Apprenticeship 1-4 credit hours

The chemistry apprenticeship program is meant to provide meaningful experiences such as teaching and preparation of demonstrations. The apprentice will work mainly with one member of the department whose permission must be obtained before registration.

Total Credits Allowed: 4.00

CHEM 430 – Inorganic Chemistry 3 credit hours

A study of the underlying principles behind the structural and spectroscopic properties of inorganic compounds. Lecture topics include symmetry, molecular orbital theory, solid-state structures, transition metal chemistry, and organometallics. The laboratory will focus on preparation and characterization methods for inorganic compounds. Three lectures per week.

Prerequisite: Grade of C or above in CHEM 161 and CHEM 161L or CHEM 180 and CHEM 180L and MATH 202 and either PHYS 205 and PHYS 205L or PHYS 275 and PHYS 275L.

Corequisite: CHEM 430L.

CHEM 435 – Special Topics in Chemistry 1-3 credit hours

Topics are studied which are not covered in other courses offered by the department. The format will vary depending upon the nature of the topic and the instructor but will typically be a seminar/discussion format with lab work included as appropriate.

Department Consent Required

Total Credits Allowed: 3.00

CHEM 440 – Materials Chemistry 3 credit hours

A study of solid-state compounds and the relationships between overall physical properties and atomic-or molecular-level structure. Topics may include crystalline and amorphous solid structures, metals, semiconductors, polymers, nanomaterials, and characterization techniques.

Prerequisite: CHEM 430 and CHEM 480 or permission of instructor.

CHEM 451 – Advanced Biochemistry 3 credit hours

This course covers the basic principles of intermediary metabolism and the application of biochemical principles of living systems. Three lectures per week.

Prerequisite: CHEM 352 and CHEM 352L.

CHEM 461 – Qualitative Organic Analysis 3 credit hours

A study of classical and spectroscopic techniques used in the identifications of organic compounds including the application of NMR, FTIR, UV/Vis, and mass spectroscopy. Three lectures per week.

Prerequisite: Grade of C or above in CHEM 361 and CHEM 361L.

CHEM 469 – Senior Seminar in Chemistry 1 credit hour

The third of three seminars in chemistry including a critical examination and discussion of recent accomplishments of chemical investigations, career preparation with respect to resumes, interviewing techniques, and professional exam preparation. One hour per week.

Prerequisite: CHEM 480 and CHEM 480L and CHEM 369.

CHEM 470 – Advanced Organic Chemistry 3 credit hours

This course will cover advanced theoretical aspects of organic chemistry. Areas of emphasis will be bonding, spectroscopy, synthesis, and mechanism. Three lectures per week.

Prerequisite: CHEM 361 and CHEM 361L.

CHEM 475 – Instrumental Analysis 3 credit hours

Take concurrently with CHEM 475L. The study of modern methods of analysis using chemical instrumentation. Three lectures per week.

Prerequisite: CHEM 301 and CHEM 301L and CHEM 480 and CHEM 480L or permission of instructor.

Corequisite: CHEM 475L.

CHEM 480 – Physical Chemistry 3 credit hours

The first semester of a two semester sequence covering the physical basis of chemistry including topics of quantum mechanics, spectroscopy, elementary thermodynamics, phase transitions, solutions, and kinetics.

Three lectures per week.

Prerequisite: PHYS 205 or PHYS 275 and grade of C or above in CHEM 301 and MATH 115.

CHEM 481 – Physical Chemistry II 3 credit hours

The second semester of a two semester sequence covering the physical basis of chemistry including topics of quantum mechanics, spectroscopy, elementary thermodynamics, phase transitions, solutions, and kinetics.

Three lectures per week.

Prerequisite: Grade of C or above in CHEM 480.

CHEM 482 – Physical Chemistry for the Life Sciences 3 credit hours

A single semester survey of physical chemistry with a Biochemistry emphasis. Topics include thermodynamics, kinetics, and structure, spectroscopy of biochemical systems. Three lectures per week.

Prerequisite: PHYS 205 or PHYS 275 and grade of C or above in CHEM 301 and MATH 115.

CHEM 489 – Internship in Chemistry 1-15 credit hours

This course will be taken in the last two years of the chemistry major and will emphasize professional development of the individual student.

Department Consent Required

Total Credits Allowed: 15.00

CHEM 490L – Advanced Chemistry Laboratory I 2 credit hours

The first semester of a full year interdisciplinary chemistry lab covering techniques from inorganic, physical, instrumental, advanced organic, and materials chemistry focusing on larger projects including synthesis of many types of materials, measurement of physical properties, and understanding and application of modern instrumentation and spectroscopic methods.

Prerequisite: Completion of or current enrollment in CHEM 430 or CHEM 480 or CHEM 475.

Additional Course Fee Required

CHEM 491L – Advanced Chemistry Laboratory II 2 credit hours

The second semester of a full year interdisciplinary chemistry lab covering techniques from inorganic, physical, instrumental, advanced organic, and materials chemistry focusing on larger projects including synthesis of many types of materials, measurement of physical properties, and understanding and application of modern instrumentation and spectroscopic methods.

Prerequisite: CHEM 490L

Additional Course Fee Required

CHEM 499L – Problems in Chemistry 1-3 credit hours

Independent investigations of chemistry problems. Three hours of laboratory work each week for each hour credit.

Department Consent Required

Total Credits Allowed: 6.00