Department of Chemistry

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Students who complete the major in chemistry will graduate with a Bachelor of Science degree. The program in chemistry is approved by the Committee on Professional Training of the American Chemical Society. Students who complete the approved major will have their degree certified by the American Chemical Society.

All chemistry majors complete the general chemistry sequence and a common forty-hour sequence of major courses. These courses, plus the prerequisite hours in physics and mathematics, provide each student with a solid background in analytical, inorganic, organic, physical, and biochemistry.

Each student is required to select 6 hours of advanced chemistry courses as part of the major. The selection, made with the assistance of a departmental advisor, will be made with the postgraduate needs of the student in mind. Students who wish to pursue graduate study in chemistry should select all chemistry courses, while those who wish to accept positions in industrial or government laboratories may wish to select some chemistry and some biology courses to complete the major. Those who plan to attend professional school (medicine, dentistry, veterinary medicine, law, or business) will select courses to satisfy entry requirements in the particular program of interest.

The chemistry major is designed for students to develop the critical thinking skills needed for problem solving. Students will be able to state a problem succinctly, outline methods of solving the problem, and proceed to solve the problem after choosing a suitable method. Mastery of problem solving techniques is especially apparent in students who participate in an undergraduate research project. Although the research problems chosen for solution by students are taken from the chemical sciences, the methods developed for problem solving are applicable to other fields.

The core curriculum provides opportunity for every student in the University to obtain the skills necessary for effective written and oral communication. The department requires chemistry majors to demonstrate mastery of those skills by preparing and presenting papers in advanced chemistry courses. Each senior must present a departmental seminar on a topic which is generally not covered in courses in the department. Successful completion of the departmental seminar will demonstrate that the student is able to search the literature on an unfamiliar topic, prepare a pertinent outline and abstract of the topic, present the material in a clear oral presentation, and answer questions on the topic from both faculty and student colleagues. Majors may satisfy the requirement for the senior seminar by completing CHEM 4210.

Selected Educational Outcomes

The major in chemistry is designed to prepare graduates to enter professional school, to attend graduate school, or to join the work force in a government, industrial, or commercial setting. Among the anticipated educational outcomes of the department are that each graduate will:

1. understand, speak, and write in the language used by professional chemists;
2. demonstrate proficiency in problem solving and experimental design and show proficiency in laboratory procedure and the skills of measurement, analysis, data treatment, and interpretation;
3. demonstrate an understanding of professional ethics in terms of data collection, evaluation, and reporting and an understanding of environmental issues concerning handling and disposal of chemicals and chemical wastes; and understand the importance of chemistry in its impact on society;
4. demonstrate proficiency in the principles and theories that govern chemistry and appreciate the fact that chemistry is a changing discipline which requires a commitment to life-long learning.

Examples of Outcome Assessments

In order to follow the success with which the educational outcomes are fulfilled, the chemistry department has developed a number of assessment techniques, both formal and informal. The formal assessment techniques include the following:

1. The department will maintain a portfolio of each chemistry major that will contain the following materials:
   a. results of discipline-related American Chemical Society Examinations.
   b. samples of written assignments (papers and laboratory reports) from upper division classes.
   c. faculty evaluation of the student's senior seminar and abstract.
2. Each student will present a seminar on a subject related to chemistry in the senior year. The student will gather and organize the necessary information, develop appropriate visual media, and write an abstract of the talk.
3. A formal alumni interview will be used to evaluate the program.

- Bachelor of Science with a Major in Chemistry (http://catalog.valdosta.edu/archive/2015-2016/undergraduate/academic-programs/arts-sciences/chemistry/bs-chemistry)
- Minor in Chemistry (http://catalog.valdosta.edu/archive/2015-2016/undergraduate/academic-programs/arts-sciences/chemistry/minor-chemistry)

CHEM 1010. Introductory Chemistry for Environmental Studies. 4 Hours.
A chemistry course with a focus on real-world societal issues. Students will develop critical thinking skills and an appreciation for the theoretical and practical aspects of chemistry while learning the fundamentals of chemistry. Chemical knowledge will be developed on a need-to-know basis in decision making activities. The course is designed for non-science majors seeking a laboratory science course.

CHEM 1110K. Introduction to General, Organic, and Biological Chemistry. 4 Hours.
An introduction to the fundamental principles of chemistry, emphasizing modern atomic theory, the structure and behavior of atoms, the properties and states of matter, energy relations, periodicity, mole concepts, and the preparation and reactions of organic compounds in light of modern theories of molecular structure. Study will also include the chemistry of living systems, structure of biological molecules, metabolism, and molecular genetics. Laboratory experiments supplement the study of the listed topics.

CHEM 1151K. Survey of Chemistry I. 4 Hours.
A study of the fundamental principles of chemistry emphasizing modern atomic theory, the structure and behavior of atoms, the properties and states of matter, energy relations, periodicity and mole concepts. Laboratory experiments supplement the study of the listed topics.

CHEM 1152K. Survey of Chemistry II. 4 Hours.
Prerequisite: CHEM 1151K with a grade of “C” or better. A study of the properties, preparation, and reactions of organic compounds in light of modern theories of molecular structure. An overview of the chemistry of living systems including the structure of biological molecules, metabolism, and molecular genetics. Laboratory experiments supplement the study of the listed topics.

CHEM 1200. Pre General Chemistry. 3 Hours.
A one-semester introductory and preparatory course for CHEM 1211. This course covers basic concepts in general chemistry with concentration on problem solving and a focus on mathematical operations, nomenclature, measurements, classification of matter, and stoichiometry, atomic structure, and other basic principles. This course is for students who want to take CHEM 1211 Principles of Chemistry I but have not taken high school chemistry or the prerequisite for CHEM 1211.

CHEM 1210. First Year Seminar. 1 Hour.
An introduction to the college-level study of chemistry. Topics include an introduction to the chemistry department, the American Chemical Society, program of study and career planning, computer skills, library skills, chemical safety, and resources to support strategies for success at the undergraduate level and beyond.

CHEM 1211. Principles of Chemistry I. 3 Hours.
Prerequisite: A mathematics SAT score of 540 or higher, a mathematics ACT score of 23 or higher, a passing score on the Chemistry Department placement exam, or CHEM 1200 with a grade of “C” or higher. Prerequisite or corequisite: MATH 1111, MATH 1112, or MATH 1113. Corequisite: CHEM 1211L. An introduction to a quantitative study of the physical and chemical behavior of matter in its several phases and a consideration of modern theories of bonding forces at the molecular level. Atomic and molecular structure, chemical nomenclature,stoichiometry, thermochemistry, the gaseous state, and properties of solutions are discussed.

CHEM 1211H. Honors Principles of Chemistry I. 3 Hours.
Prerequisite: A mathematics SAT score of 540 or higher, a mathematics ACT score of 23 or higher, a passing score on the Chemistry Department placement exam, or CHEM 1200 with a grade of “C” or higher. Prerequisite or corequisite: MATH 1111, MATH 1112, or MATH 1113. Corequisite: CHEM 1211L. High school chemistry is recommended but not required. Fundamental theories of chemistry with additional focus on medical and environmental issues. The course is taught in an enriched environment in which the experimental nature of chemical knowledge is stressed and the development of critical thinking skills is emphasized.

CHEM 1211K. Principles of Chemistry I. 4 Hours.
First course in a two-semester sequence covering the fundamental principles and applications of chemistry designed for science majors. Topics to be covered include composition of matter, stoichiometry, periodic relations, and nomenclature. Laboratory exercises supplement the lecture material. Prerequisites: High school chemistry course with laboratory or introductory college chemistry course with laboratory. College algebra. Precalculus as a prerequisite or co-requisite is highly recommended. For more information on this institution's eCore courses, please see http://www.valdosta.edu/ecore/.

CHEM 1211L. Principles of Chemistry Laboratory I. 1 Hour.
Prerequisites or corequisites: MATH 1111 or MATH 1113, and CHEM 1211. Laboratory exercises to supplement material discussed in CHEM 1211.

CHEM 1212. Principles of Chemistry II. 3 Hours.
Prerequisites: MATH 1111 or MATH 1113, and CHEM 1211 and CHEM 1211L, each with a grade of “C” or better. Corequisite: CHEM 1212L. A continuation of the quantitative study of the physical and chemical behavior of matter in its several phases and a consideration of modern theories of bonding forces at the molecular level. Reaction kinetics, chemical equilibrium, oxidation-reduction and acid-base chemistry, electrochemistry, chemical thermodynamics, nuclear chemistry, and the descriptive chemistry of selected elements and their compounds are discussed.

CHEM 1212K. Principles of Chemistry II. 4 Hours.
Second course in a two-semester sequence covering the fundamental principles and applications of chemistry designed for science majors. Laboratory exercises supplement the lecture material. Prerequisites: CHEM 1211K College algebra. Precalculus as a prerequisite or co-requisite is highly recommended. For more information on this institution's eCore courses, please see http://www.valdosta.edu/ecore/.

CHEM 1212L. Principles of Chemistry Laboratory II. 1 Hour.
Prerequisites: MATH 1111 or MATH 1113, and CHEM 1211 and CHEM 1211L, each with a grade of “C” or better. Corequisite: CHEM 1212. Laboratory exercises to supplement material discussed in CHEM 1212.

CHEM 2210. Sophomore Seminar. 1 Hour.
Discussion of and reports on current topics in chemistry and on topics related to the chemist as a professional. Demonstrated comprehension of topic, knowledge of pertinent literature and competence in communication skills, both oral and written, will be considered in assigning a course grade. Required of majors. One meeting per week.

CHEM 2310. Quantitative Analysis. 4 Hours.
Prerequisite: CHEM 1212/1212L with a grade of "C" or better. A study of techniques of quantitative analysis, involving volumetric, gravimetric, and instrumental methods. Theory underlying the experimental techniques, methods of recording and statistically evaluating data and calculations utilizing the data are considered. The methods discussed are applied in the laboratory to determine certain constituents in several samples.

CHEM 3320. Environmental Chemistry. 3 Hours.
Prerequisite: CHEM 1211/1211L, CHEM 1212/1212L, CHEM 3401, and CHEM 3402. Development of a general understanding of how microscopic properties of atoms and molecules can affect macroscopic changes in the environment. Basic chemical concepts, including equilibrium, oxidation-reduction, kinetics, solubility, acid-base chemistry, and thermodynamics, will be applied to complex environmental processes with heavy emphasis on current environmental problems and concerns. Field trips will be required of all students.

CHEM 3401. Organic Chemistry I. 4 Hours.
Prerequisite: CHEM 1212/1212L with a grade of "C" or better. A study of the structure, properties, preparation and reactions of organic compounds in light of modern theories of molecular structure and reaction mechanisms.

CHEM 3402. Organic Chemistry II. 4 Hours.
Prerequisite: CHEM 3401 with a grade of "C" or better. Continuation of CHEM 3401 with emphasis on spectroscopy, organic synthesis, and reaction mechanisms.

CHEM 3510. Inorganic Chemistry. 4 Hours.
Prerequisites: CHEM 1211, CHEM 1211L, CHEM 1212, CHEM 1212L, each with a grade of "C" or better. Descriptive chemistry of the inorganic elements through discussions of periodic trends, reactivity patterns, and structure. Bonding models, thermodynamics, and acid-base chemistry as they apply to the descriptive chemistry of the elements will be covered.

CHEM 3601. Biochemistry I. 3 Hours.
Prerequisites: CHEM 3401 and CHEM 3402 with a grade of "C" or better and an introductory biology course. Principles of the structure and function of biological molecules including carbohydrates, lipids, proteins, membranes, enzymes and nucleic acids. An overview of the major metabolic and biosynthetic pathways is also presented.

CHEM 3601L. Laboratory Techniques in Biochemistry. 2 Hours.
Corequisite or Prerequisite: CHEM 3601. Experiments to illustrate the principles and research techniques in biochemistry and molecular biology.

CHEM 3602. Biochemistry II. 3 Hours.
Prerequisite: CHEM 3601 with a grade of "C" or better. A continuation of CHEM 3601. Comprehensive discussion of regulatory, metabolic and biosynthetic pathways, advanced enzyme kinetics, regulation of gene expression and recombinant DNA technology.

CHEM 3801. Physical Chemistry I. 4 Hours.
Prerequisites: CHEM 3402, MATH 2262, and PHYS 2212K or PHYS 1112K, all with a grade of "C" or better. A theoretical and mathematical treatment of the fundamental theories and laws of chemistry with an emphasis on thermodynamics. Experimental investigations will supplement the study of phase diagrams, solution calorimetry, bomb calorimetry, thermodynamic modeling and additional solid, liquid, and gas phase energy transfer studies.

CHEM 3802. Physical Chemistry II. 4 Hours.
Prerequisites: CHEM 3402, MATH 2262, and PHYS 2212K or PHYS 1112K, all with a grade of "C" or better. A theoretical and mathematical treatment of the fundamental theories and laws of chemistry with an emphasis on quantum mechanics, kinetics, and statistical mechanics. Experimental investigations will supplement the study of quantum mechanics, kinetics, and statistical mechanics as applied to systems of interest to chemists.

CHEM 4210. Seminar. 1 Hour.
Prerequisites: Senior standing and completion of at least 15 hours of upper division chemistry courses. Discussion of and reports on current topics in chemistry. Demonstrated comprehension of topic, knowledge of pertinent literature, and competence in communication skills, both oral and written, will be considered in assigning a course grade. Required of majors during the senior year. One meeting per week.

CHEM 4310. Instrumental Analysis. 4 Hours.
Prerequisites: CHEM 2310 and CHEM 3802. A study of the advantages and the limitations of the use of instruments for the solution of problems in chemical analysis. The physical and chemical processes, instrumentation, and data analysis techniques as applied to mass spectrometry, optical spectroscopy, nuclear magnetic resonance spectroscopy, separations science, electrochemistry, radiochemical analysis, surface analysis, and thermal analysis will be discussed in lecture and utilized in laboratory.

CHEM 4420. Physical Organic Chemistry. 3 Hours.
Prerequisites: CHEM 3402 and CHEM 3802. A study of the methods used to elucidate organic reaction mechanisms. Topics covered include: reaction kinetics, isotope effects; linear free energy relationships; general acid and base catalysis and the acidity functions; reactive intermediates including free radicals, carbenes, carbanions, and carbocations; symmetry controlled reactions; photochemistry.

CHEM 4510. Advanced Inorganic Chemistry. 3 Hours.
Prerequisites: CHEM 3801 or CHEM 3802 with a grade of “C” or better or permission of the instructor. An advanced course concentrating on specific aspects of inorganic chemistry including discussions of atomic and molecular structure, chemical bonding, isomerism, coordination compounds and descriptive chemistry of selected elements.

CHEM 4510L. Advanced Inorganic Chemistry Laboratory. 1 Hour.
Pre of Co-requisite: CHEM 4510. An advanced course concentrating on synthetic methods in inorganic chemistry. Students will learn techniques to synthesize air-sensitive (main group and organometallic) compounds, inorgainc polymers, ceramics, and coordination complexes.

CHEM 4810. Computational Chemistry. 2 Hours.
Prerequisite: CHEM 3802 with a grade of “C” or better. Computational and modeling software will be introduced through projects involving systems in physical chemistry and spectroscopy as well as organic chemistry, inorganic chemistry, and biochemistry. Computational predictions will be correlated with laboratory experimental results, either from literature sources or from laboratory work done by the student.

CHEM 4910. Laboratory Problems. 1-3 Hours.
Prerequisite: Consent of the instructor and approval of the Department Head. Experimental work in analytical, inorganic, organic, physical or biochemistry. The student should have completed at least one semester of a background course in the appropriate area in order for the research to be of an advanced nature at the undergraduate level. Although it is not possible to predict the exact time required for a research project, a student should expect to spend at least four hours per week for each credit hour awarded in this course. A report, in a format suitable for presentation to a chemical journal, shall be presented before credit is awarded.

CHEM 4920. Special Topics. 1-3 Hours.
Prerequisite: Consent of the instructor and approval of the Department Head. Topics and credit to be assigned. May be taken more than once if topics are different.