

# CHEMISTRY (CHEM)

## CHEM 1500 Chemistry in Modern Living 3 s.h.

Introduction to basic chemical concepts, the scientific method, and the impact of chemistry on human life and society. Examples may include water treatment, air quality, plastics, drugs, cosmetics, energy resources, food, and the chemical basis of life. Not intended for Chemistry majors.

**Gen Ed:** Natural Science.

## CHEM 1500L Chemistry in Modern Living Laboratory 1 s.h.

Introduction to basic laboratory techniques designed to supplement CHEM 1500. Three hours per week.

**Concurrent with:** CHEM 1500.

## CHEM 1501 An Introduction to Chemistry 3 s.h.

Metric units, dimensional analysis, chemical nomenclature, the mole concept, chemical stoichiometry. Emphasis on problem solving and the mathematics required for success in the study of chemistry. For students without high school chemistry and others needing preparation for CHEM 1510 or CHEM 1515. Three hours lecture, no laboratory.

**Prereq.:** "C" or better in MATH 1510 or Level 20 on the MPT or one unit each of high school algebra and geometry.

## CHEM 1505R Recitation for Allied Health Chemistry 1 1 s.h.

Discussion and problem solving exercises to complement and enhance study in CHEM 1505.

**Concurrent with:** CHEM 1505.

## CHEM 1506R Recitation for Allied Health Chemistry 2 1 s.h.

Discussion and problem solving exercises to complement and enhance study in CHEM 1506.

**Concurrent with:** CHEM 1506.

## CHEM 1510 Chemistry for the Allied Health Sciences 4 s.h.

An overview of general, organic, and biochemistry. General chemistry introduces basic principles of chemistry. Organic chemistry examines the physical and chemical properties of molecules based on their functional groups. Biochemistry applies these chemistry concepts to the living organism. Intended for majors in allied health and other applied sciences. Three hours lecture, three hours laboratory.

**Prereq.:** "C" or better CHEM 1501 or equivalent, Level 20 or better on the MPT.

**Gen Ed:** Natural Science.

## CHEM 1510L Chemistry for the Allied Health Sciences Laboratory 0 s.h.

Laboratory for the allied health chemistry course.

**Concurrent:** CHEM 1510.

## CHEM 1510R Chemistry for the Allied Health Sciences Recitation 1 s.h.

Discussion and problem solving exercises to complement and enhance study in CHEM 1510.

**Concurrent:** CHEM 1510.

## CHEM 1515 General Chemistry 1 3 s.h.

An introduction to the fundamental principles of chemistry, including measurement and calculation; chemical stoichiometry; the properties of gases; atomic and molecular structure; bonding; thermochemistry; and periodic properties. Intended for majors in the natural sciences and engineering. Three hours lecture.

**Prereq.:** "C" or better in CHEM 1501 or equivalent; "C" or better in MATH 1513 or "C" or better in MATH 1510.

**Coreq.:** CHEM 1515.

**Gen Ed:** Natural Science.

## CHEM 1515L General Chemistry 1 Laboratory 1 s.h.

Quantitative experiments focusing on topics covered in CHEM 1515 lectures. Three hours lab.

**Prereq.:** "C" or better in CHEM 1501 or equivalent; "C" or better in MATH 1513 or "C" or better in MATH 1510.

**Coreq.:** CHEM 1515.

## CHEM 1515R Recitation for General Chemistry 1 1 s.h.

Discussion and problem solving based on current material in CHEM 1515. Required for chemistry majors or for those repeating CHEM 1515.

**Concurrent with:** CHEM 1515.

## CHEM 1516 General Chemistry 2 3 s.h.

A continuation of the study of the principles of chemistry, including solution properties; acids and bases; chemical equilibrium; thermodynamics; reaction kinetics; and electrochemistry. Intended for majors in the natural sciences and engineering. Three hours lecture.

**Prereq.:** "C" or better in CHEM 1515 and "C" or better in CHEM 1515L.

**Coreq.:** CHEM 1516L; CHEM 1516R if major or repeating CHEM 1516.

**Gen Ed:** Natural Science.

## CHEM 1516L General Chemistry 2 Laboratory 1 s.h.

Quantitative experiments focusing on topics covered in CHEM 1516 lectures. Three hours lab.

**Prereq.:** "C" or better in CHEM 1515L; "C" or better in CHEM 1515.

**Coreq.:** CHEM 1516.

## CHEM 1516R Recitation for General Chemistry 2 1 s.h.

Discussion and problem solving based on current material in CHEM 1516. Required for chemistry majors or for those repeating CHEM 1516.

**Concurrent with:** CHEM 1516.

## CHEM 1520 Allied Health Chemistry for Online Programs 3 s.h.

An overview of general, organic, and biochemistry. General chemistry introduces basic principles of chemistry. Organic chemistry examines the physical and chemical properties of molecules based on their functional groups. Biochemistry applies these chemistry concepts to the living organism. Intended for students in the accelerated RN to BSN program.

**Gen Ed:** Natural Science.

## CHEM 2602 African and African-American Contributions to Science 3 s.h.

Introduction to basic science concepts, the scientific method, and the impact of chemistry as a central science on society. Examples include works of African-American scientists.

## CHEM 2604 Quantitative Analysis 5 s.h.

Chemical equilibrium, stoichiometry, theory of errors, and volumetric and gravimetric procedures as applied to quantitative determinations. Introduction to electroanalytical, chromatographic and spectrophotometric methods. Emphasis on development of technique. Three hours lecture, six hours lab.

**Prereq.:** CHEM 1516.

## CHEM 2604L Quantitative Analysis Laboratory 0 s.h.

Quantitative Analysis Laboratory.

## CHEM 2650 Introduction to Undergraduate Research 1-2 s.h.

Introduction to the methods of chemical research under the direction of a faculty member. May include literature search and analysis, instructional laboratory development, and/or original basic or applied research. May be repeated to a maximum of 4 s.h.

**Prereq. or concurrent:** CHEM 1516 and approval of department chairperson.

## CHEM 3719 Organic Chemistry 1 4 s.h.

Organic compounds, reactions and theories. Typical preparations and procedures of analysis. Three hours lecture, three hours lab-discussion.

**Prereq.:** "C" or better in CHEM 1516.

## CHEM 3719L Organic Chemistry 1 Laboratory 0 s.h.

Organic Chemistry 1 Laboratory.

## CHEM 3719R Organic Chemistry Recitation 1 1 s.h.

An introduction to the preparation and analysis of organic compounds. Discussion of CHEM 3719 material and approaches to problem solving. Required for chemistry majors.

**Concurrent with:** CHEM 3719.

## CHEM 3720 Organic Chemistry 2 4 s.h.

Organic compounds, reactions and theories. Typical preparations and procedures of analysis. Three hours lecture, three hours lab-discussion.

**Prereq.:** "C" or better in CHEM 3719.

**CHEM 3720L Organic Chemistry 2 Laboratory 0 s.h.**

Organic Chemistry 2 Laboratory.

**CHEM 3720R Organic Chemistry Recitation 2 1 s.h.**

An introduction to the preparation and analysis of organic compounds. Discussion of CHEM 3720 material and approaches to problem solving. Required for chemistry majors.

**Concurrent with:** CHEM 3720.**CHEM 3729 Inorganic Chemistry 3 s.h.**

Fundamental principles underlying the structure, bonding, and properties of the elements and molecular, solid state, and coordination compounds.

**Prereq. or concurrent:** CHEM 3739.**CHEM 3739 Physical Chemistry 1 3 s.h.**

Principles and applications of thermodynamics and kinetics to chemical systems.

**Prereq.:** "C" or better in CHEM 3720, PHYS 2610, MATH 1572.**CHEM 3739L Physical Chemistry 1 Laboratory 1 s.h.**

Quantitative thermodynamic and kinetic measurements of chemical systems. Prereq. or Coreq. CHEM 3739.

**CHEM 3740 Physical Chemistry 2 3 s.h.**

Principles and applications of quantum mechanics and statistical thermodynamics to chemical systems. Three hours lecture.

**Prereq.:** "C" or better in CHEM 3739; PHYS 2611, MATH 2673.**CHEM 3740L Physical Chemistry 2 Laboratory 1 s.h.**

Spectroscopy and computational measurements of chemical systems. Prereq. or.

**Coreq.:** CHEM 3740.**CHEM 3761 Introduction to Polymer Chemistry 1 s.h.**

Survey of polymer chemistry for representative classes of organic polymers, their preparation, characterization, and structure-property relationships.

**Prereq.:** CHEM 3720.**CHEM 3764 Chemical Toxicology 3 s.h.**

Introduction to the basic principles of toxicology; disposition of toxic agents, focus on the effect that chemical structure has on biotransformation and the mechanism of action of chemicals on living organisms. Prereq.: CHEM 3720.

**CHEM 3785 Biochemistry 1 3 s.h.**

Structure and function of proteins, nucleic acids, and carbohydrates. Includes techniques of protein purification and analysis, the study of enzyme catalysis and kinetics. Study of the organization and regulation of metabolic pathways: glycolysis, the citric acid cycle, and oxidative phosphorylation.

**Prereq.:** "C" or better in CHEM 3720.**CHEM 3785L Biochemistry Laboratory 1 s.h.**

Analysis and separation techniques of biochemistry. Three hours lab-discussion.

**Prereq. or concurrent:** CHEM 3785.**CHEM 3786 Biochemistry 2 3 s.h.**

Continues the study of the organization and regulation of metabolic pathways: glycogen metabolism, the pentose phosphate pathway, amino acid, lipid, and nucleic acid metabolism. Biochemical information pathways including replication, transcription, and translation followed by the regulation of gene expression.

**Prereq.:** "C" or better in CHEM 3785.**CHEM 3790 Undergraduate Seminar 1 s.h.**

Students participate in departmental seminars and present a seminar to the class. May be repeated once.

**Prereq. or concurrent:** CHEM 2604 and CHEM 3720.**CHEM 4850 Chemistry Research 1 s.h.**

Research planning, design, and execution including literature survey techniques, proposal writing, and critical scientific analysis. The student gives an oral presentation of a research proposal for CHEM 4850L, or on another topic as approved by the instructor.

**Prereq.:** CHEM 2604 or CHEM 3719 and approval of department chairperson.**Gen Ed:** Capstone.**CHEM 4851 Chemistry Research Project 2-3 s.h.**

Research participation under the direction of a faculty member. The student prepares an acceptable written report on the completed project. May be repeated to a maximum of 5 semester hours. Prereq. CHEM 4850 and approval of department chairperson.

**CHEM 4851A Chemistry Research Project Biochemistry 2-3 s.h.**

Research participation under the direction of a faculty member. The student prepares an acceptable written report on the completed project. May be repeated to a maximum of 5 semester hours. Prereq. CHEM 4850 and approval of department chairperson. 2-3 s.h.

**CHEM 4851B Chemistry Research Project Analytical 2-3 s.h.**

Research participation under the direction of a faculty member. The student prepares an acceptable written report on the completed project. May be repeated to a maximum of 5 semester hours. Prereq. CHEM 4850 and approval of department chairperson. 2-3 s.h. 4851B.

**CHEM 4851C Chemistry Research Project Materials 2-3 s.h.**

Research participation under the direction of a faculty member. The student prepares an acceptable written report on the completed project. May be repeated to a maximum of 5 semester hours. Prereq. CHEM 4850 and approval of department chairperson.

**CHEM 4851D Chemistry Research Project Organic 2-3 s.h.**

Research participation under the direction of a faculty member. The student prepares an acceptable written report on the completed project. May be repeated to a maximum of 5 semester hours. Prereq. CHEM 4850 and approval of department chairperson.

**CHEM 4851E Chemistry Research Project Inorganic 2-3 s.h.**

Research participation under the direction of a faculty member. The student prepares an acceptable written report on the completed project. May be repeated to a maximum of 5 semester hours. Prereq. CHEM 4850 and approval of department chairperson.

**CHEM 4851F Chemistry Research Project Physical 2-3 s.h.**

Research participation under the direction of a faculty member. The student prepares an acceptable written report on the completed project. May be repeated to a maximum of 5 semester hours. Prereq. CHEM 4850 and approval of department chairperson.

**CHEM 4860 Regulatory Aspects of Industrial Chemistry 2 s.h.**

Roles and responsibilities of industrial chemists. Industrial hygiene and safety. Industrial chemical processes, their waste products, their environmental effects, and the treatment of pollutants. Governmental regulations relating to waste disposal, product safety, occupational safety, resource conservation, environmental protection, and problems of awareness and compliance.

**Prereq.:** CHEM 3720.**CHEM 4891 Special Topics 1-3 s.h.**

Topics selected by the faculty from fields of current research interest or of special emphasis. May be repeated with different topics.

**CHEM 5804 Chemical Instrumentation 4 s.h.**

The theoretical foundations of instrumental procedures and the use of instruments in analytical work. Two hours lecture, six hours lab.

**Prereq.:** CHEM 3739.**CHEM 5804L Chemical Instrumentation Laboratory 0 s.h.**

Chemical Instrumentation Laboratory.

**CHEM 5821 Intermediate Organic Chemistry 3 s.h.**

An intermediate treatment of organic chemistry building on the principles introduced at the sophomore level. Emphasis on curved arrow notation in mechanism and the planning of organic syntheses. Structural analysis of organic compounds using NMR, IR and MS and the application of structural knowledge to questions of mechanism.

**Prereq.:** CHEM 3720.

**CHEM 5822 Advanced Organic Laboratory 4 s.h.**

An advanced approach to the applications of organic chemistry in the laboratory. Synthesis and purification of organic molecules using modern techniques, structure elucidation using spectroscopic techniques. Lecture discussion includes use of instrumentation, planning of practical syntheses, use of the primary chemical literature and safety in the laboratory. Two hours lecture, six hours lab.

**Prereq.:** CHEM 3720.

**CHEM 5822L Advanced Organic Laboratory 0 s.h.**

Advanced Organic Laboratory.

**CHEM 5830 Intermediate Inorganic Chemistry 2 s.h.**

Reactions and descriptive chemistry of transition metal, organometallic, and main-group compounds.

**Prereq.:** CHEM 3729, CHEM 3740 (may be concurrent).

**CHEM 5831L Inorganic Chemistry Laboratory 2 s.h.**

Preparation of typical inorganic compounds and their characterization. Six hours lab-discussion. **Prereq. or**

**Coreq.:** CHEM 3729 and CHEM 3739.

**CHEM 5832 Solid State Structural Methods 3 s.h.**

The determination of structures of biological, organic, and inorganic materials in the solid state. Introduction to the crystalline state, defects, diffraction of waves, powder and single crystal diffraction methods of neutron and x-ray analysis, electron microscopy, and solid state NMR. Two hours lecture, three hours lab.

**Prereq.:** CHEM 3729.

**CHEM 5832L Solid State Structural Methods Laboratory 0 s.h.**

Solid State Structural Methods Laboratory.

**CHEM 5836 Quantum Chemistry 3 s.h.**

Basic principles of quantum chemistry, with applications to problems in molecular structure, spectroscopy and thermodynamics.

**Prereq.:** CHEM 3740.

**CHEM 5861 Polymer Science 1: Polymer Chemistry and Plastics 3 s.h.**

Preparation, characterization, structure-property relationships, morphology, and uses of the major commercial polymers. Two hours lecture, three hours lab.

**Prereq.:** CHEM 3739.

**CHEM 5861L Polymer Science 1: Polymer Chemistry and Plastics Laboratory 0 s.h.**

Polymer Science 1: Polymer Chemistry and Plastics Laboratory.

**CHEM 5862 Polymer Science 2: Polymer Rheology, Processing, and Composites 3 s.h.**

Polymer rheology, processing methods, and materials characterization. The effects of additives and the major classes of thermoplastic, thermoset, elastomeric, and composite materials. Two hours lecture, three hours lab.

**Prereq.:** CHEM 5861 or consent of the chairperson.

**CHEM 5862L Polymer Science 2: Polymer Rheology, Processing, and Composites Laboratory 0 s.h.**

Polymer Science 2: Polymer Rheology, Processing, and Composites Laboratory.

**CHEM 5876 Enzyme Analysis 2 s.h.**

Advanced biochemistry laboratory focusing on the methods of enzyme purification and characterization. One hour lecture, two hours lab.

**Prereq.:** CHEM 3785 or equivalent and CHEM 3785L or equivalent.

**CHEM 6911 Advanced Analytical Chemistry 1 3 s.h.**

Theory and applications of spectroscopy and theory of chemical separation methods.

**Prereq.:** CHEM 3739 Physical Chemistry I.

**CHEM 6912 Advanced Analytical Chemistry 2 3 s.h.**

Applications of chemical separation methods and theory and applications of electrochemistry and electrochemical techniques.

**Prereq.:** CHEM 3739 Physical Chemistry.

**CHEM 6921 Advanced Biochemistry 1 3 s.h.**

Protein structure and intermediary metabolism.

**Prereq.:** CHEM 3720, or concurrently with CHEM 3737 or CHEM 3739.

**CHEM 6922 Advanced Biochemistry 2 3 s.h.**

A study of metabolic pathways and other biochemical systems at the molecular level.

**Prereq.:** CHEM 6921.

**CHEM 6931 Advanced Inorganic Chemistry 1 3 s.h.**

Current theories and types of bonding. Modern structural principles with applications in main-group molecular compounds, coordination compounds, and inorganic solids.

**Prereq.:** CHEM 3729 Inorganic Chemistry.

**CHEM 6932 Advanced Inorganic Chemistry 2 3 s.h.**

Transition metal organometallic chemistry emphasizing molecular structure, bonding methods, characterization, and functional group reactivity. The properties, chemical reactivity, and trends of the elements.

**Prereq.:** CHEM 5830, CHEM 6931, or permission of instructor.

**CHEM 6933 Physical Methods in Structure Determination 3 s.h.**

The determination of molecular-level structures of biological, organic, and inorganic compounds in the gas phase, solution, and solid state by diffraction and spectroscopic methods, especially X-ray crystallography and NMR spectroscopy. Three hours lecture.

**Prereq.:** CHEM 5822, CHEM 5832, or permission of instructor.

**CHEM 6941 Advanced Organic Chemistry 1 3 s.h.**

Principles of chemical bonding and structure in organic molecules, physical organic chemistry, structure of reactive intermediates, stereochemistry, and detailed descriptions of reaction mechanisms.

**Prereq.:** CHEM 3721 Genetics and CHEM 3740 Physical Chemistry 2.

**CHEM 6942 Advanced Organic Chemistry 2 3 s.h.**

Detailed study of functional group transformations in organic synthesis as applied to the preparation of complex molecules. Carbon-carbon bond forming reactions, organometallic reagents in organic synthesis, oxidation-reduction chemistry, and multi-step synthesis.

**Prereq.:** CHEM 6941.

**CHEM 6951 Advanced Physical Chemistry 1 3 s.h.**

Principles of quantum chemistry and spectroscopy with applications.

**CHEM 6952 Advanced Physical Chemistry 2 3 s.h.**

Molecular basis of thermodynamics and kinetics.

**CHEM 6963 Advanced Polymer Science 3 s.h.**

Advanced methods of polymer synthesis and characterization, high performance polymers, polymerization kinetics and mechanisms, polymer processing, materials optimization, and high performance applications. Three hours lecture.

**Prereq.:** CHEM 3740 and CHEM 5861, or permission of the instructor.

**CHEM 6969 Laboratory Problems 2 s.h.**

A laboratory course that stresses individual effort in solving chemical problems. Recommended for high school chemistry teachers. Not applicable to the M.S. degree in chemistry. May be repeated up to six semester hours.

**Prereq.:** An undergraduate minor in chemistry.

**CHEM 6971 The Teaching and Learning of Chemistry 3 s.h.**

An introduction to the current literature and research problems in the teaching and learning of chemistry. Topics include theories of teaching, learning styles, assessment, problem solving, misconceptions, and the role of laboratories, recitations, and demonstrations in learning chemistry. Also includes examination of these issues as related to teaching biology.

**CHEM 6972 Methods of Chemistry Education Research 3 s.h.**

Principles of chemistry education research. Issues of problem design, data collection, and data analysis are considered from both quantitative and qualitative frameworks. Methodologies include surveys and questionnaires, think-along protocols, interviews, observations, and action research. Also includes examination of these issues as related to biology.

**CHEM 6973 Chemistry and National Science Education Standards 3 s.h.**

Implications of national standards for modifying high school chemistry instruction in a variety of classroom situations. Topics include inquiry learning, science and technology literacy, the history and nature of science, preservice science teacher education, assessment, and the impact of standards on advanced placement chemistry.

**CHEM 6975 An Introduction to Teaching Chemistry 1 s.h.**

A course to prepare graduate students to serve as teaching assistants in both chemistry laboratories and recitations. Topics include laboratory safety (governmental regulations, ACS guidelines, hazardous materials, waste disposal) and practical matters of teaching (active learning, leading discussions, grading, cheating, etc.). Required of all graduate students serving as first-year teaching assistants.

**CHEM 6976 Teaching Practicum in General Chemistry 2 s.h.**

Teaching strategies in the General Chemistry laboratory. Students will meet with General Chemistry course instructors and must demonstrate proficiency in the material to be presented in CHEM 1515 General Chemistry 1 and CHEM 1516 General Chemistry 2 laboratories. Grading for CHEM 6976 is S/U. May be repeated for a total of six semester hours for CHEM 6976, CHEM 6977, CHEM 6978, and CHEM 6979.

**Prereq. or concurrent:** CHEM 6975.

**CHEM 6977 Teaching Practicum in Chemistry for Allied Health Sciences Lab 2 s.h.**

Teaching strategies in CHEM 1510. Students will meet with the course instructor and must demonstrate proficiency in the material to be presented in CHEM 1510. Grading for CHEM 6977 is S/U. May be repeated for a total of six semester hours for CHEM 6977.

**Prereq.:** or concurrent: CHEM 6975.

**CHEM 6978 Teaching Practicum in Organic Chemistry 2 s.h.**

Teaching strategies in the organic chemistry laboratory. Students will meet with organic chemistry course instructors and must demonstrate proficiency in the material to be presented in CHEM 3719 Organic Chemistry 1 and CHEM 3720 Organic Chemistry 2 laboratories. Grading for CHEM 6978 is S/U. May be repeated for a total of six semester hours for CHEM 6976, CHEM 6977, CHEM 6978, and CHEM 6979.

**Prereq. or concurrent:** CHEM 6975.

**CHEM 6979 Teaching Practicum for Chemistry in Modern Living Lab 1 s.h.**

Teaching strategies in the Chemistry in Modern Living Laboratory. Students will meet with course coordinator and must demonstrate proficiency in the material to be presented in CHEM 1500L. Grading for CHEM 6979 is S/U. May be repeated for a total of six semester hours for CHEM 6979.

**Prereq. or concurrent:** CHEM 6975.

**CHEM 6980 Introduction to Chemical Research 3 s.h.**

Principles of chemical research planning, design, execution, and reporting. Includes research proposals, record keeping, written reports, oral presentations, the reviewing process, and professional standards. The application of the principles of chemical research to the student's M.S. research project. Required of all first-year students in the M.S. program in chemistry.

**CHEM 6981 Seminar 1 1 s.h.**

Preparation of a formal written research proposal and oral presentation of the proposal. Under the guidance of a research supervisor, the student will investigate the background literature and rationale for a project. Required of all first-year students in the M.S. program in chemistry. Hours arranged.

**Prereq.:** CHEM 6980 and permission of the Chemistry chair.

**CHEM 6982 Seminar 2 1 s.h.**

Oral presentation and defense of thesis. Hours arranged.

**Prereq.:** CHEM 6981 and permission of the thesis advisor, or concurrently with six semester hours of CHEM 6990.

**CHEM 6985 Fundamental Chemistry for Educators 3 s.h.**

Fundamentals of general, organic, and biological chemistry including application to the teaching of science. Two hours lecture, three hours laboratory/discussion. Not applicable to the M.S. degree in chemistry.

**Prereq.:** Admission to the graduate program or permission of instructor.

**CHEM 6989 Special Topics in Chemistry Practicum 1-3 s.h.**

Topics selected by the faculty from fields of current research, pedagogical interest, or special emphasis. S/U grading option. May be repeated with different topics.

**CHEM 6990 Thesis 1-9 s.h.**

Hours arranged. May be repeated.

**CHEM 6991 Special Topics 1-3 s.h.**

Topics selected by the faculty from fields of current research interest or of special emphasis. May be repeated with different topics.