

# CHEMISTRY (CH)

## CH-146 Art Science Experiments (1 credit)

This course explores color as a multifaceted scientific, mathematic and artistic mode of self-expression and problem solving. Elements of study could include emotions and color symbolism, creativity, cultural history, vision science-perception, natural phenomena and resources, material science, chemistry and greener product development. Students complete research on personally selected color theory or history. They then use natural and synthetic dyes and pigments in lab and studio problem solving. Students develop a beginner/intermediate understanding of art and chemistry involved in producing dyes or pigments and experimenting to apply them to cloth, wool or other surfaces. No experience necessary.

### CH-146A Art/Science Experiments: Color (1 credit)

Science, Technology, Engineering, Art and Mathematics (STEAM) concepts are used to guide critical thinking and dialogue among students and educators. The Art/Science Experiments are a series of courses co-taught by arts, sciences and mathematics faculty who develop questions that will be enriched through multi-disciplinary problem solving and aesthetic engagement. Students who enter the dialogue need no experience in STEAM fields. Students will gain basic concepts, vocabulary knowledge and technical skills during STEAM experimentation and evaluation of theories and products. Laboratory and studio experiences are balanced with research and development of personal themes by students. Students complete research on personally selected color theory or history. They then use natural and synthetic dyes and pigments in lab and studio problem solving. Students develop a beginner/intermediate understanding of art and chemistry involved in producing dyes or pigments and experimenting to apply them to cloth, wool or other surfaces. No experience necessary.

*Prerequisite(s):* Open to all students. Experimenting and creating with metal oxidation, dyes, pigments and varied paint products. No experience in art/science is necessary.

### CH-146B Art/Science Experiments Series Courses (1 credit)

Science, Technology, Engineering, Art and Mathematics (STEAM) concepts are used to guide critical thinking and dialogue among students and educators. The Art/Science Experiments are a series of courses co-taught by arts, sciences and mathematics faculty who develop questions that will be enriched through multi-disciplinary problem solving and aesthetic engagement. Students who enter the dialogue need no experience in STEAM fields. Students will gain basic concepts, vocabulary knowledge and technical skills during STEAM experimentation and evaluation of theories and products. Laboratory and studio experiences are balanced with research and development of personal themes by students.

## CH-213 Chemistry of Bioorganic Molecules (3 credits)

The student analyzes the structures of organic and biological molecules. Students learn to interpret the physical and chemical properties of these molecules, explaining observed properties in relation to a molecule's shape and electronic nature. They also investigate the thermodynamic and kinetic basis of chemical transformation with particular emphasis on enzymes and metabolic pathways. In the laboratory, students examine some of the molecules, properties, and reactions discussed in class. They also conduct two investigations in which variables are tested, and an independent investigation in which they modify the design of an experiment to answer a question. Through this investigative process, students develop laboratory writing and research skills.

*Prerequisite(s):* SC-119 & SC-119L

## CH-213L Chemistry of Bioorganic Molecules Lab (1 credit)

Concurrent registration in CH-213

*Prerequisite(s):* Must register concurrently for CH-213.

## CH-221 Organic Chemistry 1 (3 credits)

The student applies the structure-property framework in the analysis of organic molecules. In particular, students learn to interpret physical and chemical properties of organic molecules, explaining the observed properties in relation to a molecule's structural and electronic features. The thermodynamic and kinetic basis of chemical transformation is also studied. In the laboratory students apply structure-property analysis in solving problems related to physical and chemical separation methods. They analyze the structure of organic molecules with spectroscopic methods. In understanding and designing separation methods, students use microscale techniques to investigate intermolecular forces.

*Prerequisite(s):* CH-213 & CH-213L

## CH-221L Organic Chemistry 1 - Lab (1 credit)

The student applies structure-property analysis in solving problems related to physical and chemical separation methods. Students analyze the structure of organic molecules with spectroscopic methods. In understanding and designing separation methods, students use microscale scale techniques to investigate intermolecular forces.

*Prerequisite(s):* Take concurrent with CH-221.

## CH-228H Intro to Biochemistry (3 credits)

Students will gain a working understanding of human metabolism from the standpoint of the chemical reactions involved. They will investigate the chemistry of life using three major frameworks: structure/function, energetics and dynamic equilibrium. Students will also develop and apply these frameworks to the analysis of the chemistry of organic and biological molecules and metabolic reactions and processes. At the same time, students will articulate their understanding in writing, demonstrating correct and precise use of biochemical terminology and appropriate chemical rationale. Course open to Prerequisite DEMSN students only.

## CH-234 Analytical Chemistry/Quantitative Analysis (3 credits)

Offered Spring Term only. The student studies basic concepts of titrimetric, gravimetric, and colorimetric analysis. Students learn to use basic analytical techniques in the laboratory and to evaluate the accuracy and precision of data.

*Prerequisite(s):* MT-123 or equivalent math placement., CH-213 & CH-213L, or CH-260 & CH-260L.

## CH-234L Analytical Chem-Quant Analysis Lab (1 credit)

The student learns to use basic analytical techniques and to evaluate the accuracy and precision of her data. Contact instructor to arrange a three-hour laboratory time on Thursdays between 9 am and 3 pm.

*Prerequisite(s):* CH-234

## CH-246B Art/Science Experiments Series Courses (1 credit)

A-246 moves beyond basic problem solving to allow students to expand the study to generate higher levels of production and aesthetic engagement. Students who select this course may have taken the A-146 course or are students who wish to study intermediate aesthetic engagement.

*Prerequisite(s):* A-146B or CH-146B

## CH-260 Chemistry of Inorganic Materials (3 credits)

The student investigates relationships between the properties of elements and their position on the Periodic Table. Students use the oxidation reduction model and models for various types of chemical bonds as they predict and explain properties of inorganic materials.

*Prerequisite(s):* SC-119 & SC-119L or CH-213 & CH-213L. Problem Solving level 2 completed.

**CH-260L Chemistry/Inorganic Materials - Lab (1 credit)**

*Prerequisite(s):* CH-260.

**CH-322 Organic Chemistry 2 (3 credits)**

The student applies the structure-property framework in the analysis of chemical transformation. In particular, students learn to predict chemical changes by analyzing the electronic, structural, and stereochemical features of a molecule. Students apply an understanding of reactions and reaction mechanisms in designing multistep syntheses. In the lab, students work collaboratively to investigate factors that affect reaction rates and reaction mechanisms. Computational methods are used to study the chemical and physical properties of organic molecules. Finally, students apply problem-solving skills as they modify published procedures for the synthesis of organic molecules and as they verify product structures using spectroscopic methods.

*Prerequisite(s):* CH-221 & CH-221L

**CH-322L Organic Chemistry 2 Lab (1 credit)**

The student applies the structure-property framework in the analysis of chemical transformation. In particular, students learn to predict chemical changes by analyzing the electronic and structural features of a molecule. Students apply an understanding of reactions and reaction mechanisms in designing multistep syntheses. In the lab, students work collaboratively to investigate factors that affect reaction rates and reaction mechanisms. Computational methods are used to study the chemical and physical properties of organic molecules and as they verify product structures using spectroscopic methods.

*Prerequisite(s):* CH-221 and CH-221L, CH-234 & CH-234L, CH-322

**CH-328 Biochemistry (4 credits)**

The student analyzes the structure and function of biomolecules with an emphasis on proteins and particularly enzymes. Students also study the function, regulation, and integration of metabolic pathways. In laboratory work, students learn some basic biochemistry techniques and employ them in determining the molecular weight of a protein, purifying an enzyme, and conducting enzyme kinetic studies.

*Prerequisite(s):* CH-221, CH-221L & MT-123 or MP-2 or higher. Students register for lecture and lab., CH-328L

**CH-328L Biochemistry - Lab (0 credits)**

The student analyzes the structure and function of biomolecules with an emphasis on proteins and particularly enzymes. Students also study the function, regulation, and integration of metabolic pathways. In laboratory work, students learn some basic biochemistry techniques and employ them in determining the molecular weight of a protein, purifying an enzyme, and conducting enzyme kinetic studies.

*Prerequisite(s):* Take concurrent with CH-328

**CH-337 Instrumental Methods of Analysis Lab (3 credits)**

The student studies the advantages and limitations of different instrumental methods for analyzing chemical samples, and applies them in the analysis of various real-life samples.

*Prerequisite(s):* CH-234 & CH-234L

**CH-374 CH Assessment in Effective Citizenship (0 credits)**

The student identifies a community organization through which they can address an issue, sets a goal for volunteer work with the organization, and designs and carries out a strategy for achieving their goal. Students summarize their work in a log and address their effectiveness in a written reflection.

*Prerequisite(s):* CH Majors: Effective Citizenship Level 3 completed.

**CH-395 Biochemistry of Micronutrients (3 credits)**

The goal of this course is to provide an increased understanding of the biochemical and physiological mechanisms involved in micronutrient action and metabolism and the regulation of micronutrient homeostasis in the body. This course will provide an in-depth understanding of the basis of the need for fat-soluble vitamins, water-soluble vitamins, and minerals and the molecular functions of these nutrients. The student will increase conceptual knowledge concerning the application of laboratory techniques that are commonly used in modern biological science research through analysis of primary research papers in a journal club format. Offered in spring terms every other year.

*Prerequisite(s):* SC-120, CH-213 or CH-221

**CH-397 Independent Study (1-4 credits)**

The student selects a topic in chemistry related to their career goals and, under the direction of a chemistry faculty member, investigates that topic in depth.

**CH-399 Formal Introduction to Advanced Work (0 credits)**

The Advanced-Level Event marks a significant accomplishment as each student proceeds into the work of the major department. When a department determines that a student is ready for advanced work within a discipline, the student is invited to participate in a ceremony that is both a celebration and an explanation of future requirements of the major and support areas. The student registers for this experience at a point determined by the major department: for most majors the registration is connected to the taking of a particular course. Students and faculty gather for an afternoon during Mid-semester Assessment Days. Following a general program, students meet in departmental sessions with their faculty to discuss advanced outcomes, department courses, advising procedures, and so on.

*Prerequisite(s):* Completion of 1 of the following courses: CH-221, CH-234 or CH-260.

**CH-414 Chemistry Professional Portfolio (0 credits)**

This assessment offers students with a major or a support area in chemistry the opportunity to show that they can effectively use and communicate chemical information. The student assembles a portfolio of communications, including laboratory notebooks, written reports and papers, videotapes of speeches, and abstracts. The student describes the research strategies employed in the portfolio work. The student assesses the portfolio, describing personal strengths and weaknesses. Take in your final semester senior year.

**CH-425 Molecular Biology (4 credits)**

Offered Spring Term only. In this course, the student integrates and applies knowledge from a breadth of fields in biology, chemistry, and physics to the analysis of molecular mechanisms and control of nucleic acids in living organisms. The course focuses on the theoretical and technical mechanisms of nucleic acid (DNA and RNA) function, including replication and gene expression. There is a strong emphasis on current laboratory techniques for manipulating the genome, and laboratory work is closely integrated with the lecture/discussion component.

*Prerequisite(s):* BI-325 or BI-361, CH-425L

**CH-425L Molecular Biology Lab (0 credits)**

Offered Spring Term only. In this course, the student integrates and applies knowledge from a breadth of fields in biology, chemistry, and physics to the analysis of molecular mechanisms and control of nucleic acids in living organisms. The course focuses on the theoretical and technical mechanisms of nucleic acid (DNA and RNA) function, including replication and gene expression. There is a strong emphasis on current laboratory techniques for manipulating the genome, and laboratory work is closely integrated with the lecture/discussion component.

*Prerequisite(s):* Take CH-425 concurrently

**CH-441 Physical Chemistry 1 (3 credits)**

The student uses models and equations to predict the behavior of chemical systems and learns how the models and equations were developed from experimental data and the principles of chemistry, physics, and mathematics. The emphasis is on gases and thermodynamics.

*Prerequisite(s):* CH-234, MT-253 completed & PH-232 or PH-242 completed.

**CH-442 Physical Chemistry 2 (3 credits)**

Offered Spring Term only. The student continues her study of physical chemistry, with an emphasis on kinetics, quantum mechanics, and spectroscopy.

*Prerequisite(s):* CH-441

**CH-450L Physical Chemistry Lab (2 credits)**

Student works relatively independently on laboratory projects related to physical chemistry and her career goals.

*Prerequisite(s):* CH-441 & CH-442

**CH-497 Independent Study (4 credits)**

Under the approval and direction of a faculty member, independent study is available to students.