

# CHEMISTRY (CH)

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## CH-106 Paper Or Plastics?

**LASC Categories:** NSP

Students will study modern issues related to chemistry. These will include sustainability, green chemistry, climate change and the ozone layer.

Every year. 3 Credits

## CH-112 Survey of Chemistry

**LASC Categories:** LAB, NSP

Chemical and physical properties of inorganic, organic and biochemical compounds with implications for human health and environment.

Ancillary course - Nursing program. Three lecture hours and three laboratory hours per week.

Fall and Spring and every year. 4 Credits

## CH-120 General Chemistry I

**LASC Categories:** NLL, QR

**Prerequisites:** Math placement exam score of 5 or above required.

Modern survey of chemistry. Topics include chemical equations, properties of gases, atomic structure, periodic table, chemical bonding, chemistry of carbon. Three lecture hours and three laboratory hours per week. CH-120 and CH-121 provide the foundation for further courses in chemistry.

Every year. 4 Credits

## CH-121 General Chemistry II

**LASC Categories:** NLL

**Prerequisites:** CH-120 with a minimum grade of C-.

Continuation of CH120. Topics include elements of thermodynamics, acids and bases, reaction rates, oxidation-reduction reactions, and electrochemistry. Three hours of lecture and a three-hour laboratory per week.

Spring only and every year. 4 Credits

## CH-193 Special Topics in Chemistry for First Year Students

**LASC Categories:** FYS

Introductory level course covering topics of special interest to first-year students.

Every year. 3 Credits

## CH-201 Organic Chemistry I (lecture)

**Prerequisites:** CH-120 and CH-121 with a C- or above.

Structure, reactions, mechanisms, and stereochemistry of the alkanes, alkenes, alkynes, dienes, alkyl halides. Introduction to aromatic chemistry.

Every year. 3 Credits

## CH-202 Organic Chemistry II (lecture)

**Prerequisites:** CH-201 with a C- or above.

Continuation of CH-201. Reactions and mechanisms of aromatic chemistry; structures and reactions of alcohols, ethers, carboxylic acids, aldehydes, ketones.

Every year. 3 Credits

## CH-203 Organic Chemistry Laboratory I

**LASC Categories:** NLL

**Prerequisites or Corequisite:** CH-201 with a C- or above.

Techniques of preparation, purification, and identification of aliphatic compounds. One four-hour laboratory per week.

Every year. 2 Credits

## CH-204 Organic Chemistry Laboratory II

**LASC Categories:** NLL

**Prerequisites:** CH-203 with a C- or above.

**Prerequisites or Corequisite:** Corequisite: CH-202 (C- or better)

Application of basic and more advanced techniques to increasingly complicated synthetic problems. One four-hour laboratory per week. Every year. 2 Credits

## CH-210 Chemical Analysis: an Introduction to Modern Methods

**LASC Categories:** NLL, WAC

**Prerequisites:** CH-120, CH-121 (minimum grade C-), and EN-102.

Introduction to modern methods of chemical analysis including gravimetry, acid-base and redox titrations, potentiometry, UV-visible and atomic absorption spectrophotometry, and gas and HPLC chromatography. Three lecture hours and four laboratory hours per week.

Every year. 5 Credits

## CH-215 Science of Stuff

**LASC Categories:** NSP, LAB

Students will engage in both lecture and hands-on activities to explore the synthesis/production, and properties of the "stuff" that makes up the world around us (e.g. concrete, plastic, paper, etc.). There will be a focus on the application of the scientific method, scientific reporting, and increasing scientific literacy by accessing the primary literature, studying current events, and the public perception of "science".

Every year. 4 Credits

## CH-250 Instrumental Technology for Forensic Analysis

**LASC Categories:** NSP, QAC, LAB

**Prerequisites:** CH-120 and CH-121, minimum grade C- or take CH-112, minimum grade C-.

Introduction to instrumental techniques used to analyze crime scene evidence. Includes HPLC, IR spectrometry, Atomic spectroscopy, and GC-MS. Three lecture hours and three lab hours per week.

Other or on demand. 4 Credits

## CH-260 Chemistry Literature Seminar

**Prerequisites:** CH-201 and CH-203

This course will serve to provide a foundation for chemistry majors in searching, evaluating, and using up-to-date chemical literature resources. Additionally, students will gain first-hand experience in scientific word processing, production of presentations (posters and slide shows), presentation (written and oral) scientific data, and chemical drawing software. This course will also introduce students to the wide variety of career and post-bachelor degree opportunities for chemists in addition to the different fields of chemistry (organic, inorganic, biochemistry, physical, analytical, etc.).

Spring only and every year. 1 Credit

## CH-290 Ind Study: Chemistry

Students will be introduced to the concepts of laboratory research through involvement in an original research project.

Fall and Spring and every year. 1-6 Credits

## CH-301 Physical Chemistry I (Lecture Only)

**Prerequisites:** CH-120, CH-121, MA-200, MA-201, PY-241, and PY-242 with a C- or above.

Study of quantum theory, chemical bonding, spectroscopy, molecular structure, and computational molecular modeling. Three lecture hours per week.

Every year. 3 Credits

**CH-302 Physical Chemistry II (Lecture Only)****Prerequisites:** CH-301 with a grade of C- or better.

Continuation of CH-301. Study of first, second, and third laws of thermodynamics, and of chemical solution, and phase equilibria. Three lecture hours per week.

Every year. 3 Credits

**CH-303 Physical Chemistry Laboratory I****LASC Categories:** NLL**Prerequisites or Corequisite:** CH-301 with a C- or above.

Laboratory deals with methods of physical measurement of chemical systems and their application to the determination of molecular structure, spectroscopy and thermodynamic data. One four-hour laboratory per week, lecture is CH301.

Other or on demand. 2 Credits

**CH-312 Tackling Global Issues using STEM****Prerequisites:** Complete 15 credits at the 100/200 level in at least 4 categories from the STEM minor.

The STEM Seminar is aimed to engage cohorts of students to develop and communicate solutions to real-world problems using the knowledge they've garnered during the courses above but also bringing the advanced skills they've gained during their major coursework to bear on a problem of their choosing. They will gain first-hand experience in choosing and defining a problem, identifying the issues that need to be addressed, developing plausible solutions, and communicating those ideas/solutions to a broad audience. Rotating global issues will be chosen each semester.

Every year. 3 Credits

**CH-320 Environmental Chemistry****LASC Categories:** NLL**Prerequisites:** CH-120 and CH-121 with a C- or above.

Chemistry of the atmosphere, soil, and natural water systems, air and water pollution, water treatment, hazardous wastes and pollution control. Lab techniques including sampling and analysis of environmental media. Lecture 3 hours per week and Lab will meet once a week for 3 hours.

Fall only and every year. 4 Credits

**CH-330 Environmental Toxicology****Prerequisites:** CH-201 or CH-320 with a C- or above.

Topics include the pharmacological and biochemical properties of toxins and the effects of toxins on human health, including the assessment of risk(s).

Every 2-3 years. 3 Credits

**CH-335 Green Chemistry****Prerequisites:** CH-201 or CH-320 with a C- or above.

This course will provide an understanding of the fundamentals of green chemical design that either eliminates or reduces the use or generation of hazardous substances. Three hours of lecture/lab per week.

Every 2-3 years. 3 Credits

**CH-340 Advanced Inorganic Chemistry****Prerequisites:** CH-120, CH-121, CH-201, or CH-202, with a C- or above. CH-301 recommended.

This course is a survey of the chemistry of the inorganic elements, focusing on the relationship between electronic structure, physical properties, and reactivity across the periodic table.

Every 2-3 years. 3 Credits

**CH-350 Medicinal Chemistry****Prerequisites:** CH-201 and CH-202 with a C- or above.

A study of how drugs work and the science and technology of modern drug discovery illustrated with case histories. Three lecture hours per week.

Every 2-3 years. 3 Credits

**CH-355 Molecular Pharmacology****Prerequisites:** CH-201, CH-202, BI-141, with a C- or above.**Prerequisites or Corequisite:** CH-410, with a C- or above.

Course examines the interdisciplinary science of pharmacology from a chemical perspective. Topics include pharmacotherapeutics, pharmacokinetics, pharmacodynamics, pharmacognosy, pharmacy and toxicology. Three lecture hours per week.

Every 2-3 years. 3 Credits

**CH-360 Introduction to Materials Science****Prerequisites:** CH-120, CH-121 and either PY-221 and PY-222 or PY-241 and PY-242 with a C- or above.

Physical structure of solids. Electrical, magnetics, thermal, and optical properties of solids, liquids, and soft matter. Structure-property relationships in materials.

Every year. 3 Credits

**CH-370 Introduction to Nuclear Science****Prerequisites:** CH-120, CH-121, MA-200, and either PY-221 and PY-222 or PY-241 and PY-242 with a C- or above.

Fundamentals of nuclear science. Topics include nuclear structure and forces, radioactive decays, nuclear reactions, and modern applications.

Every 2-3 years. 3 Credits

**CH-402 Advanced Organic Chemistry****Prerequisites:** CH-202 and CH-204 with a C- or above.

This advanced organic chemistry course will continue the study of synthetic organic reactions and mechanisms: stereochemical features including conformation and stereoelectronic effects; reaction dynamics and special reactive intermediates. It is a course built on the foundation of Organic Chemistry I &amp; II and is appropriate for upper-level undergraduates. This course will also be an immersive overview of organic reactivity, the use and synthetic manipulations of functional groups, and total synthesis tactics.

Alternating and other or on demand. 3 Credits

**CH-408 Directed Study: Chemistry**

Directed study offers students, who because of unusual circumstances may be unable to register for a course when offered, the opportunity to complete an existing course with an established syllabus under the direction and with agreement from a faculty member.

3-4 Credits

**CH-410 Biochemistry I****LASC Categories:** NLL**Prerequisites:** CH-201 with a C- or above.

The chemistry of proteins, nucleic acids, carbohydrates, and lipids; enzymes, biological oxidations; and correlations in intermediary metabolism. Three hours of lecture and a three-hour laboratory per week.

Every year. 4 Credits

**CH-411 Biochemistry II****LASC Categories:** NLL**Prerequisites:** CH-410 or BI-410 with a C- or above.

The generation and storage of metabolic energy; biosynthesis of macromolecular precursors, DNA, RNA, and protein; and biochemical regulation. Three hours of lecture and three hours of lab per week.

Every 2-3 years. 4 Credits

**CH-435 Advanced Laboratory Experience****LASC Categories:** LAB, NLL**Prerequisites:** CH-204 and CH-210 and CH-303 CH-303 with a C- or above.

Problem based laboratory class that incorporates topics from the various disciplines within chemistry. This course requires laboratory skills learned in previous lab courses. Students will devise and execute their own experiments associated with the topics being covered. This course is intended to provide a more realistic approach to solving research type problems. With guidance from the instructors, students will bring their project to completion and present their findings.

Spring only and every 2-3 years. 2 Credits

**CH-440 Organometallics for Organic Synthesis****Prerequisites:** CH-201 CH-201 with a C- or above.

Have you ever wondered about the elements below carbon on the periodic table that we never talk about in organic chemistry? Now is your chance to learn about the transition metals and the role they play in organic synthesis. We will learn about organometallic complexes and how they are used in modern industrial processes. Knowledge of 18-electron complexes, ligand types, and organometallic mechanisms will allow us to study catalysis and its role in the manufacture of modern commodity products such as polymers, pharmaceuticals, and fine chemical precursors.

Fall only and every 2-3 years. 3 Credits

**CH-450 Computational Chemistry****Prerequisites:** CH-301 with a C- or above.

Modern theoretical methods used in studying molecular structure, bonding, and reactivity. Application of these theories to various chemical systems.

Every 2-3 years. 3 Credits

**CH-455 Special Topics in Chemistry**

Exploration of frontier areas of chemistry, including chemical kinetics, quantum chemistry, polymers, spectroscopy, materials science, environmental bioinorganic and medicinal bioinorganic and medicinal chemistry. Prerequisites: 18 credits in Chemistry and consent of Department.

Every 2-3 years. 3-4 Credits

**CH-470 Instrumental Analysis****LASC Categories:** NLL**Prerequisites:** CH-120, CH-121, and CH-210 or CH-301 with a C- or above.

Advanced level survey of instrumental methods of separation and analysis including spectrophotometry, potentiometry, polarography, and chromatography. Laboratories are project-oriented. Two lecture hours and six laboratory hours per week.

Every 2-3 years. 4 Credits

**CH-475 Chemistry Seminar****LASC Categories:** CAP**Prerequisites:** CH-260 and 25 credits in Chemistry.

Contemporary developments in chemistry, review of technical literature in both print and electronic format, preparation and presentation of technical paper. [Prerequisite: Successful completion of 25 Chemistry credits or special permission of instructor.]

Every year. 1 Credit

**CH-480 Internship: Chemistry**

Project completed at an institution other than Worcester State by a student with a non-Worcester State sponsor and Worcester State liaison.

Every year. 1-6 Credits

**CH-492 Advanced Chemistry Research Methods**

Students develop and execute a research project in a field of chemistry under the direction of a faculty member. This may include the development of a formal research proposal in collaboration with the faculty mentor, conducting needed background literature search, data collection through appropriate lab experiments and, analysis of data and production of a research paper summarizing the findings. Permission of instructor.

Every year. 1-6 Credits