

Chemistry

FACULTY: Donald Calbreath, Tony Mega, Karen Stevens

chemistry@whitworth.edu

Requirements for a Chemistry Major, B.A. (46)

One of the following:	3
CH 161 Principles of Chemistry I	
CH 162 Honors Principles of Chemistry I	
CH 161L Principles of Chemistry I Lab	1
CH 271 Organic Chemistry I	3
CH 271L Organic Chemistry I Lab	1
CH 278 Organic Chemistry II	3
CH 278L Organic Chemistry II Lab	1
CH 281 Principles of Chemistry II	3
CH 281L Principles of Chemistry II Lab	1
CH 481 Seminar	1
CH 483 Seminar	1
Three of the following:	12
CH 351 Inorganic Chemistry plus lab	
CH 401W Biochemistry I plus lab	
Either: CH 335W Analytical Chemistry plus lab	
or CH 336 Spectroscopic Analysis plus lab	
Either: CH 421W Thermochemistry plus lab	
or CH 423W Quantum Chemistry plus lab	
MA 110 Calculus I	4
MA 111 Calculus II	4
PS 151 General Physics I	4
PS 153 General Physics II	4
For teacher certification, the following additional courses are required:	
EDU455 Methods of Teaching Science: Secondary	2
CO 350 Western Civilization III: The Scientific Tradition	4

Requirements for a Chemistry Major, B.S. (65)

One of the following:	.....	3
CH 161	Principles of Chemistry I	3
CH 162	Honors Principles of Chemistry I	
CH 161L	Principles of Chemistry I Lab	1
CH 271	Organic Chemistry I	3
CH 271L	Organic Chemistry I Lab	1
CH 278	Organic Chemistry II	3
CH 278L	Organic Chemistry II Lab	1
CH 281	Principles of Chemistry II	3
CH 281L	Principles of Chemistry II Lab	1
CH 335W	Analytical Chemistry	3
CH 335L	Analytical Chemistry Lab	1
CH 336	Spectroscopic Analysis	3
CH 336L	Spectroscopic Analysis Lab	1
CH 351	Inorganic Chemistry	3
CH 351L	Inorganic Chemistry Lab	1
CH 401W	Biochemistry I	3
CH 401L	Biochemistry I Lab	1
CH 421W	Thermochemistry	3
CH 421L	Thermochemistry Lab	1
CH 423W	Quantum Chemistry	3
CH 423L	Quantum Chemistry Lab	1
CH 481	Seminar	1
CH 483	Seminar	1
Three credits of chemistry research:	.....	3
Either:	CH 493 Literature Preparation for Research (1)	
	CH 494 Research in Chemistry (2)	
or	CH 496 Off-Campus Research in Chemistry (3)	
MA 110	Calculus I	4
MA 111	Calculus II	4
PS 151	General Physics I	4
PS 153	General Physics II	4
One of the following:	.....	4
MA 210	Calculus III	
PS 251W	General Physics III	
For teacher certification, the following additional courses are required:		
EDU455	Methods of Teaching Science: Secondary	2
CO 350	Western Civilization III: The Scientific Tradition	4

Tracks in Chemistry

Each track requires the following foundational courses: (45)

One of the following:	.....	3
CH 161	Principles of Chemistry I	3
CH 162	Honors Principles of Chemistry I	
CH 161L	Principles of Chemistry I Lab	1
CH 271	Organic Chemistry I	3
CH 271L	Organic Chemistry I Lab	1
CH 278	Organic Chemistry II	3
CH 278L	Organic Chemistry II Lab	1
CH 281	Principles of Chemistry II	3
CH 281L	Principles of Chemistry II Lab	1
CH 335W	Analytical Chemistry	3
CH 335L	Analytical Chemistry Lab	1
CH 336	Spectroscopic Analysis	3
CH 336L	Spectroscopic Analysis Lab	1
CH 481	Seminar	1
CH 483	Seminar	1

Three credits of chemistry research:	3
Either	CH 493 Literature Preparation for Research (1)
	CH 494 Research in Chemistry (2)
or	CH 496 Off-Campus Research in Chemistry (3)
MA 110	Calculus I 4
MA 111	Calculus II 4
PS 151	General Physics I 4
PS 153	General Physics II 4

Biochemistry Track (68)

Foundational courses	45
CH 401W	Biochemistry I 3
CH 401L	Biochemistry I Lab 1
CH 403W	Biochemistry II 3
One of the following:	4
CH 421W	Thermochemistry plus lab
CH 423W	Quantum Chemistry plus lab
BI 150	Cell Biology 2
BI 152	Animal Biology 2
BI 153	Plant Biology 2
BI 154	Microbial Biology 2
BI 399	Molecular Biology 3
BI 399L	Molecular Biology Lab 1

Physical Chemistry Track (68)

Foundational courses	45
CH 421W	Thermochemistry 3
CH 421L	Thermochemistry Lab 1
CH 423W	Quantum Chemistry 3
CH 423L	Quantum Chemistry Lab 1
MA 210	Calculus III 4
PS 251W	General Physics III 4
Two additional approved math or physics courses	7

Requirements for a Chemistry Minor or Supporting Endorsement in Chemistry (20)

CH 161	Principles of Chemistry I 3
CH 161L	Principles of Chemistry I Lab 1
CH 271	Organic Chemistry I 3
CH 271L	Organic Chemistry I Lab 1
CH 281	Principles of Chemistry II 3
CH 281L	Principles of Chemistry II Lab 1
Two of the following:	8
CH 278*	Organic Chemistry II plus lab
CH 351	Inorganic Chemistry plus lab
Either:	CH 335W Analytical Chemistry* plus lab or
	CH 336 Spectroscopic Analysis plus lab
Either:	CH 421W Thermochemistry plus lab or
	CH 423W Quantum Chemistry plus lab

*This course is required for students seeking teacher certification.

The following additional courses are required for certification:

EDU455	Methods of Teaching Science: Secondary 2
CO 350	Western Civilization III: The Scientific Tradition 4

Requirements for a Biochemistry Minor (20)

CH 161	Principles of Chemistry I	3
CH 161L	Principles of Chemistry I Lab	1
BI 150	Cell Biology	2
BI 152	Animal Biology	2
CH 271	Organic Chemistry I	3
CH 271L	Organic Chemistry I Lab	1
CH 278	Organic Chemistry II	3
CH 278L	Organic Chemistry II Lab	1
CH 401W	Biochemistry I	3
CH 401L	Biochemistry I Lab	1

Requirements for a Science Primary Endorsement for majors in Biology, Chemistry, or Physics

BI 150	Cell Biology	2
BI 152	Animal Biology	2
BI 153	Plant Biology	2
BI 154	Microbial Biology	2
CH 161/162	Principles of Chemistry I	3
CH 161L	Lab: Principles of Chemistry I	1
One of the following:	.....	4
CH 271	Organic Chemistry plus lab	
CH 281	Principles of Chemistry II plus lab	
PS 151	General Physics I	4
PS 153	General Physics II	4
One of the following:	.....	4
GL 131	Understanding Earth	
GL 139	Environmental Geology	
PS 141	Introduction to Astronomy	
EDU455	Methods of Teaching Science: Secondary	2
CO 350	Western Civilization III: The Scientific Tradition	4

Nutrition Course

NF 315 Nutrition 3
 Consideration of nutrients and their functions in the body. Discussion of nutrition and health, clinical applications of nutrition, facts and fallacies about diet. Prerequisite: CH 163. Fall semester.

Natural Science Courses

NS 201 Inquiry Science: Physical Science 2
 This course provides science content and models hands-on science instruction in an inquiry-based format. Focus is on scientific inquiry and how to ask and answer science questions. For elementary education students.

Chemistry Courses

CH 101 Introduction to Chemistry 3
 An exploration of fundamental concepts in chemistry for nursing majors and other selected allied health fields. Recommended for science majors whose chemistry background is not adequate for initial placement in CH 161. Fall semester.

CH 101L Introduction to Chemistry Lab 1
 Basic laboratory practices, titration, radioisotope measurement, simple synthesis. Prerequisite: concurrent enrollment in CH 101. Fall semester.

- CH 112 Chemistry and Health** 3
Applications of chemical principles to concepts of health and disease. Overview of chemistry discoveries and their contributions to understanding current health issues. For non-majors. Jan Term, occasionally.
- CH 115 World of Organic Chemistry** 3
An introduction to organic chemistry. Topics include spectroscopy, covalent bonding, molecular structure, naming molecules, stereochemistry, and understanding chemical reactions. Important bioorganic molecules will also be studied. Prerequisite: one year high school chemistry or biology. For non-majors. Jan Term, occasionally.
- CH 122 Chemistry in Modern Living** 3
Overview of current chemical issues, for the non-science student. Topics may include air pollution, global warming, ozone layer, acid rain, nuclear energy, solar energy, plastics, nutrition and/or pharmaceutical drugs. Basic math and algebra skills will be used. For non-majors. Jan Term, occasionally.
- CH 161 Principles of Chemistry I** 3
Foundational course in chemistry. Treatment of measurement concepts, atomic and molecular theories, radioactivity, chemical reactions, basic calculations. Prerequisite: one year of high school chemistry and a passing score on the mathematics proficiency examination. Students without this prerequisite must take CH 101 (Introduction to Chemistry) before electing CH 161. Fall semester.
- CH 161L Principles of Chemistry I Lab** 1
Basic laboratory techniques, simple synthesis, titration, qualitative analysis. Prerequisite: CH 161, CH 162, or concurrent enrollment. Fall semester and occasionally spring semester.
- CH 162 Honors Principles of Chemistry I** 3
An advanced treatment of topics covered in CH 161, with emphasis on environmental applications.
- CH 163 Bioorganic Chemistry** 3
Fundamentals of organic chemistry and biochemistry for nursing students. Organic structure, isomerism, nomenclature. Properties and reactions of lipids, carbohydrates, proteins. Prerequisite: CH 101, CH 161, or CH 161. Spring semester.
- CH 163L Bioorganic Chemistry Lab** 1
Simple quantitative analysis, separation techniques, enzyme studies. Prerequisite: concurrent enrollment in CH 163. Spring semester.
- CH 196 Topics in Chemistry** 1-3
Selected lower-division topics in chemistry. Periodic offering.
- CH 271 Organic Chemistry I** 3
Detailed treatment of basic organic chemistry concepts. Nomenclature, conformational and structural analysis, basic reaction mechanisms. Prerequisite: CH 161 or CH 162. Spring semester.
- CH 271L Organic Chemistry I Lab** 1
Preparation, purification and identification of organic compounds. An introduction to organic synthesis. Prerequisite: CH 271 and CH 161L. Fall semester.
- CH 278 Organic Chemistry II** 3
Reactions of organic molecules, mechanisms of reactions and how such reactions may be employed in the synthesis of new compounds. Prerequisite: CH 271. Fall semester.
- CH 278L Organic Chemistry II Lab** 1
Synthetic techniques for organic compounds, design of multi-step synthesis. Prerequisite: CH 278. Spring semester.

- CH 281 Principles of Chemistry II** **3**
 Properties of solutions, introduction to kinetics, acid-base concepts, equilibria, nuclear radioactivity, electrochemistry, and thermochemistry. Prerequisite: CH 161 or CH 162, and CH 161L. Spring semester.
- CH 281L Principles of Chemistry II Lab** **1**
 Titrations, equilibrium constant determination, reaction kinetics, electrochemical studies. Prerequisite: concurrent enrollment in CH 281. Spring semester.
- CH 335W Analytical Chemistry** **3**
 Sampling, basic statistics, quality control, UV-visible absorption techniques, fluorescence measurements, ion-selective electrodes, atomic absorption. Prerequisite: CH 271, CH 281 (CH 278 suggested). Fall semester, odd years.
- CH 335L Analytical Chemistry Lab** **1**
 Statistical analysis of data, separation techniques, use of instrumentation in solving analytical problems. Prerequisite: concurrent enrollment in CH 335W. Fall semester, odd years.
- CH 336 Spectroscopic Analysis** **3**
 Advanced treatment of the most common spectroscopic techniques including UV-Vis, IR, NMR, and GC-MS. Prerequisite: CH 278, CH 281. Spring semester, even years.
- CH 336L Spectroscopic Analysis Lab** **1**
 Use of instrumentation in solving analytical problems. Prerequisite: concurrent enrollment in CH 336. Spring semester, even years.
- CH 351 Inorganic Chemistry** **3**
 A study of the elements (especially metals) and their compounds. Bonding, crystal field theory, coordination compounds, organometallics, symmetry, group theory and descriptive inorganic chemistry. Prerequisites: CH 281 and MA 110. Spring semester, even years.
- CH 351L Inorganic Chemistry Lab** **1**
 Approaches to synthesis of inorganic compounds. Prerequisite: concurrent enrollment in CH 351. Spring semester, even years.
- CH 396 Topics In Chemistry** **1-3**
 Selected upper-division topics in chemistry. Periodic offering.
- CH 401W Biochemistry I** **3**
 Structure and function of classes of biochemical materials. Metabolic conversions, biochemical energy. Prerequisite: CH 271, BI 150, and BI 152 or by permission. Fall semester, even years.
- CH 401L Biochemistry I Lab** **1**
 Separations in biochemical systems, protein structure, enzyme kinetics, study of metabolic pathways. Prerequisite: concurrent enrollment in CH 401W. Fall semester, even years.
- CH 403W Biochemistry II** **3**
 Membrane structure and function, active transport, receptors, metabolic control, biochemical information systems, drug action, neurochemistry, endocrine biochemistry. Prerequisite: CH 401W or by permission. Spring semester, odd years.
- CH 421W Thermochemistry** **3**
 Kinetics, thermodynamics, liquids and solids, changes of state, phase diagrams. Prerequisites: CH 281, PS 153, and MA 111. Fall semester, even years.
- Ch 421L Thermochemistry Lab** **1**
 Kinetic and thermodynamic studies. Prerequisite: concurrent enrollment in CH 421W. Fall semester, even years.
- CH 423W Quantum Chemistry** **3**
 A study of quantum mechanics and its significance in rotational, vibrational and electronic spectroscopy. Prerequisites: CH 281, PS 153 and MA 111. Spring semester, odd years.

- CH 423L Quantum Chemistry Lab** **1**
Infrared and electronic spectroscopy, laser spectroscopy and computer modeling of quantum chemistry problems. Prerequisite: concurrent enrollment in CH 423W. Spring semester, odd years.
- CH 481, 483 Seminars** **1**
Discussion of current chemical topics. Student presentations, guest lectures, attendance at local scientific meetings. By permission; usually requires junior standing.
- CH 493 Literature Preparation for Research** **1**
This course should be taken during the term preceding the one in which the student plans to carry out a research project. After selecting a research project with a faculty member, the student will perform a literature search and initiate ordering of any necessary chemical supplies and/or equipment needed to perform the research. By permission.
- CH 494 Research in Chemistry** **2**
Student pursuit of a laboratory problem of fundamental interest, under direct guidance of a faculty member. At the conclusion of the research, students will be required to submit their notebooks for evaluation, write a paper, and undertake one of the following: make a poster display, present a seminar on the research findings, or create a website of their research. By permission.
- CH 496 Off-campus Research in Chemistry** **3**
Students may perform a research project at an off-campus facility such as another university, an industry site or a national laboratory. Forty hours of research experience are expected to be completed for each semester credit granted. Thus, 120 hours of research work must be performed in order to earn three credits. During the semester in which the student returns to campus, he or she will be evaluated based on faculty conversations with the student's field supervisor. The student will also be expected to write a paper, and to undertake one of the following: present a seminar on the research findings, create a poster display, or create a website on the research. This course can only be taken with prior faculty approval.
- Directed Studies**
Independent Studies (191, 291, 391, 491); Readings (386, 486); Internships (290, 490); Field Studies (280, 480); and Teaching Assistantships (395, 495). See Page 169 for details.