

CHEMISTRY B.S.

Program Learning Outcomes

- Vanguard University Chemistry graduates should have demonstrated an understanding of the major concepts, theories, and experimental evidence of and the ability to solve problems in: Analytical Chemistry, Biological Chemistry, General Chemistry, Organic Chemistry, and Physical Chemistry;
- Demonstrated competence in practical laboratory-based aspects of chemistry, including: basic laboratory skills, selection and use of modern instruments, proper standardization and calibration practices, and computer-based data acquisition;
- Developed critical thinking skills and problem-solving approaches using scientific methods to: identify the relevant factors which define problems, develop and evaluate methods, employ appropriate statistical analysis and instrumentation, and draw reasonable conclusions;
- Identified the principles in the American Chemical Society Ethics Code, recognized ethical components in complex situations, designed solutions appropriate to professional standards, and practiced science in a safe manner;
- Demonstrated comprehension of chemical literature and the ability to communicate professionally about chemistry through writing in an accepted scientific format and orally in a public venue; and
- Acquired familiarity with the process of chemical research through the formal participation in an undergraduate research project that involved: project management, methods development, data analysis, and written contribution to the discipline in the form of a presentation or publication.

Requirements

Code	Title	Units
Core Curriculum Requirements (https://catalog.vanguard.edu/interdisciplinary-offerings/core-curriculum/) ¹		46
Chemistry Major Requirements		75
General Electives		0
Total Units		121

Chemistry Major Requirements

Code	Title	Units
Lower Division:		
CHEM-120 & 120L	General Chemistry I and General Chemistry I Lab ²	4
CHEM-121 & 121L	General Chemistry II and General Chemistry II Lab	4
CHEM-252 & 252L	Analytical Chemistry and Analytical Chem Techniques	4
MATH-180C	Calculus 1	4
MATH-181C	Calculus II	4
MATH-281	Multivariable Calculus	4
PSCI-223C & 223CL	Mechanics of Solids and Fluids and Mechanics of Solids and Fluids Lab	4

PSCI-225 & 225L	Electricity and Magnetism and Electricity and Magnetism Lab	4
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Upper Division:		
CHEM-304 & 304L	Organic Chemistry I and Organic Chemistry Techniques I	4
CHEM-305 & 305L	Organic Chemistry II and Organic Chemistry Technqs II	4
CHEM-430 & 430L	Biochemistry and Experimental Tech/Biochemistry	4
CHEM-435	Advanced Biochemistry	3
CHEM-440 & 440L	Instrumental Analysis and Instrumental Analysis Lab	4
CHEM-456 & 456L	Physical Chemistry: Thermodynamics and Physical Chemistry Technique Lab	4
CHEM-457	Physical Chemistry: Kinetics	2
CHEM-458	Physical Chemistry: Quantum Mechanics	2
CHEM-499C	Chemistry Capstone Seminar	2

Electives:		
Complete 6 or more units of the following:		6
CSCI-208	Java Programming	
CSCI-218	Python Programming	
ENGR-307	Computational Problem Solving	
MATH-285	Introduction to Advanced Mathematics	
MATH-300	Linear Algebra	
MATH-310	Differential Equations	
MATH-365	Probability and Statistics	
MATH-390	Numerical Analysis	
PSCI-227	Waves, Optics and Modern Physics	

Complete 6 or more Units in MATH, BIOL, CHEM, ENVR, ENGR, CSCI, DSCI 300/400 Level 6

Research Requirement:		
Complete 2 or more units using one of the following:		2
CHEM-450	UG Research Or Internship Program	
CHEM-485	Undergraduate Research	
CHEM-488	Chemistry Senior Project	

Total Units 75

1

Number of units required from the Core Curriculum not included in the major requirements below.

2

See CHEM-120 General Chemistry I course description for prerequisites.

Four Year Plan

Disclaimer: This sample Four Year Plan is provided as a guide for the recommended sequencing of courses. Vanguard University requires that students complete a minimum of 120 units of required course work as outlined on the Requirements tab in order to receive a Bachelor of Arts, Bachelor of Music, Bachelor of Science, or Bachelor of Science in Nursing degree. It is the student's responsibility to confirm with the department the course rotation before enrolling in courses. If applicable, please note the footnotes at the bottom of the page for additional information related



to courses listed in a particular year and term. Questions, contact the Department of Physical Sciences and Applied Mathematics.

Study Abroad Participation: Students interested in participating in the university's Study Abroad programs are encouraged to reach out to the Global Education and Outreach Office (studyabroad@vanguard.edu) for more information and collaboration in their academic course planning. Students using Education and Training Benefits through the U.S. Department of Veteran Affairs are encouraged to also reach out to the School Certifying Official (veteranscertifyingofficial@vanguard.edu) for more information regarding how benefits can be applied.

Course	Title	Units
Year 1 Term 1		
CORE-100C	Cornerstone	1
CHEM-120	General Chemistry I	3
CHEM-120L	General Chemistry I Lab	1
MATH-180C	Calculus 1	4
ENGL-120C	Persuasive Writing	3
NT-101C	New Testament Survey	3
KINE-148C	Lifetime Fitness and Wellness Lecture	3
Units		18
Year 1 Term 2		
CHEM-121	General Chemistry II	3
CHEM-121L	General Chemistry II Lab	1
FINA-PLCR	Fine Arts Core Curriculum Requirement	3
MATH-181C	Calculus II	4
HIST-PLCR1	History Core Req (US Hist Or Democracy)	3
Units		14
Year 2 Term 1		
PSCI-223C	Mechanics of Solids and Fluids	3
PSCI-223CL	Mechanics of Solids and Fluids Lab	1
MATH-281	Multivariable Calculus	4
CHEM-252	Analytical Chemistry	3
CHEM-252L	Analytical Chem Techniques	1
CHEM-304	Organic Chemistry I	3
CHEM-304L	Organic Chemistry Techniques I	1
THEO-101C	Foundations of Christian Life	3
Units		19
Year 2 Term 2		
PSCI-225	Electricity and Magnetism	3
PSCI-225L	Electricity and Magnetism Lab	1
OT-201C	Old Testament Survey	3
CHEM-305	Organic Chemistry II	3
CHEM-305L	Organic Chemistry Technqs II	1
CHEM-PLHD34	3-4 Units from MATH, CSCI, PSCI	3-4
Units		14-15
Year 3 Term 1		
CHEM-456	Physical Chemistry: Thermodynamics	2
CHEM-440	Instrumental Analysis	2

CHEM-440L	Instrumental Analysis Lab	2
THEO-300C	Developing a Christian World View	3
ENGL-220C	Researched Writing	3
CHEM-PLHD34	3-4 Units from MATH, CSCI, PSCI	3-4
Units		15-16
Year 3 Term 2		
CHEM-457	Physical Chemistry: Kinetics	2
CHEM-458	Physical Chemistry: Quantum Mechanics	2
PSYC-103C	Introduction to Psychology	3
CHEM-PLHDL2	Physical Chemistry Technique Lab	1
CHEM-PLHD34U	3-4 Ud Units From Math, Csci, Psci	3-4
CHEM-PLHDRCH	Undergraduate Research	2-4
Units		13-16
Year 4 Term 1		
ENGL-230C	Literature and the Human Experience	3
COMM-201C	Speech Composition and Presentation	3
CHEM-430	Biochemistry	3
CHEM-430L	Experimental Tech/Biochemistry	1
HIST-PLCR2	History Core Requirement (World Civ)	3
Units		13
Year 4 Term 2		
CHEM-499C	Chemistry Capstone Seminar	2
CHEM-435	Advanced Biochemistry	3
CHIS-400C	Christian Heritage	3
SOC-PLCR	Social Science Core Curriculum Reqm't	3
CHEM-PLHD34U	3-4 Ud Units From Math, Csci, Psci	3-4
Units		14-15
Total Units		120-126

