

# BIOCHEMISTRY 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 ( <a href="https://catalog.vanguard.edu/interdisciplinary-offerings/core-curriculum/">https://catalog.vanguard.edu/interdisciplinary-offerings/core-curriculum/</a> ) <sup>1</sup>		46
Biochemistry Major Requirements		76
General Electives		0
<b>Total Units</b>		<b>122</b>

## Biochemistry Major Requirements

Code	Title	Units
<b>Lower Division:</b>		
BIOL-111 & 111L	Principles of Cell and Molecular Biology and Principles of Biology Lab, Principles of Cell/Molecular Biology Lab	4
CHEM-120 & 120L	General Chemistry I and General Chemistry I Lab	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 I	4
MATH-181C	Calculus II	4

PSCI-130C & 130CL	General Physics I and General Physics I Lab <sup>2</sup>	4
or PSCI-223C & 223CL	Mechanics of Solids and Fluids and Mechanics of Solids and Fluids Lab	
PSCI-131 & 131L	General Physics II and General Physics II Lab <sup>3</sup>	4
or PSCI-225 & 225L	Electricity and Magnetism and Electricity and Magnetism Lab	

<b>Upper Division:</b>		
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	3
CHEM-457	Physical Chemistry: Kinetics	2
CHEM-499C	Chemistry Capstone Seminar	2

<b>Electives:</b>		
Complete 4 or more Units in BIOL, CHEM, ENVR, ENGR, CSCI, DSCI at any level		4
Complete 4 or more Units in BIOL, CHEM, ENVR, ENGR, CSCI, DSCI 200/300/400 Level		4
Complete 8 or more Units in BIOL, CHEM, ENVR, ENGR, CSCI, DSCI 300/400 Level		8

<b>Research Requirement:</b>		
CHEM-450	UG Research Or Internship Program	2
or CHEM-481	Undergraduate Research	
or CHEM-484	Chemistry Senior Project	
or BIOL-485	Undergrad Biological Research	

**Total Units** **76**

<sup>1</sup> Number of units required from the Core Curriculum not included in the major requirements below.

<sup>2</sup> PSCI-130C/CL is trigonometry based and PSCI-223C/CL is calculus based.

<sup>3</sup> PSCI-131C/CL is trigonometry based and PSCI-225C/CL is calculus based.

## 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 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
<b>Year 1 Term 1</b>		
CORE-100C	Cornerstone	1
ENGL-120C	Persuasive Writing	3
CHEM-120	General Chemistry I	3
CHEM-120L	General Chemistry I Lab	1
MATH-180C	Calculus I	4
THEO-PLHD	Theology Core Requirement	3
KINE-148C	Lifetime Fitness and Wellness Lecture	3
<b>Units</b>		<b>18</b>
<b>Year 1 Term 2</b>		
CHEM-121	General Chemistry II	3
CHEM-121L	General Chemistry II Lab	1
BIOL-111	Principles of Cell and Molecular Biology	3
BIOL-111L	Principles of Biology Lab, Principles of Cell/ Molecular Biology Lab	1
MATH-181C	Calculus II	4
NT-101C	New Testament Survey	3
<b>Units</b>		<b>15</b>
<b>Year 2 Term 1</b>		
CHEM-252	Analytical Chemistry	3
CHEM-252L	Analytical Chem Techniques	1
PSCI-223C	Mechanics of Solids and Fluids	3
PSCI-223CL	Mechanics of Solids and Fluids Lab	1
CHEM-304	Organic Chemistry I	3
CHEM-304L	Organic Chemistry Techniques I	1
HIST-PLCR1	History Core Req (US Hist Or Democracy)	3
<b>Units</b>		<b>15</b>
<b>Year 2 Term 2</b>		
SOC-PLCR	Social Science Core Curriculum Req'm't	3
PSCI-225	Electricity and Magnetism	3
PSCI-225L	Electricity and Magnetsm Lab	1
OT-201C	Old Testament Survey	3
CHEM-305	Organic Chemistry II	3
CHEM-305L	Organic Chemistry Technqs II	1

CHEM-PLHDRCH	Undergraduate Research	2-4
<b>Units</b>		<b>16-18</b>
<b>Year 3 Term 1</b>		
CHEM-456	Physical Chemistry: Thermodynamics	2
THEO-300C	Developing a Christian World View	3
FINA-PLCR	Fine Arts Core Curriculum Requirement	3
CHEM-440	Instrumental Analysis	2
CHEM-440L	Instrumental Analysis Lab	2
CHEM-PLHD4	STEM Elective	4
<b>Units</b>		<b>16</b>
<b>Year 3 Term 2</b>		
COMM-201C	Speech Composition and Presentation	3
CHEM-PLUD4A	Upper Division STEM Elective (4 units)	4
CHEM-PLHD4	STEM Elective	4
CHEM-457	Physical Chemistry: Kinetics	2
CHEM-456L	Physical Chemistry Technique Lab	1-2
<b>Units</b>		<b>14-15</b>
<b>Year 4 Term 1</b>		
CHEM-430	Biochemistry	3
CHEM-430L	Experimental Tech/Biochemistry	1
HIST-PLCR2	History Core Requirement (World Civ)	3
ENGL-220C	Researched Writing	3
PSYC-103C	Introduction to Psychology	3
<b>Units</b>		<b>13</b>
<b>Year 4 Term 2</b>		
CHEM-499C	Chemistry Capstone Seminar	2
CHEM-435	Advanced Biochemistry	3
CHIS-400C	Christian Heritage	3
ENGL-230C	Literature and the Human Experience	3
CHEM-PLUD4A	Upper Division STEM Elective (4 units)	4
<b>Units</b>		<b>15</b>
<b>Total Units</b>		<b>122-125</b>

