

# CHEMISTRY, BACHELOR OF SCIENCE (B.S.) WITH A CONCENTRATION IN BIOCHEMISTRY

The curriculum in chemistry prepares students for graduate study in chemistry and related fields and for admission to schools of medicine, dentistry, pharmacy and veterinary medicine. It prepares students to teach in secondary schools or to work in chemical and industrial laboratories and in related fields of business and industry. The department also offers required and elective courses in chemistry to students in other programs of study.

The Department of Chemistry offers five areas of concentration for completing the Bachelor of Science in Chemistry: chemical science, professional chemist, professional chemist with honors, biochemistry and chemical modeling. With proper selection of electives, the degree satisfies admission requirements to most schools of medicine, dentistry, pharmacy and veterinary medicine.

The biochemistry concentration focuses on the biological aspects of chemistry, including molecular genetics and molecular biotechnology. This degree is another option for students planning to study medicine or dentistry.

## Student learning outcomes

Upon completing this program, students will know how to do the following:

### Chemistry core outcomes

- Demonstrate proficiency in the major concepts and theoretical principles of chemistry, critical thinking and problem-solving skills
- Demonstrate proficiency in laboratory skills, including wet chemistry and instrumental methods, and laboratory safety practices
- Demonstrate communication skills, both written and oral, needed to explain chemical phenomenon
- Demonstrate proficiency in scientific literacy skills including searching and reading scientific publications
- Demonstrate an understanding of the need for ethical practices in chemistry

### Biochemistry concentration-specific outcome

- Demonstrate proficiency in biochemical topics

## Special requirements

Students must complete 44-45 credits in chemistry and related courses and 44-46 credits of ancillary requirements in addition to general education requirements.

A minimum grade of C is required in each prerequisite course, except for CHEM 100, which requires a minimum grade of B.

Course	Title	Hours
CHEM 100	Introductory Chemistry (if required through placement qualifiers)	3
CHEM 101	General Chemistry I	3

CHEM 102	General Chemistry II	3
CHEM 301	Organic Chemistry	3
CHEM 302	Organic Chemistry	3
CHEM 309	Quantitative Analysis	3
CHEM 313	Physical Chemistry I	3
or CHEM 314	Physical Chemistry I with Math Modules	
CHEZ 101	General Chemistry Laboratory I	1
CHEZ 102	General Chemistry Laboratory II	1
CHEZ 301	Organic Chemistry Laboratory I	2
CHEZ 302	Organic Chemistry Laboratory II	2
CHEZ 309	Quantitative Analysis Laboratory	2

VCU students in other programs who wish to declare chemistry as their major must complete CHEM 101, CHEZ 101, CHEM 102 and CHEZ 102, each with a minimum grade of C and have a minimum GPA in their chemistry courses of 2.0.

## Degree requirements for Chemistry, Bachelor of Science (B.S.) with a concentration in biochemistry

Course	Title	Hours
<b>General education (<a href="http://bulletin.vcu.edu/undergraduate/undergraduate-study/general-education-curriculum/">http://bulletin.vcu.edu/undergraduate/undergraduate-study/general-education-curriculum/</a>)</b>		
Select 30 credits of general education courses in consultation with an adviser.		30
<b>Major requirements</b>		
• Major core requirements		
CHEM 102 & CHEZ 102	General Chemistry II and General Chemistry Laboratory II	4
CHEM 301 & CHEZ 301	Organic Chemistry and Organic Chemistry Laboratory I	5
CHEM 302 & CHEZ 302	Organic Chemistry and Organic Chemistry Laboratory II	5
CHEM 309 & CHEZ 309	Quantitative Analysis and Quantitative Analysis Laboratory	5
CHEM 315	Physical Chemistry II	3
CHEM 320	Inorganic Chemistry I	3
CHEM 398	Professional Practices and Perspectives Seminar	1
CHEM 313 or CHEM 314	Physical Chemistry I or Physical Chemistry I with Math Modules	3-4
CHEM 499	Chemistry Capstone Experience <sup>1</sup>	0
CHEZ 313	Physical Chemistry Laboratory I	2
• Concentration requirements		
CHEM 403	Biochemistry I	3
CHEM 404	Biochemistry II	3
Capstone requirement: one two-credit 400-level CHEZ course or two credits of CHEM 392 or CHEM 492 in addition to CHEM 403 or CHEM 404.		2
Major electives (select from list below)		5
<b>Ancillary requirements</b>		
BIOZ 151 & BIOZ 151	Introduction to Biological Sciences I and Introduction to Biological Science Laboratory I	4

BIOL 152 & BIOZ 152	Introduction to Biological Sciences II and Introduction to Biological Science Laboratory II	4
BIOL 300	Cellular and Molecular Biology	3
CHEM 101 & CHEZ 101	General Chemistry I and General Chemistry Laboratory I (both satisfy general education BOK for natural sciences and AOI for scientific and logical reasoning)	4
HUMS 202	Choices in a Consumer Society	1
MATH 200	Calculus with Analytic Geometry I (satisfies general education quantitative foundations)	4
MATH 201	Calculus with Analytic Geometry II	4
STAT 210 or STAT 212	Basic Practice of Statistics Concepts of Statistics	3
PHYS 201 or PHYS 207	General Physics I (either satisfies general education BOK for natural sciences and AOI for scientific and logical reasoning) University Physics I	4-5
PHYS 202 or PHYS 208	General Physics II University Physics II	4-5
Experiential fine arts <sup>2</sup>		1-3
Foreign language through the 102 level (by course or placement)		0-6
<b>Open electives</b>		
Select any course.		11-22
<b>Total Hours</b>		<b>120</b>

1

Students in this concentration meet the capstone requirement by taking at least one two-credit 400-level CHEZ course or two credits of CHEM 392 or CHEM 492 in addition to CHEM 404.

2

Course offered by the School of the Arts

The minimum number of credit hours required for this degree is 120.

## Major electives

Course	Title	Hours
BIOL 310	Genetics	3
CHEM 306	Industrial Applications of Inorganic Chemistry	3
CHEM 310	Medicinal Chemistry and Drug Design	3
CHEM 391	Topics in Chemistry	1-4
CHEM 392	Directed Study	1-4
CHEM 406	Inorganic Chemistry II	3
CHEM 409 & CHEZ 409	Instrumental Analysis and Instrumental Analysis Laboratory	5
CHEM 491	Topics in Chemistry	1-4
CHEM 492	Independent Study	1-4
CHEM 493	Chemistry Internship	1-3
CHEM 498	Honors Thesis	1

CHEM 504	Advanced Organic Chemistry I	3
CHEM 507	Introduction to Natural Products	3
CHEM 510	Atomic and Molecular Structure	3
CHEM 511	Chemical Thermodynamics and Kinetics	3
CHEM 512	Applied Molecular Modeling	3
CHEM 520	Advanced Inorganic Chemistry	3
CHEZ 400	Exploring the Frontiers of Chemistry: Research Methods	2
CHEZ 406	Inorganic Chemistry Laboratory	2
CHEZ 404	Biochemistry Laboratory	2
CHEZ 413	Advanced Physical Chemistry Laboratory	2

What follows is a sample plan that meets the prescribed requirements within a four-year course of study at VCU. Please contact your adviser before beginning course work toward a degree.

### Freshman year

Fall semester		Hours
BIOL 151 & BIOZ 151	Introduction to Biological Sciences I and Introduction to Biological Science Laboratory I	4
CHEM 101 & CHEZ 101	General Chemistry I and General Chemistry Laboratory I (both satisfy general education BOK for natural sciences and AOI for scientific and logical reasoning)	4
MATH 200	Calculus with Analytic Geometry I (satisfies general education quantitative foundations)	4
UNIV 111	Focused Inquiry I (satisfies general education UNIV foundations)	3
Play course video for Focused Inquiry I		
<b>Term Hours:</b>		<b>15</b>

Spring semester		Hours
BIOL 152 & BIOZ 152	Introduction to Biological Sciences II and Introduction to Biological Science Laboratory II	4
CHEM 102 & CHEZ 102	General Chemistry II and General Chemistry Laboratory II	4
HUMS 202	Choices in a Consumer Society	1
MATH 201	Calculus with Analytic Geometry II	4
UNIV 112	Focused Inquiry II (satisfies general education UNIV foundations)	3
Play course video for Focused Inquiry II		
<b>Term Hours:</b>		<b>16</b>

### Sophomore year

Fall semester		Hours
CHEM 301 & CHEZ 301	Organic Chemistry and Organic Chemistry Laboratory I	5
CHEM 398	Professional Practices and Perspectives Seminar	1

PHYS 201 or PHYS 207	General Physics I (either satisfies general education AOI for scientific and logical reasoning) or University Physics I	4-5
STAT 210 or STAT 212	Basic Practice of Statistics or Concepts of Statistics	3
UNIV 200	Advanced Focused Inquiry: Literacies, Research and Communication (satisfies general education UNIV foundations)	3

**Term Hours: 16-17**

#### Spring semester

CHEM 302 & CHEZ 302	Organic Chemistry and Organic Chemistry Laboratory II	5
CHEM 309 & CHEZ 309	Quantitative Analysis and Quantitative Analysis Laboratory	5
PHYS 202 or PHYS 208	General Physics II or University Physics II	4-5

**Term Hours: 14-15**

#### Junior year

##### Fall semester

BIOL 300	Cellular and Molecular Biology	3
CHEM 313 or CHEM 314	Physical Chemistry I or Physical Chemistry I with Math Modules	3-4
CHEZ 313	Physical Chemistry Laboratory I	2
Foreign language 101		3
General education course <sup>1</sup>		3

**Term Hours: 14-15**

##### Spring semester

CHEM 315	Physical Chemistry II	3
CHEM 320	Inorganic Chemistry I	3
Foreign language 102		3
General education course <sup>1</sup>		3
General education course <sup>1</sup>		3

**Term Hours: 15**

#### Senior year

##### Fall semester

CHEM 403	Biochemistry I	3
Major elective		3
Open electives		9

**Term Hours: 15**

##### Spring semester

CHEM 404	Biochemistry II	3
CHEM 499	Chemistry Capstone Experience <sup>2</sup>	0
Experiential fine arts		1-3
Major elective		2
Open electives		9

**Term Hours: 15-17**

**Total Hours: 120-125**

<sup>1</sup>

At least three additional general education courses (nine credits) are required. Three credits come from each of the following areas of inquiry: diversities in the human experience; creativity, innovation and aesthetic inquiry; and global perspectives. The latter two areas of inquiry courses should also fulfill the breadth of knowledge requirement from the areas of humanities/fine arts and social/behavioral sciences.

<sup>2</sup>

Students in this concentration meet the capstone requirement by taking at least one two-credit 400-level CHEZ course or two credits of CHEM 392 or CHEM 492 in addition to CHEM 403.

The minimum number of credit hours required for this degree is 120.