CHEMISTRY, BACHELOR OF SCIENCE (B.S.) WITH A CONCENTRATION IN CHEMICAL MODELING

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 chemical modeling concentration emphasizes areas of overlap between chemistry and the mathematical sciences and computer science. Students in this concentration will focus on learning the chemistry and computer technology for modeling the structure, properties and reactivity of molecules.

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

Chemical modeling concentration-specific outcome

- Demonstrate proficiency in computer programming and advanced math topics applied to molecular modeling

Special requirements

Students must complete 39-40 credits in chemistry and related major courses and 47 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 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 chemical modeling

Course	Title	Hours
General education (http://bulletin.vcu.edu/undergraduate/undergraduate-study/general-education-curriculum/)		
Select 30 credits of general education courses in consultation with an adviser.		30
Major requirements		
• 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 313	Physical Chemistry I	3-4
or CHEM 314	Physical Chemistry I with Math Modules	
CHEM 315	Physical Chemistry II	3
CHEM 320	Inorganic Chemistry I	3
CHEM 398	Professional Practices and Perspectives Seminar	1
CHEM 499	Chemistry Capstone Experience [1]	0
CHEZ 313	Physical Chemistry Laboratory I	2
• Concentration requirements		
CHEM 510	Atomic and Molecular Structure	3
or CHEM 512	Applied Molecular Modeling	
CHEZ 413	Advanced Physical Chemistry Laboratory	2
• Major electives		
Select from the list below.		3
Ancillary requirements		

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
CMSC 255	Introduction to Object-oriented Programming	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
MATH 302	Numerical Calculus	3
or MATH 310	Linear Algebra	
MATH 307	Multivariate Calculus	4
MEDC 541	Survey of Molecular Modeling Methods	1
PHYS 207 & PHYS 208	University Physics I and University Physics II (PHYS 207 satisfies general education BOK for natural sciences and AOI for scientific and logical reasoning)	10
STAT 210	Basic Practice of Statistics	3
or STAT 212	Concepts of Statistics	
Experiential fine arts [2]		1-3
Foreign language through the 102 level (by course or placement)		0-6
Open electives		
Select any course.		15-24
Total Hours		**120**

[1]

Students in this concentration meet the capstone requirement by taking CHEM 510 (http://bulletin.vcu.edu/search/?P=CHEM%20510) or CHEM 512 (http://bulletin.vcu.edu/search/?P=CHEM%20512) and CHEZ 413 (http://bulletin.vcu.edu/search/?P=CHEZ%20413).

[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
CHEM 306	Industrial Applications of Inorganic Chemistry	3
CHEM 391	Topics in Chemistry	1-4
CHEM 403	Biochemistry I	3
CHEM 404	Biochemistry II	3
CHEM 406	Inorganic Chemistry II	3
CHEM 409	Instrumental Analysis	3
CHEM 492	Independent Study	3
or CHEM 392	Directed Study	
CHEM 504	Advanced Organic Chemistry I	3
CHEM 510	Atomic and Molecular Structure (may select course not taken as major requirement)	3
or CHEM 512	Applied Molecular Modeling	
CHEM 511	Chemical Thermodynamics and Kinetics	3
CHEZ 400	Exploring the Frontiers of Chemistry: Research Methods	2
CHEZ 404	Biochemistry Laboratory	2
MATH 301	Differential Equations	3
OPER 327	Mathematical Modeling	3
STAT 321	Introduction to Statistical Computing for Data Science	3

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**
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 Play course video for Focused Inquiry I	Focused Inquiry I (satisfies general education UNIV foundations)	3
General education course [1]		3
Experiential fine arts		1-3
	Term Hours:	**15-17**
Spring semester		
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
STAT 210 or STAT 212	Basic Practice of Statistics or Concepts of Statistics	3
UNIV 112 Play course video for Focused Inquiry II	Focused Inquiry II (satisfies general education UNIV foundations)	3
	Term Hours:	**15**
Sophomore year		
Fall semester		
CHEM 301 & CHEZ 301	Organic Chemistry and Organic Chemistry Laboratory I	5
MATH 307	Multivariate Calculus	4
PHYS 207	University Physics I (satisfies AOI for scientific and logical reasoning)	5

UNIV 200	Advanced Focused Inquiry: Literacies, Research and Communication (satisfies general education UNIV foundations)	3
	Term Hours:	**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
CHEM 398	Professional Practices and Perspectives Seminar	1
PHYS 208	University Physics II	5
	Term Hours:	**16**
Junior year		
Fall semester		
CHEM 313 or CHEM 314	Physical Chemistry I or Physical Chemistry I with Math Modules	3-4
CHEM 320	Inorganic Chemistry I	3
CHEZ 313	Physical Chemistry Laboratory I	2
CMSC 255	Introduction to Object-oriented Programming	4
Foreign language 101		3
	Term Hours:	**15-16**
Spring semester		
CHEM 315	Physical Chemistry II	3
Foreign language 102		3
General education course [1]		3
General education course [1]		3
Major elective		3
	Term Hours:	**15**
Senior year		
Fall semester		
CHEM 510 or CHEM 512	Atomic and Molecular Structure or Applied Molecular Modeling	3
MEDC 541	Survey of Molecular Modeling Methods	1
Open electives		9
	Term Hours:	**13**
Spring semester		
CHEM 499	Chemistry Capstone Experience [2]	0
CHEZ 413	Advanced Physical Chemistry Laboratory	2
MATH 302 or MATH 310	Numerical Calculus or Linear Algebra	3
Open electives		9
	Term Hours:	**14**
	Total Hours:	**120-123**

1

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.

2

Students in this concentration meet the capstone requirement by taking CHEM 510 (http://bulletin.vcu.edu/search/?P=CHEM%20510) or CHEM 512 (http://bulletin.vcu.edu/search/?P=CHEM%20512) and CHEZ 413 (http://bulletin.vcu.edu/search/?P=CHEZ%20413).

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