

B.S. Degrees from the Department of Chemistry and Biochemistry 2017-2018

The Department of Chemistry and Biochemistry offers two B.S. degrees: a B.S. degree in Chemistry, and a B.S. degree in Biochemistry and Molecular Biology. The Chemistry degree has several options: the standard B.S. in chemistry, the Coatings and Polymeric Materials Option, the Biochemistry Option, the Pre-Professional Option, and the Chemistry Education Option.

The standard B.S. degree in Chemistry (ACS Certified) is designed for students seeking careers in the chemical industry, or careers in law, government, journalism, business, etc., that would benefit from a strong background in the physical sciences and mathematics. Many B.S. graduates go on to M.S. or Ph.D. studies. Graduates completing the standard program for the B.S. Degree in Chemistry are certified by the American Chemical Society.

The curriculum for the Coatings and Polymeric Materials Option adds specialized courses in polymer science to the standard program. The curriculum for the Biochemistry Option adds biological sciences courses and substitutes some upper division chemistry courses with advanced biochemistry courses. These two curricula are also ACS Certified. The Pre-Professional Option, designed for students intending to apply for medical or other professional schools, substitutes some upper division chemistry courses with biology coursework. The Chemistry Education Option, designed for students planning on a career in K-12 education, includes several education courses. The Pre-Professional and Chemistry Education Options are not ACS certified.

The B.S. degree in Biochemistry and Molecular Biology is listed on the last page of this document. This degree provides excellent preparation for work in the biotechnology industries, as well as graduate or professional schools.

Scholarships are available from the department for highly qualified students. See <https://www.ndsu.edu/admission/scholarships/> for information and application procedures. Students in the Coatings and Polymeric Materials Option should consult with the Coatings and Polymeric Materials department for additional scholarship opportunities. Students in the Chemical Education Option should consult with their advisor for additional opportunities.

Notes: Although all the B.S. options in both majors can be completed in four years, students should take especial note of the following prerequisite issues:

- 1) In the Chemistry curriculum., Chem 425 (inorganic chemistry), has Chem 364 (physical chemistry) as a prerequisite. Chem 364 has Math 259 (multivariate calculus) as a prerequisite. Therefore, the Math coursework should be completed as early in the curriculum as possible. Most of the Math courses are offered every semester as well as summer, allowing opportunities to catch up.
- 2) Chem 364 also has a Physics 252 prerequisite, however with instructors permission and a paper permit, students have been allowed to take Chem 364,365 concurrently with Phys 251, 252.
- 3) Bioc 460 has Chem 342 (organic II) and Biol 150 (general biology) as prereqs. Bioc 460 is itself a prereq. for most of the senior-level biochemistry coursework. It is therefore important for Biochemistry majors to have completed Chem 341, 342, and Biol 150 in the first two years.
- 4) Course offerings: In general, most Chem and Bioc courses are offered once per year, in either Fall or Spring as shown on the curriculum sheets. Some exceptions: Chem 121, and 122 are offered Fall, Spring, and Summer. Chem 341 is offered Fall and Summer, and Chem 342 is offered Spring and Summer.
- 5) Students with curricular questions are strongly encouraged to see their advisor or the department's Director of Undergraduate Studies (John Hershberger, john.hershberger@ndsu.edu).

Required Curriculum
Chemistry Major, ACS Certified

ACS Certified B.S. in Chemistry		Credits	
First Year		F	S
Chem 150, 151	Principles of Chemistry I, II	3	3
Chem 160, 161	Principles of Chemistry I, II Labs	1	1
Biol 150	General Biology	3	
Comm 110	Fundamentals of Public Speaking		3
Engl. 120	College Composition	3	
Gen. Ed. Electives*	General Education Elective, Wellness		5
Math 165, 166	Calculus I, II	4	4
		14	16
Second Year			
Chem 341, 342	Organic Chemistry I, II	3	3
Chem 353, 354	Organic Chemistry I, II Majors Labs	1	2
Gen. Ed. Electives*	General Education Electives	3	3
Math 128	Introduction to Linear Algebra	1	
Math 259**, 266	Calc III, Intro. To Diff Equations	3	3
Phys 251, 252	University Physics I, II	4	4
Phys 251L, 252L	University Physics Laboratory I, II	1	1
		16	16
Third Year			
Chem 431, 431L	Analytical Chemistry I and Lab	5	
Chem 364, 365	Physical Chemistry I, II	3	3
Chem 380	Chemistry Junior Seminar		1
Chem 471	Physical Chemistry Laboratory		2
Engl 324	Writing in the Sciences	3	
Gen. Ed.	General Education and other electives*	3	9
		14	15
Fourth Year			
Bioc 460, 460L	Found. of Biochem. & Lab	4	
Chem 425, 429	Inorganic Chemistry and Laboratory	5	
Chem 432, 432L	Analytical Chemistry II and Lab		4
Chem 491	Chemistry Senior Seminar		2
Gen. Ed.	General Education and other electives*	6	9
		15	15
SAMPLE CURRICULUM TOTAL		121	

*Electives must include 18 credits in humanities and social sciences; six of these must be in humanities/fine arts, and six in social sciences. In addition, three credits must have a global perspective, and three must be in the cultural diversity category.

**MATH 265 may be substituted for MATH 259; substitution form needed.

Required Curriculum
Chemistry Major with the Biochemistry Option

ACS Certified B.S. in Chemistry, Biochemistry Option		Credits	
First Year		F	S
Biol. 150	General Biology	3	
Biol. 150L	General Biology Laboratory	1	
Chem 150, 151	Principles of Chemistry I, II	3	3
Chem 160, 161	Principles of Chemistry I, II Labs	1	1
Comm 110	Fundamentals of Public Speaking		3
Engl. 120	College Composition	3	
Math 165, 166	Calculus I, II	4	4
Gen. Ed. Electives	Wellness, General Education Electives		5
		15	16
Second Year			
Chem 341, 342	Organic Chemistry I, II	3	3
Chem 353, 354	Organic Chemistry I, II Majors Labs	1	2
Math 128	Introduction to Linear Algebra	1	
Math 259**, 266	Calculus III, Intro. To Differential Eq.	3	3
Phys 251, 252	University Physics I, II	4	4
Phys 251L, 252L	University Physics Laboratory I, II	1	1
Gen. Ed. Electives*	General Ed. Electives	3	3
		16	16
Third Year			
Chem. 364, 365	Physical Chemistry	3	3
Chem. 471	Physical Chemistry Laboratory		2
Chem 431, 431L	Analytical Chemistry I and Lab	5	
Chem 380	Chemistry Junior Seminar		1
Bioc 460,461	Found. Of Biochem. I , II	3	3
Bioc 460L	Found. Of Biochem I Lab	1	
Micr 350, 350L	Microbiology and Laboratory	4	
Engl. 324	Writing in the Sciences		3
Gen. Ed. Electives*	General Education Electives	0	3
		16	15
Fourth Year			
Bioc. 473	Methods in Biochemical Research	3	
Bioc. 474	Methods of Recombinant DNA Tech.		3
Chem 491	Chemistry Senior Seminar		2
Chem 425	Inorganic Chemistry	3	
Chem 429	Inorganic Chemistry Laboratory	2	
Biol. Sci. Electives***		3	3
Gen. Ed. Electives*	General Education Electives	3	6
		14	14
SAMPLE CURRICULUM TOTAL		122	

*Electives must include 18 credits in humanities and social sciences; six of these must be in humanities/fine arts, and six in social sciences. In addition, three credits must have a global perspective and three must be in the cultural diversity category.

**MATH 265 may be substituted for MATH 259.

*** Biological Science electives include Bio 351 (L), Biol 364, Bot 380, Zoo 370, and Micr 352.

Required Curriculum

Chemistry Major with the Coatings and Polymeric Materials Option

This program is for students who wish to prepare for a career as a chemist in coatings and polymeric materials industries, or for graduate school in polymer chemistry. This is the only program in the U.S. that combines an ACS-certified B.S. degree in Chemistry with a coatings and polymeric materials curriculum. Students have numerous opportunities to participate in the summer research and cooperative programs sponsored by industry. For students who elect the Polymers and Coatings Option to the B.S. Degree in Chemistry, substantial scholarship support is available.

ACS Certified B.S. in Chemistry, P&C Option		Credits	
First Year		F	S
Chem 150, 151	Principles of Chemistry I, II	3	3
Chem 160, 161	Principles of Chemistry I, II Labs	1	1
Biol 150	General Biology	3	
Comm 110	Fundamentals of Public Speaking		3
Engl. 120	College Composition	3	
Gen. Ed. Electives*	General Education Elective, Wellness		5
Math 165, 166	Calculus I, II	4	4
		14	16
Second Year			
Chem 341, 342	Organic Chemistry I, II	3	3
Chem 353, 354	Organic Chemistry I, II Majors Labs	1	2
Gen. Ed. Electives*	General Education Electives	3	3
Math 128	Introduction to Linear Algebra	1	
Math 259**, 266	Calculus III, Intro. to Differential Eq.	3	3
Phys 251, 252	University Physics I, II	4	4
Phys 251L, 252L	University Physics Laboratory I, II	1	1
		16	16
Third Year			
Chem 431, 431L	Analytical Chemistry I and Lab	5	
Chem 364, 365	Physical Chemistry I, II	3	3
Chem 380	Chemistry Junior Seminar		1
Chem 471	Physical Chemistry Laboratory		2
Gen. Ed. Electives*	General Education Electives		3
Engl. 324	Writing in the Sciences	3	
P&C 474/84, 475/85	Coatings I and II, and Labs	5	5
		16	14
Fourth Year			
Bioc 460, 460L	Found. of Biochem I & Lab	4	
Chem 425, 429	Inorganic Chemistry and Laboratory	5	
Chem 432, 432L	Analytical Chemistry II and Lab		4
Chem 491	Chemistry Senior Seminar		2
Gen. Ed., Electives*	General Education and other electives	3	9
P&C 473	Polymer Synthesis	3	
		15	15
SAMPLE CURRICULUM TOTAL		122	

*Electives must include 18 credits in humanities and social sciences; six of these must be in humanities/fine arts, and six in social sciences. In addition, three credits must have a global perspective and three must be in the cultural diversity category.

**MATH 265 may be substituted for MATH 259.

Required Curriculum

Chemistry Major with the Pre-Professional Option

This option is designed for students interested in medical, dental, optometry, or veterinary professional school, but who wish to have an alternative career path to careers in industry, law, government, journalism, business, etc., that would benefit from a strong background in the physical sciences and mathematics. This option also provides excellent preparation for graduate study in biochemistry, biotechnology, and molecular biology.

B.S. in Chemistry, Pre-Professional Option		Credits	
First Year		F	S
Biol. 150	General Biology	3	
Biol. 150L	General Biology Laboratory	1	
Chem 150, 151	Principles of Chemistry I, II	3	3
Chem 160, 161	Principles of Chemistry I, II Labs	1	1
Engl. 120	College Composition	3	
Comm. 110	Fundamentals of Public Speaking		3
Math 165, 166	Calculus I, II	4	4
Gen. Ed.	Wellness, General Ed. Electives		5
		15	16
Second Year			
Chem 341, 342	Organic Chemistry I, II	3	3
Chem 353, 354	Organic Chemistry I, II Majors Labs	1	2
Math 128	Introduction to Linear Algebra	1	
Math 259**	Calculus III	3	
Matth 266 or Stat 330	Intro. To Differential Eq., or Intro. Statistics		3
Phys 251, 252	University Physics I, II	4	4
Phys 251L, 252L	University Physics Laboratory I, II	1	1
Gen. Ed., Electives*	General Ed. Elective	3	3
		16	16
Third Year			
Chem 431, 431L	Analytical Chemistry I and Laboratory	5	
Chem 364, 365	Physical Chemistry I, II	3	3
Chem 380	Chemistry Junior Seminar		1
Micr. 350, 350L	Microbiology I and Laboratory	4	
Engl. 324	Writing in the Sciences		3
Gen. Ed. Electives*	General Education Electives	3	6
		15	13
Fourth Year			
Chem 425	Inorganic Chemistry	3	
Bioc 460, 460L	Found. of Biochem. I & Lab	4	
Biol. 220, 221	Human Anatomy and Physiology	3	3
Biol. 220L, 221L	Human Anatomy Laboratory	1	1
Chem 491	Chemistry Senior Seminar		2
Electives	Electives	3	3
Gen. Ed. Electives*	General Education and other Electives		7
		14	16
SAMPLE CURRICULUM TOTAL		121	

*Electives must include 18 credits in humanities and social sciences; six of these must be in humanities/fine arts, and six in social sciences. In addition, three credits must have a global perspective and three must be in the cultural diversity category.

**MATH 265 may be substituted for MATH 259.

Required Curriculum

Chemistry Major with the Chemical Education Option

This option is designed for the student interested in a disciplinary degree in chemistry, but who is also considering becoming a chemistry and physics teacher. The curriculum includes physics coursework beyond the usual chemistry major to enable the graduate to teach physics in most states. For teacher certification, students must apply to the School of Education to enroll in the additional requirements, which includes Educ 389, 451, 481, 486, Educ 487, taken post-baccalaureate.

ACS Certification can be earned by taking Chem 471, 429, and Chem 432/432L as additional courses, and choosing Bioc 460 instead of 260.

Scholarships starting in the sophomore year are available for students in the Chemical Education Option.

B.S. in Chemistry, Chemical Education Option		Credits	
First Year		F	S
Chem 150, 151	Principles of Chemistry I, II	3	3
Chem 160, 161	Principles of Chemistry I, II Labs	1	1
Comm 110	Fundamentals of Public Speaking		3
Engl. 120	College Composition I, II	3	
Math 165, 166	Calculus I, II	4	4
Biol. 150, 150L	General Biology I and Laboratory	4	
Gen. Ed. Electives*			3
		15	14
Second Year			
Chem 341, 342	Organic Chemistry I, II	3	3
Chem 353, 354	Organic Chemistry I, II Majors Labs	1	2
Math 128	Introduction to Linear Algebra	1	
Math 259**	Calculus III	3	
Math 266 or Stat 330	Intro. To Differential Eq. or Intro. Statistics		3
Phys 251, 252	University Physics I, II	4	4
Phys 251L, 252L	University Physics Laboratory I, II	1	1
Gen. Ed. Electives*	Wellness, General Education Electives	2	3
		15	16
Third Year			
Chem 431, 431L	Analytical Chemistry I and Laboratory	5	
Chem 364, 365	Physical Chemistry I, II	3	3
Chem 380	Chemistry Junior Seminar		1
Educ 321, 322	Intro. To Teaching, Ed. Psychology	3	3
Educ 381	Early Experience		1
Gen. Ed. Electives*	General Education Electives	2	6
Physics Elective	Physics Elective	3	0
		16	14
Fourth Year			
Bioc 460, 460L	Found. Biochem. I & Lab	4	
Chem 425	Inorganic Chemistry	3	
Chem 491	Chemistry Senior Seminar		2
Engl. 324	Writing in the Sciences	3	
Electives	Electives**	4	6
Gen. Ed. Elective*	General Education Electives	3	6
		17	14
SAMPLE CURRICULUM TOTAL		121	

*Electives must include 18 credits in humanities and social sciences; six of these must be in humanities/fine arts, and six in social sciences. In addition, three credits must have a global perspective and three must be in the cultural diversity category.

**MATH 265 may be substituted for MATH 259.

***A course in earth sciences and in biology may be required for certification in some states. Geol 105/105L and Biol 151/151L are recommended electives.

Biochemistry and Molecular Biology

Biochemistry and molecular biology involve the interdisciplinary study of the chemical and physical properties of living matter and the chemical changes that take place during life processes. This field requires preparation in chemistry and biology as well as biochemistry and molecular biology. Careers exist in medical, pharmaceutical, food processing, and agricultural laboratories. Graduates also will have excellent preparation for graduate school or schools of medicine, dentistry, veterinary science, and business.

B.S. in Biochemistry and Molecular Biology,		Credits	
First Year		F	S
Biol 150	General Biology I	3	
Biol 150L	General Biology Lab I	1	
Chem 150, 151 (or Chem 121, 122)	Principles of Chemistry I, II	3	3
Chem 160, 161 (or Chem 121L, 122L)	Principles of Chemistry I, II Labs	1	1
Engl. 120	College Composition	3	
Math 165, 166	Calculus I, II	4	4
Gen. Ed., Electives*	Wellness and General Ed. Electives		6
		15	15
Second Year			
Comm 110	Fund. Public Speaking		3
Chem 341, 342	Organic Chemistry I, II	3	3
Chem 353, 354	Organic Chemistry I, II Majors Labs	1	2
Zool 315	Genetics	3	
Phys 251, 252	University Physics I, II	4	4
Phys 251L, 252L	University Physics Laboratory I, II	1	1
Gen. Ed., Electives*	General Ed. and other Electives	3	3
		15	16
Third Year			
Bioc 460, 461	Biochem/Molec. Biol. I, II	3	3
Bioc 460L	Found. Biochem. I Lab	1	
Chem 431	Analytical Chemistry	3	
Chem 380	Junior Chem./Bioc. Seminar		1
Micr 350, 350L	Gen. Microbiol.	4	
Bioc 474	Recombinant DNA Tech.		3
Science Electives**	Science Electives**		3
Engl. 324	Writing in the Sciences	3	
Stat. 330	Intro. Statistics		3
Gen. Ed., Electives*	General Ed. and other Electives		3
		14	16
Fourth Year			
Bioc 473	Meth. Biochem Research	3	
Bioc 483	Cell. Sig. Trans. Metabl.		3
Chem 465	Survey of Physical Chemistry	4	
Bioc 487	Molec. Biol. Gene Expr.	3	
Chem 491	Senior Chem./Bioc. Seminar		2
Science Electives**	Science Electives**	3	3
Gen. Ed., Electives*	General Ed. and other Electives	3	6
		16	14
Curriculum Totals		121	

*General Education Electives must include 18 credits in humanities and social sciences; six of these must be in humanities/fine arts, and six in social sciences. In addition, three credits must have a global perspective and three must be in the cultural diversity category.

** Upper Division science electives. 9 additional credits of 300- or 400- level courses in BIOL, BIOC, BOT, ZOO, CHEM, CSCI, MICR, PSCI, PHYS, PPTH, or STAT. No more than 6 credits from one prefix may apply. Research credits (CHEM 494/BIOC 494) may count towards up to 3 of these credits.