

CHEMISTRY, B.S. (BEHREND)

Begin Campus: Any Penn State Campus

End Campus: Erie

Program Description

This major provides a strong foundation in chemistry and prepares students for graduate or professional programs and for careers with companies and agencies requiring chemistry or related areas. The major has four options that allow students to choose an area of specialization to meet their career goals. These options are:

1. general chemistry,
2. biochemistry,
3. business, and
4. chemistry education pre-certification.

Students have the opportunity to participate in research with faculty members.

What is Chemistry?

Chemistry is the study of matter and its transformations. Chemists seek a molecular-level understanding of the ways in which atoms combine to form molecules and bulk materials, how molecular structure and interactions lead to macroscopic material properties, and how chemical transformations can be used to create useful materials and store energy.

You Might Like This Program If...

- You are curious about the world around you. How and why does it look, sound, smell, taste, and feel the way it does? What are objects composed of? Why do substances react the way they do?
- You find both theoretical and hands-on laboratory learning appealing.
- You enjoy the challenge of problem-solving.
- You are interested in working with instrumentation and making precise measurements.
- You want to study in an American Chemical Society-approved degree program.

Entrance to Major

In order to be eligible for entrance to the CHMBC major (all options), a student must have:

1. attained at least 29.1 credits and
2. earned at least a 2.00 cumulative grade-point average.

Degree Requirements

For the Bachelor of Science degree in Chemistry, a minimum of 124 credits is required:

Requirement	Credits
General Education	45
Electives	0-5
Requirements for the Major	92-102

18-24 of the 45 credits for General Education are included in the Requirements for the Major. For the General Chemistry Option and Biochemistry Option, this includes: 9 credits of GN courses; 6 credits

of GQ courses; 3 credits of GWS courses. For the Business Option, this includes: 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GS courses; 3 credits of GWS courses. For the Chemistry Education Pre-Certification Option, this includes 9 credits of GN courses; 6 credits of GQ courses; 6 credits of GS courses; 3 credits of GWS courses.

Per Senate Policy 83.80.5, the college dean or campus chancellor and program faculty may require up to 24 credits of coursework in the major to be taken at the location or in the college or program where the degree is earned.

General Education

Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (<http://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program>) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

Foundations (grade of C or better is required.)

- **Quantification (GQ):** 6 credits
- **Writing and Speaking (GWS):** 9 credits

Knowledge Domains

- **Arts (GA):** 6 credits
- **Health and Wellness (GHW):** 3 credits
- **Humanities (GH):** 6 credits
- **Social and Behavioral Sciences (GS):** 6 credits
- **Natural Sciences (GN):** 9 credits

Integrative Studies (may also complete a Knowledge Domain requirement)

- **Inter-Domain or Approved Linked Courses:** 6 credits

University Degree Requirements

First Year Engagement

All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

Cultures Requirement

6 credits are required and may satisfy other requirements

- **United States Cultures:** 3 credits
- **International Cultures:** 3 credits

Writing Across the Curriculum

3 credits required from the college of graduation and likely prescribed as part of major requirements.

Total Minimum Credits

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

Quality of Work

Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

Limitations on Source and Time for Credit Acquisition

The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 (<http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80>)). For more information, check the Suggested Academic Plan for your intended program.

Requirements for the Major

Each student must earn at least a grade of C in each 300- and 400-level course in the major field and must have earned a minimum 2.00 grade-point average.

To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (<http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44>).

Common Requirements for the Major (All Options)

Code	Title	Credits
Prescribed Courses		
<i>Prescribed Courses: Require a grade of C or better</i>		
CHEM 110	Chemical Principles I	3
CHEM 111	Experimental Chemistry I	1
CHEM 112	Chemical Principles II	3
CHEM 113	Experimental Chemistry II	1
CHEM 210	Organic Chemistry I	3
CHEM 212	Organic Chemistry II	3
CHEM 213	Laboratory in Organic Chemistry	2
CHEM 227	Analytical Chemistry	4
CHEM 316	The Professional Chemist	1
CHEM 400	Chemical Literature	1
CHEM 413	Chemistry of the Elements	4
CHEM 431W	Organic and Inorganic Preparations	3
CHEM 440	Instrumental Analysis	3
CHEM 441	Instrumental Analysis Laboratory	1
CHEM 443	Electrochemistry and Chromatography Laboratory	1
CHEM 457	Experimental Physical Chemistry	1
CHEM 472	General Biochemistry I	3
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4

PHYS 211	General Physics: Mechanics	4
PHYS 212	General Physics: Electricity and Magnetism	4

Requirements for the Option

Select an option 38-48

Requirements for the Option

General Chemistry Option (38 credits)

Code	Title	Credits
Prescribed Courses		
<i>Prescribed Courses: Require a grade of C or better</i>		
CHEM 450	Physical Chemistry - Thermodynamics	3
CHEM 452 & CHEM 457	Physical Chemistry - Quantum Chemistry and Experimental Physical Chemistry	4
ENGL 202C	Effective Writing: Technical Writing	3
MATH 230	Calculus and Vector Analysis	4
Additional Courses		
<i>Additional Courses: Require a grade of C or better</i>		
Select 6 credits of 400-level CHEM courses ¹		6
CHEM 494	Chemical Research	3
or CHEM 496	Independent Studies	
MATH 250	Ordinary Differential Equations	3
or STAT 401	Experimental Methods	
Supporting Courses and Related Areas		
Select 12 credits from school-approved list ²		12

¹ Excluding CHEM 494, CHEM 495, and CHEM 496.

² Students may apply up to 6 credits of ROTC.

Biochemistry Option (44 credits)

Code	Title	Credits
Prescribed Courses		
<i>Prescribed Courses: Require a grade of C or better</i>		
BIOL 110S	Biology: Basic Concepts and Biodiversity	4
BIOL 230W	Biology: Molecules and Cells	4
BMB 402	General Biochemistry	3
BMB 403	Biochemistry Laboratory	1
CHEM 450	Physical Chemistry - Thermodynamics	3
CHEM 452 & CHEM 457	Physical Chemistry - Quantum Chemistry and Experimental Physical Chemistry	4
ENGL 202C	Effective Writing: Technical Writing	3
MATH 230	Calculus and Vector Analysis	4
Additional Courses		
<i>Additional Courses: Require a grade of C or better</i>		
Select 3 credits of 400-level CHEM courses ¹		3
CHEM 494	Chemical Research	3
or CHEM 496	Independent Studies	
MATH 250	Ordinary Differential Equations	3
or STAT 401	Experimental Methods	
Select one of the following:		3
BIOL 322	Genetic Analysis	
BMB 406	Molecular Biology	
BMB 465	Protein Structure and Function	
MICRB 201	Introductory Microbiology ²	

Supporting Courses and Related Areas

Select 6 credits from school-approved list³ 6

¹ Excluding CHEM 494, CHEM 495, and CHEM 496.

² MICRB 201 does not require a grade of C or better.

³ Students may apply up to 6 credits of ROTC.

Business Option (46-47 credits)

Code	Title	Credits
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Prescribed Courses

Prescribed Courses: Require a grade of C or better

CHEM 496	Independent Studies	3
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ECON 102	Introductory Microeconomic Analysis and Policy	3
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ENGL 202D	Effective Writing: Business Writing	3
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MGMT 301	Basic Management Concepts	3
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MKTG 301	Principles of Marketing	3
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SCM 200	Introduction to Statistics for Business	4
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STAT 401	Experimental Methods	3
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Additional Courses

Additional Courses: Require a grade of C or better

Select 6 credits of 400-level CHEM courses¹ 6

CHEM 450	Physical Chemistry - Thermodynamics	3
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or CHEM 452	Physical Chemistry - Quantum Chemistry	3
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Select 9-10 credits in one of the following sequences: 9-10

Sequence A

MGMT 331	Management and Organization	
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MGMT 410	Project Management	
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MGMT 420	Negotiation and Conflict Management	
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SCM 310	Introduction to Operations Management	
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Sequence B

MKTG 327	Retailing	
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MKTG 330	Consumer Behavior	
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MKTG 342	Marketing Research	
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MKTG 410	Personal Selling	
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MKTG 428	Advanced Sales Management ¹	
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Sequence C

CMPSC 203	Introduction to Spreadsheets and Databases	
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MIS 204	Introduction to Business Information Systems	
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MIS 336	Database Management Systems	
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MIS 430	Systems Analysis	
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MIS 445	Business Intelligence	
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Sequence D

One selection each from sequences A, B and C

Supporting Courses and Related Areas

Select 6 credits from school-approved list² 6

¹ Excluding CHEM 494, CHEM 495, and CHEM 496.

² Students may apply up to 6 credits of ROTC.

Chemistry Education Pre-Certification Option (47-48 credits)

This option helps prepare students for chemistry education teaching positions in secondary schools. It includes the academic requirements for the Chemistry Education Instructional I certificate issued by the Pennsylvania Department of Education.

Code	Title	Credits
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Prescribed Courses

EDPSY 14 & CI 295	Learning and Instruction and Introductory Field Experience for Teacher Preparation (must be taken concurrently)	4
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EDTHP 115 & CI 295	Education in American Society and Introductory Field Experience for Teacher Preparation (must be taken concurrently)	4
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Prescribed Courses: Require a grade of C or better

CHEM 395	Chemistry Teacher Assistant Training	1-2
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CHEM 450	Physical Chemistry - Thermodynamics	3
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CHEM 452 & CHEM 457	Physical Chemistry - Quantum Chemistry and Experimental Physical Chemistry	4
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ENGL 202C	Effective Writing: Technical Writing	3
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MATH 230	Calculus and Vector Analysis	4
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PSYCH 100	Introductory Psychology	3
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Additional Courses

HDFS 129	Introduction to Human Development and Family Studies	3
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or PSYCH 212	Introduction to Developmental Psychology	
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Additional Courses: Require a grade of C or better

Select 6 credits of 400-level CHEM courses¹ 6

CHEM 494	Chemical Research	3
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or CHEM 496	Independent Studies	
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MATH 250	Ordinary Differential Equations	3
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or STAT 401	Experimental Methods	
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Supporting Courses and Related Areas

Select 6 credits from school-approved list² 6

¹ Excluding CHEM 494, CHEM 495, and CHEM 496.

² Students may apply up to 6 credits of ROTC.

Program Learning Objectives

- Periodic Table:** The student will understand the importance of the Periodic Table of the Elements, how it came to be, and its role in organizing chemical information.
- Integrate Knowledge:** The student will understand the interdisciplinary nature of chemistry and to integrate knowledge of mathematics, physics and other disciplines to a wide variety of chemical problems.
- Experiment Design:** The student will learn the laboratory skills needed to design, safely conduct and interpret chemical research.
- Chemical Literature:** The student will acquire a foundation of chemistry of sufficient breadth and depth to enable them to critically interpret the primary chemical literature.
- Communication:** The student will develop the ability to effectively communicate scientific information and research results in written and oral formats.
- Professionalism:** The student will learn professionalism, including the ability to work in teams and apply basic ethical principles.

Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of

both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (<http://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy>)

Erie

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Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2019-20 academic year. To access previous years' suggested academic plans, please visit the archive (<http://bulletins.psu.edu/undergraduate/archive>) to view the appropriate Undergraduate Bulletin edition (*Note: the archive only contain suggested academic plans beginning with the 2018-19 edition of the Undergraduate Bulletin*).

Biochemistry Option at Erie Campus

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

Fall	Credits	Spring	Credits
CHEM 110 ^{**†}	3	CHEM 112 ^{**†}	3
CHEM 111 ^{**†}	1	CHEM 113 ^{**†}	1
MATH 140 ^{**†}	4	MATH 141 ^{**†}	4
ENGL 15 or 30 [‡]	3	PHYS 211 or BIOL 230W ^{**†}	4
BIOL 110S [*]	4	General Education Course	3
PSU 7	1	General Education Course (GHW)	1.5
	16		16.5

Second Year

Fall	Credits	Spring	Credits
CHEM 210 [*]	3	CHEM 212 [*]	3
CHEM 227 [*]	4	CHEM 213 [*]	2
PHYS 211 or BIOL 230W ^{**†}	4	PHYS 212 ^{**†}	4
MATH 230 [*]	4	MATH 250 or STAT 401 [*]	3
General Education Course (GHW)	1.5	General Education Course	3
	16.5		15

Third Year

Fall	Credits	Spring	Credits
CHEM 450 [*]	3	CHEM 452 [*]	3
CHEM 457 [*]	1	CHEM 457 [*]	1
CHEM 400 [*]	1	CHEM 440 [*]	3
CHEM 316 [*]	1	CHEM 441 [*]	1
CHEM 472 [*]	3	CHEM 494 or 496 [*]	1
ENGL 202C ^{**†}	3	CAS 100 [‡]	3
General Education Course	3	BMB 402 [*]	3
	15		15

Fourth Year

Fall	Credits	Spring	Credits
CHEM 413 [*]	4	CHEM 431W [*]	3
CHEM 443 [*]	1	BMB 403 ^{**†}	1
CHEM 494 or 496 [*]	1	CHEM 494 or 496 [*]	1
CHEM 400 Level Selection [*]	3	Biology Elective (BIOL, B M B, MICRB) [*]	3
General Education Course	3	Supporting Course and Related Areas	3
Supporting Courses and Related Areas	3	General Education Course	3
	15	General Education Course	3
	15		17

Total Credits 126

- * Course requires a grade of C or better for the major
- ‡ Course requires a grade of C or better for General Education
- # Course is an Entrance to Major requirement
- † Course satisfies General Education and degree requirement

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy University Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of 'C' or better.

Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

Program Notes

- 1.) Students who have not met the admission requirement of two units of a foreign language must complete a college level-one foreign language within their first 60 credits.
- 2.) Scheduling patterns for courses not taught each semester: Some major requirement will be offered only once a year or every other year depending on demand:

Fall only courses include: CHEM 210, CHEM 227, CHEM 316, CHEM 400, CHEM 413, CHEM 450, CHEM 472

Spring only courses include: CHEM 212, CHEM 213, CHEM 431W, CHEM 440, CHEM 452

3.) All first-year baccalaureate degree candidates are required to complete, during the first academic year, a seminar course.

4.) 6 credits of supporting courses are required for the biochemistry option. There are a variety of courses you may choose from. The list given below is not completely inclusive. If there is a new course or a technical course you feel you would like to include under this selection, please speak with your Academic Adviser or the Academic Coordinator.

Supporting Courses List

EDSGN 100S

BIOL 110 or higher

CHNS 1, CHNS 2, CHNS 3

CMPSC any course

CMPEN any course

FR 1, FR 2, FR 3

GER 1, GER 2, GER 3

MATH 200-level or higher

MICRB 201 or MICRB 202

PHYS 213, PHYS 214, PHYS 237, or any 400-level course

PLET 206 or higher

SPAN 1, SPAN 2, SPAN 3

STAT 250 or higher

The following select courses can also be used as a supporting course under the designated CHMBC option.

5.) **Non-approved courses** - Some courses are not appropriate for a chemistry major and will not count toward degree requirements. These courses include, but are not limited to, those listed below:

Non-approved Courses List

BISC 1, BISC 2, BISC 3

BMB 1

CAS 126

CHEM 1, CHEM 3, CHEM 20, CHEM 21, CHEM 101, CHEM 202, CHEM 203

CMPSC 100

ENGL 4, ENGL 5

MATH 1, MATH 2, MATH 4, MATH 17, MATH 18

PHYS 1, PHYS 150, PHYS 151, PHYS 250, PHYS 251

STAT 100

Business Option at Erie Campus

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

Fall	Credits	Spring	Credits
CHEM 110 ^{**†}	3	CHEM 112 ^{**†}	3
CHEM 111 ^{**†}	1	CHEM 113 ^{**†}	1
MATH 140 ^{**†}	4	MATH 141 ^{**†}	4
ENGL 15 or 30 [‡]	3	PHYS 211 ^{**†}	4
General Education Course	3	General Education Course	3
General Education Course (GHW)	1.5	General Education Course (GHW)	1.5

PSU 7	1	
	16.5	16.5

Second Year

Fall	Credits	Spring	Credits
CHEM 210 [*]	3	CHEM 212 [*]	3
CHEM 227 [*]	4	CHEM 213 [*]	2
PHYS 212 ^{**†}	4	ENGL 202D ^{**††}	3
STAT 401 or MATH 250	3	ECON 102 ^{**†}	3
General Education Course	3	General Education Course	3
		Supporting Courses and Related Areas	3
	17		17

Third Year

Fall	Credits	Spring	Credits
CHEM 450 [*]	3	CHEM 440 [*]	3
CHEM 457 [*]	1	CHEM 441 [*]	1
CHEM 400 [*]	1	CHEM 400-Level Course [*]	3
CHEM 472 [*]	3	CHEM 496 [*]	1
CHEM 316 [*]	1	MGMT 301 [*]	3
SCM 200 or STAT 200 [*]	4	MKTG 301 [*]	3
CAS 100 [‡]	3	General Education Course	3
	16		17

Fourth Year

Fall	Credits	Spring	Credits
CHEM 413 [*]	4	CHEM 431W [*]	3
CHEM 443 [*]	1	CHEM 496 [*]	1
CHEM 496 [*]	1	Business Course (Elective)	3-4
CHEM 400-Level Course [*]	3	General Education Course	3
Business Course (Elective)	3-4	Supporting Course and Related Areas	3
Business Course (Elective)	3-4		
	15-17		13-14

Total Credits 128-131

* Course requires a grade of C or better for the major

‡ Course requires a grade of C or better for General Education

Course is an Entrance to Major requirement

† Course satisfies General Education and degree requirement

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy University Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of 'C' or better.

Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate

an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

Program Notes

1.) Students who have not met the admission requirement of two units of a foreign language must complete a college level-one foreign language within their first 60 credits.

2.) Scheduling patterns for courses not taught each semester. Some major requirement will be offered only once a year or every other year depending on demand:

Fall only courses

include: CHEM 210, CHEM 227, CHEM 316, CHEM 400, CHEM 413, CHEM 450, CHEM 472

Spring only courses

include: CHEM 212, CHEM 213, CHEM 431W, CHEM 440, CHEM 452

3.) All first-year baccalaureate degree candidates are required to complete, during the first academic year, a seminar course.

4.) 6 credits of supporting courses are required for the business option.

There are a variety of courses you may choose from. The list given below is not completely inclusive. If there is a new course or a technical course you feel you would like to include under this selection, please speak with your Academic Adviser or the Academic Coordinator.

Supporting Courses List

EDSGN 100S

BIOL 110 or higher

CHNS 1, CHNS 2, CHNS 3

CMPSC any course

CMPEN any course

FR 1, FR 2, FR 3

GER 1, GER 2, GER 3

MATH 200-level or higher

MICRB 201 or MICRB 202

PHYS 213, PHYS 214, PHYS 237, or any 400-level course

PLET 206 or higher

SPAN 1, SPAN 2, SPAN 3

STAT 250 or higher

The following select courses can also be used as a supporting course under the designated CHMBC option.

Business Course List

ACCTG 211, 300-499

BA 243

BA 301

BA 303

ECON 104, 300-499

FIN 100, 300-499

Any MIS Course

MGMT 300-499

MKTG 221, 300-499

5.) **Non-approved courses** - Some courses are not appropriate for a chemistry major and will not count toward degree requirements. These courses include, but are not limited to, those listed below:

Non-approved Courses List

BISC 1, BISC 2, BISC 3

BMB 1

CAS 126

CHEM 1, CHEM 3, CHEM 20, CHEM 21, CHEM 101, CHEM 202, CHEM 203

CMPSC 100

ENGL 4, ENGL 5

MATH 1, MATH 2, MATH 4, MATH 17, MATH 18

PHYS 1, PHYS 150, PHYS 151, PHYS 250, PHYS 251
STAT 100

General Chemistry Option at Erie Campus

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

Fall	Credits Spring	Credits
CHEM 110 ^{**†}	3 CHEM 112 ^{**†}	3
CHEM 111 ^{**†}	1 CHEM 113 ^{**†}	1
MATH 140 ^{**†}	4 MATH 141 ^{**†}	4
ENGL 15 or 30 [†]	3 PHYS 211 ^{**†}	4
PSU 7	1 General Education Course	3
General Education Course	3 General Education Course (GHW)	1.5
General Education Course (GHW)	1.5	
		16.5

Fall	Credits Spring	Credits
CHEM 210 [*]	3 CHEM 212 [*]	3
MATH 230 [*]	4 CHEM 213 [*]	2
CHEM 227 [*]	4 ENGL 202C ^{**†}	3
PHYS 212 ^{**†}	4 MATH 250 or STAT 401 [*]	3
	General Education Course	3
	General Education Course	3
		15

Fall	Credits Spring	Credits
CHEM 450 [*]	3 CHEM 452 [*]	3
CHEM 457 [*]	1 CHEM 457 [*]	1
CHEM 400 [*]	1 CHEM 440 [*]	3
CHEM 472 [*]	3 CHEM 441 [*]	1
CHEM 316 [*]	1 CHEM 494 or 496 [*]	1
CAS 100 [†]	3 Supporting Courses and Related Areas	3
Supporting Course and Related Areas	3 Supporting Courses and Related Areas	3
		15

Fall	Credits Spring	Credits
CHEM 413 [*]	4 CHEM 431W [*]	3
CHEM 443 [*]	1 CHEM 494 or 496 [*]	1
CHEM 494 or 496 [*]	1 CHEM 400-Level Selection [*]	3
CHEM 400-Level Selection [*]	3 General Education Course	3
Supporting Courses and Related Areas	3 General Education Course	3

Elective Course	3 Elective Course	3
	15	16

Total Credits 126

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- 1.) Students who have not met the admission requirement of two units of a foreign language must complete a college level-one foreign language within their first 60 credits.
- 2.) Scheduling patterns for courses not taught each semester. Some major requirement will be offered only once a year or every other year depending on demand:

Fall only courses

include: CHEM 210, CHEM 227, CHEM 316, CHEM 400, CHEM 413, CHEM 450

Spring only courses

include: CHEM 212, CHEM 213, CHEM 431W, CHEM 440, CHEM 452

- 3.) All first-year baccalaureate degree candidates are required to complete, during the first academic year, a seminar course.
- 4.) 12 credits of supporting courses are required for the general option. There are a variety of courses you may choose from. The list given below is not completely inclusive. If there is a new course or a technical course you feel you would like to include under this selection, please speak with your Academic Adviser or the Academic Coordinator.

Supporting Courses List

EDSGN 100S
 BIOL 110 or higher
 CHNS 1, CHNS 2, CHNS 3
 CMPSC any course
 CMPEN any course
 FR 1, FR 2, FR 3
 GER 1, GER 2, GER 3
 MATH 200-level or higher
 MICRB 201 or MICRB 202
 PHYS 213, PHYS 214, PHYS 237, or any 400-level course
 PLET 206 or higher
 SPAN 1, SPAN 2, SPAN 3
 STAT 250 or higher

The following select courses can also be used as a supporting course under the designated CHMBC option.

- 5.) **Free Electives** - This option has 6-credits that solely your choice. Courses students often choose for these flexible credits are ROTC, credit received for varsity sports, optional recitation courses, i.e. CHEM 108, and any other courses that do not count in any other category.
- 6.) **Non-approved courses** - Some courses are not appropriate for a chemistry major and will not count toward degree requirements. These courses include, but are not limited to, those listed below:

Non-approved Courses List

BISC 1, BISC 2, BISC 3
 BMB 1
 CAS 126
 CHEM 1, CHEM 3, CHEM 20, CHEM 21, CHEM 101, CHEM 202, CHEM 203
 CMPSC 100
 ENGL 4, ENGL 5
 MATH 1, MATH 2, MATH 4, MATH 17, MATH 18
 PHYS 1, PHYS 150, PHYS 151, PHYS 250, PHYS 251
 STAT 100

Pre-Education Option at Erie Campus

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

Fall	Credits Spring	Credits
CHEM 110 ⁺⁺	3 CHEM 112 ⁺⁺	3
CHEM 111 ⁺⁺	1 CHEM 113 ⁺⁺	1
MATH 140 ⁺⁺	4 MATH 141 ⁺⁺	4
ENGL 15 or 30 [†]	3 PHYS 211 ^{++†}	4
PSU 7	1 General Education Course	3
General Education Course (GHW)	1.5 General Education Course (GHW)	1.5
General Education Course	3	
	16.5	16.5

Second Year

Fall	Credits Spring	Credits
CHEM 210 [*]	3 CHEM 212 [*]	3
CHEM 227 [*]	4 CHEM 213 [*]	2
PHYS 212 ^{++†}	4 ENGL 202C ^{++‡}	3
MATH 230 [*]	4 MATH 250 or STAT 401 [*]	3
	PSYCH 100 ^{++†}	3
	General Education Course	3
	15	17

Third Year

Fall	Credits Spring	Credits
CHEM 450 [*]	3 CHEM 452 [*]	3
CHEM 457 [*]	1 CHEM 457 [*]	1
CHEM 400 [*]	1 CHEM 440 [*]	3
CHEM 472 [*]	3 CHEM 441 [*]	1
CHEM 316 [*]	1 CHEM 494 or 496 [*]	1

CAS 100A [‡]	3 EDPSY 14	3
PSYCH 212 or HDFS 129 [†]	3 CI 295	1
Supporting Courses and Related Areas ³		
	15	13
Fourth Year		
Fall	Credits Spring	Credits
CHEM 413*	4 CHEM 431W*	3
CHEM 443*	1 CHEM 494 or 496*	1
CHEM 494 or 496*	1 CHEM 395**†	1-2
EDTHP 115	3 CHEM 400-Level Course*	3
CI 295	1 General Education Course	3
CHEM 400-Level Selection*	3 Supporting Courses and Related Areas	3
	13	14-15
Total Credits 120-121		

- * Course requires a grade of C or better for the major
- ‡ Course requires a grade of C or better for General Education
- # Course is an Entrance to Major requirement
- † Course satisfies General Education and degree requirement

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy University Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of 'C' or better.

Integrative Studies courses are required for the General Education program. N is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

Program Notes

- 1.) Students who have not met the admission requirement of two units of a foreign language must complete a college level-one foreign language within their first 60 credits.
- 2.) Scheduling patterns for courses not taught each semester. Some major requirement will be offered only once a year or every other year depending on demand:

Fall only courses

include: CHEM 210, CHEM 227, CHEM 316, CHEM 400, CHEM 413, CHEM 450, CHEM 492

Spring only courses

include: CHEM 212, CHEM 213, CHEM 431W, CHEM 440, CHEM 452

- 3.) All first-year baccalaureate degree candidates are required to complete, during the first academic year, a seminar course.
- 4.) 6 credits of supporting courses are required for the chemistry pre-education option. There are a variety of courses you may choose from. The list given below is not completely inclusive. If there is a new course or a technical course you feel you would like to include under this

selection, please speak with your Academic Adviser or the Academic Coordinator.

Supporting Courses List

EDSGN 100S
 BIOL 110 or higher
 CHNS 1, CHNS 2, CHNS 3
 CMPSC any course
 CMPEN any course
 FR 1, FR 2, FR 3
 GER 1, GER 2, GER 3
 MATH 200-level or higher
 MICRB 201 or MICRB 202
 PHYS 213, PHYS 214, PHYS 237, or any 400-level course
 PLET 206 or higher
 SPAN 1, SPAN 2, SPAN 3
 STAT 250 or higher
 The following select courses can also be used as a supporting course under the designated CHMBC option.

Pre-Education Supporting Course List

PSYCH 301W
 PSYCH 253
 PSYCH 256
 PSYCH 445
 PSYCH 412
 PSYCH 416
 PHIL 10

5.) **Non-approved courses** - Some courses are not appropriate for a chemistry major and will not count toward degree requirements. These courses include, but are not limited to, those listed below:

Non-approved Courses List

BISC 1, BISC 2, BISC 3
 BMB 1
 CAS 126
 CHEM 1, CHEM 3, CHEM 20, CHEM 21, CHEM 101, CHEM 202, CHEM 203
 CMPSC 100
 ENGL 4, ENGL 5
 MATH 1, MATH 2, MATH 4, MATH 17, MATH 18
 PHYS 1, PHYS 150, PHYS 151, PHYS 250, PHYS 251
 STAT 100

Career Paths

Chemistry is called “the central science” for good reason—it is an incredibly versatile field of study that directly impacts other scientific fields. To help you tailor your degree to your career interests, Penn State Behrend offers four options for study with the degree program: General Chemistry, Biochemistry, Business, and Education. Penn State Behrend has a comprehensive support system to help you identify and achieve your goals for college and beyond. Meet with your academic adviser often and take advantage of the services offered by the Academic and Career Planning Center beginning in your first semester.

Careers

Chemistry offers a wealth of career options in medicine, energy, industry, consumer goods, materials, academia, and government service. Penn State Behrend's B.S. in Chemistry graduates currently work as research scientists, product development scientists, field scientists, physicians, pharmacists, consultants, university professors, technical managers, and quality engineers. They are employed at organizations that include NASA,

LORD Corporation, PPG, Hero BX, Associated Clinical Laboratories, and Pyramid Laboratories.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE CHEMISTRY PROGRAM (<http://behrend.psu.edu/school-of-science/academic-programs/chemistry>)

Opportunities for Graduate Studies

Chemistry is a foundational major for graduate study in specialized sub-disciplines such as biochemistry, toxicology, forensic chemistry, environmental chemistry, materials science, nanotechnology, pharmaceutical synthesis, polymer science, and chemical engineering. Chemistry also is a useful undergraduate major for future doctors, veterinarians, physician assistants, and other health care professionals. Penn State Behrend's B.S. in Chemistry graduates have pursued advanced degrees at universities and colleges across the nation, including University of Michigan, Princeton University, Case Western Reserve University, University of California Irvine, North Carolina State University, University of Maryland, University of Kansas, and Lake Erie College of Osteopathic Medicine, among others.

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (<http://behrend.psu.edu/school-of-science/academic-programs/chemistry>)

Professional Resources

- American Chemical Society (<https://www.acs.org/content/acs/en.html>)
- The Royal Society of Chemistry (<http://www.rsc.org>)
- American Society for Biochemistry and Molecular Biology (<http://www.asbmb.org>)
- World Association of Theoretical and Computational Chemists (<http://watoc.net>)

Contact

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