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:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>45</td>
</tr>
<tr>
<td>Electives</td>
<td>0-5</td>
</tr>
<tr>
<td>Requirements for the Major</td>
<td>92-102</td>
</tr>
</tbody>
</table>

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 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)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 110</td>
<td>Chemical Principles I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 111</td>
<td>Experimental Chemistry I</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 112</td>
<td>Chemical Principles II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 113</td>
<td>Experimental Chemistry II</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 210</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 212</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 213</td>
<td>Laboratory in Organic Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 227</td>
<td>Analytical Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 316</td>
<td>The Professional Chemist</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 400</td>
<td>Chemical Literature</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 413</td>
<td>Chemistry of the Elements</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 431W</td>
<td>Organic and Inorganic Preparations</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 440</td>
<td>Instrumental Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 441</td>
<td>Instrumental Analysis Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 443</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>CHEM 457</td>
<td>Experimental Physical Chemistry</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 472</td>
<td>General Biochemistry I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 140</td>
<td>Calculus With Analytic Geometry I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 141</td>
<td>Calculus with Analytic Geometry II</td>
<td>4</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 450</td>
<td>Physical Chemistry - Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 452</td>
<td>Physical Chemistry - Quantum Chemistry &amp; CHEM 457</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 202C</td>
<td>Effective Writing: Technical Writing</td>
<td>3</td>
</tr>
<tr>
<td>MATH 230</td>
<td>Calculus and Vector Analysis</td>
<td>4</td>
</tr>
</tbody>
</table>

Additional Courses
Select 6 credits of 400-level CHEM courses 1 | 6 |
CHEM 494 | Chemical Research | 3 |
CHEM 496 | Independent Studies | 3 |
MATH 250 | Ordinary Differential Equations | 3 |
STAT 401 | Experimental Methods | 3 |

Supporting Courses and Related Areas
Select 12 credits from school-approved list 2 | 12 |
CHEM 494, CHEM 495, and CHEM 496. |
Students may apply up to 6 credits of ROTC.

Biochemistry Option (44 credits)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 110S</td>
<td>Biology: Basic Concepts and Biodiversity</td>
<td>4</td>
</tr>
<tr>
<td>BIOL 230W</td>
<td>Biology: Molecules and Cells</td>
<td>4</td>
</tr>
<tr>
<td>BMB 402</td>
<td>General Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>BMB 403</td>
<td>Biochemistry Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 450</td>
<td>Physical Chemistry - Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 452</td>
<td>Physical Chemistry - Quantum Chemistry &amp; CHEM 457</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 202C</td>
<td>Effective Writing: Technical Writing</td>
<td>3</td>
</tr>
<tr>
<td>MATH 230</td>
<td>Calculus and Vector Analysis</td>
<td>4</td>
</tr>
</tbody>
</table>

Additional Courses
Select 3 credits of 400-level CHEM courses 1 | 3 |
CHEM 494 | Chemical Research | 3 |
CHEM 496 | Independent Studies | 3 |
MATH 250 | Ordinary Differential Equations | 3 |
STAT 401 | Experimental Methods | 3 |

Select one of the following:
BIOL 322 | Genetic Analysis | 3 |
BMB 406 | Molecular Biology | 3 |
BMB 465 | Protein Structure and Function | 3 |
MICRB 201 | Introductory Microbiology | 2 |
Supporting Courses and Related Areas
Select 6 credits from school-approved list ³  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)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Prescribed Courses</td>
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</tr>
<tr>
<td>Prescribed Courses: Require a grade of C or better</td>
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<td></td>
</tr>
<tr>
<td>CHEM 496</td>
<td>Independent Studies</td>
<td>3</td>
</tr>
<tr>
<td>ECON 102</td>
<td>Introductory Microeconomic Analysis and Policy</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 202D</td>
<td>Effective Writing: Business Writing</td>
<td>3</td>
</tr>
<tr>
<td>MGMT 301</td>
<td>Basic Management Concepts</td>
<td>3</td>
</tr>
<tr>
<td>MKTG 301</td>
<td>Principles of Marketing</td>
<td>3</td>
</tr>
<tr>
<td>SCM 200</td>
<td>Introduction to Statistics for Business</td>
<td>4</td>
</tr>
<tr>
<td>STAT 401</td>
<td>Experimental Methods</td>
<td>3</td>
</tr>
</tbody>
</table>

| Additional Courses | | |
| Additional Courses: Require a grade of C or better | | |
| Select 6 credits of 400-level CHEM courses ¹ | 6 |
| CHEM 450 | Physical Chemistry - Thermodynamics | 3 |
| or CHEM 452 | Physical Chemistry - Quantum Chemistry | 3 |

Select 9-10 credits in one of the following sequences: 9-10

| Sequence A | | |
| MGMT 331 | Management and Organization | |
| MGMT 410 | Project Management | |
| MGMT 420 | Negotiation and Conflict Management | |
| SCM 310 | | |

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

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

| Sequence D | | |
| | One selection each from sequences A, B and C | |

Supporting Courses and Related Areas
Select 6 credits from school-approved list ²  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.

Program Learning Objectives

1. 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.
2. 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.
3. Experiment Design: The student will learn the laboratory skills needed to design, safely conduct and interpret chemical research.
4. 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.
5. Communication: The student will develop the ability to effectively communicate scientific information and research results in written and oral formats.
6. 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 2020-21 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.

<table>
<thead>
<tr>
<th>First Year</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<tbody>
<tr>
<td>Fall</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 110†</td>
<td>3</td>
<td>CHEM 112†</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 111†</td>
<td>1</td>
<td>CHEM 113†</td>
<td>1</td>
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<tr>
<td>MATH 140†</td>
<td>4</td>
<td>MATH 141†</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 15 or 30†</td>
<td>3</td>
<td>PHYS 211 or BIOL 230W†</td>
<td>4</td>
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<tr>
<td>BIOL 110S†</td>
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<td>General Education Course</td>
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<td>PSU 7</td>
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<td>General Education Course (GHW)</td>
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<thead>
<tr>
<th>Second Year</th>
<th>Credits</th>
<th>Spring</th>
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<tbody>
<tr>
<td>Fall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 210†</td>
<td>3</td>
<td>CHEM 212†</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 227†</td>
<td>4</td>
<td>CHEM 213†</td>
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<td>PHYS 211 or BIOL 230W†</td>
<td>4</td>
<td>PHYS 212†</td>
<td>4</td>
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<tr>
<td>MATH 230†</td>
<td>4</td>
<td>MATH 250 or STAT 401†</td>
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<thead>
<tr>
<th>Third Year</th>
<th>Credits</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>Fall</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>CHEM 450†</td>
<td>3</td>
<td>CHEM 452†</td>
<td>3</td>
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<td>CHEM 457†</td>
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<td>1</td>
</tr>
<tr>
<td>CHEM 400†</td>
<td>1</td>
<td>CHEM 440†</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 316†</td>
<td>1</td>
<td>CHEM 441†</td>
<td>1</td>
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<tr>
<td>CHEM 472†</td>
<td>3</td>
<td>CHEM 494 or 496†</td>
<td>1</td>
</tr>
<tr>
<td>ENGL 202C‡</td>
<td>3</td>
<td>CAS 100‡</td>
<td>3</td>
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<tr>
<td>General Education Course</td>
<td>3</td>
<td>BMB 402†</td>
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<table>
<thead>
<tr>
<th>Fourth Year</th>
<th>Credits</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>Fall</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>CHEM 413†</td>
<td>4</td>
<td>CHEM 431W†</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 443†</td>
<td>1</td>
<td>BMB 403‡†</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 494 or 496†</td>
<td>1</td>
<td>CHEM 494 or 496†</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 400 Level Selection†</td>
<td>3</td>
<td>Biology Elective (BIOL, B M B, MICRB)†</td>
<td>3</td>
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<tr>
<td>General Education Course</td>
<td>3</td>
<td>Supporting Course and Related Areas</td>
<td>3</td>
</tr>
</tbody>
</table>

| Supporting Courses and Related Areas | 3 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

Related Areas
Supporting Courses and General Education Course
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 206W 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

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

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

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
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 under the designated CHMBC option.

The following select courses can also be used as a supporting course depending on demand:

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 advisor on a regular basis to develop and refine an academic plan that is appropriate for you.

Supporting Courses and Related Areas

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
EDSSN 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 206W 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 advisor on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year
Fall
Credits
CHEM 110‡ 3
CHEM 111‡ 3
MATH 140‡ 4
ENGL 15 or 30‡ 4
PSU 7 1

General Education Course 3

General Education Course (GHW) 1.5

Second Year
Fall
Credits
CHEM 210* 3
MATH 230* 4
CHEM 227* 4
PHYS 212† 4

General Education Course 3

General Education Course (GHW) 3

Third Year
Fall
Credits
CHEM 450* 3
CHEM 457* 1
CHEM 400* 1
CHEM 472* 3
CHEM 316* 1
CAS 100† 3

Supporting Course and Related Areas 3

Fourth Year
Fall
Credits
CHEM 413* 4
CHEM 443* 1
CHEM 494 or 496* 1
CHEM 400-Level Selection* 1

Supporting Courses and Related Areas 3

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 advisor on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year
Fall
Credits
CHEM 110‡ 3
CHEM 111‡ 3
MATH 140‡ 4
ENGL 15 or 30‡ 4
PSU 7 1

General Education Course 3

General Education Course (GHW) 1.5

Second Year
Fall
Credits
CHEM 210* 3
MATH 230* 4
CHEM 227* 4
PHYS 212† 4

General Education Course 3

General Education Course (GHW) 3

Third Year
Fall
Credits
CHEM 450* 3
CHEM 457* 1
CHEM 400* 1
CHEM 472* 3
CHEM 316* 1
CAS 100† 3

Supporting Course and Related Areas 3

Fourth Year
Fall
Credits
CHEM 413* 4
CHEM 443* 1
CHEM 494 or 496* 1
CHEM 400-Level Selection* 1

Supporting Courses and Related Areas 3

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 advisor on a regular basis to develop and refine an academic plan that is appropriate for you.
Elective Course | 3
---|---
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
   - 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. These 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

<table>
<thead>
<tr>
<th>Course</th>
<th>Notes</th>
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<tbody>
<tr>
<td>EDSGN 100S</td>
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<tr>
<td>BIOL 110 or higher</td>
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<tr>
<td>CHNS 1, CHNS 2, CHNS 3</td>
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<td>CMPSC any course</td>
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<td>GER 1, GER 2, GER 3</td>
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<td>MATH 200-level or higher</td>
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<tr>
<td>MICR 201 or MICR 202</td>
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<tr>
<td>PHYS 213, PHYS 214, PHYS 237, or any 400-level course</td>
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<tr>
<td>PLET 206W or higher</td>
<td></td>
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<tr>
<td>SPAN 1, SPAN 2, SPAN 3</td>
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<tr>
<td>STAT 250 or higher</td>
<td></td>
</tr>
</tbody>
</table>

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

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<th>Course</th>
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<td>CHEM 112†</td>
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<td>CHEM 111†</td>
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<td>MATH 140†</td>
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<td>ENGL 15 or 30‡</td>
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### Second Year

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<tr>
<td>CHEM 210*</td>
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<td>CHEM 212*</td>
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<td>CHEM 227*</td>
<td>4</td>
<td>CHEM 213*</td>
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<td>PHYS 212†</td>
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<td>ENGL 202C‡</td>
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<td>MATH 230*</td>
<td>4</td>
<td>MATH 250 or STAT 401*</td>
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<tr>
<td>PSYCH 100†</td>
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### Third Year

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<th>Course</th>
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<th>Spring</th>
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<td>CHEM 452*</td>
<td>3</td>
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<td>CHEM 457*</td>
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<td>CHEM 457*</td>
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<tr>
<td>CHEM 400*</td>
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<td>CHEM 440*</td>
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<tr>
<td>CHEM 472*</td>
<td>3</td>
<td>CHEM 441*</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 315*</td>
<td>1</td>
<td>CHEM 494 or 496*</td>
<td>1</td>
</tr>
</tbody>
</table>
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 494, EDTHP 115
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
BIOI 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
MICR 201 or MICR 202
PHYS 213, PHYS 214, PHYS 237, or any 400-level course
PLET 206W 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/)

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814-898-6105
behrend-science@psu.edu

http://behrend.psu.edu/school-of-science (http://behrend.psu.edu/school-of-science/)