

# DEPARTMENT OF PHYSICAL SCIENCES

The Department of Physical Sciences offers the following undergraduate degree programs:

**BS in Chemistry**

**BS in Chemistry/Engineering** (offered as a dual degree program with Clemson University)

**BS in Chemistry with an emphasis in Forensic Science**

**BS in Chemistry with an emphasis in Health Sciences**

**BS in Chemistry Education, Secondary Certification**

**BS in Environmental Science**

**BS in Environmental Science with Forensic Science Emphasis**

**The course requirements for each of these degree programs are on the respective program worksheets on pages 246-259.**

The Department's webpage (<http://www.lander.edu/science>) contains information about the individual programs of study, scholarships available for students majoring in Chemistry, Chemistry/Engineering Dual Degree, Chemistry with an emphasis in Forensic Science, Chemistry with an emphasis in Health Sciences, Chemistry Education, Environmental Science, or Environmental Science with an emphasis in Forensic Science, a link to an on-line application for these scholarships, and links to the home pages of faculty members.

An honors program is available in chemistry. Minors are available in chemistry, environmental science, and forensic science.

Curricular programs are also offered in pre-medicine, pre-pharmacy, pre-dentistry, and other pre-professional allied health science fields.

Courses in chemistry, physics, geology, and physical science are offered as support courses for professional, pre-professional, and general education areas of study.

## **Chemistry Major**

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Chemistry is an experimental science that has as its goal the development of an atomic and molecular interpretation of the properties and behavior of matter. The fundamental nature and extensive application of chemistry to other fields of science gives the chemistry graduate a variety of career choices and advanced study opportunities. Among these are industrial chemistry, government service, sales or supervision, secondary school teaching, and entry into graduate or professional schools. A program of maximum flexibility can best serve this wide variety of potential interests.

The student will have competency in the following areas prior to graduating from Lander University with a degree in chemistry:

1. Chemistry: Fundamental principles of analytical, inorganic, organic, and physical chemistry.
2. Mathematics: Fundamental principles of differential, integral, and multivariable calculus.
3. Physics: Fundamental principles of mechanics, heat, electricity, magnetism, and waves.

## **Chemistry Goals**

### **Students graduating with a BS Degree in Chemistry will**

1. have developed an understanding of modern scientific concepts and issues related to organic, inorganic, analytical, and physical chemistry;
2. demonstrate appropriate scientific communication skills to prepare and present a seminar presentation on a literature topic or undergraduate research experience; and
3. demonstrate skills necessary for safe and appropriate collection, analysis, and interpretation of data in chemistry laboratory experiments.

The core requirements for a Bachelor of Science degree in chemistry are CHEM 111-CHEM 112, CHEM 198, CHEM 199, CHEM 221- CHEM 222, CHEM 299, CHEM 330, CHEM 331, CHEM 401 and PSCI 499. Additional requirements include BIOL 112, CHEM 341, CHEM 402, PHYS 202 or PHYS 212, plus a minimum of nine hours of elective courses from CHEM 360 or above. Required cognates include MATH 123 and MATH 211 or MATH 141 and MATH 211, PHYS 201 or PHYS 211, and a minimum of nine hours of electives from the following: ASTR 101, BIOL 111 or higher, CHEM 260 or higher, CIS 130 or higher, ES 111 or higher, GEOL 111 or higher, MATH 141 or

higher, PHYS 203, PHYS 314, or PSCI 451. The program features extensive student participation in experimental laboratory work. In many instances, experiments are chosen to coincide with a student's specific needs and interests.

Chemistry courses are normally offered according to the following schedule:

<u>Every Fall</u>	<u>Every Spring</u>
CHEM 111	CHEM 112
CHEM 221	CHEM 198
CHEM 260	CHEM 199
CHEM 330	CHEM 222
CHEM 401	CHEM 299
CHEM 420	CHEM 301
	CHEM 331
	CHEM 341
	CHEM 360
	CHEM 402
	PSCI 499

Even Year Fall

CHEM 311

Other specialized courses may be offered as needed.

### Chemistry Honors Program

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A student graduating from Lander University with the Bachelor of Science degree in chemistry may qualify for the "Honors Degree in Chemistry" if the following conditions have been met:

1. Upon graduation, the student must have at least a GPA of 3.5 in both overall coursework and chemistry program requirements. There can be no grade below a "C" in any chemistry coursework, including repeated courses.
2. In addition to the normal course requirements, the following courses must be taken:  
Calculus: MATH 141  
Chemistry elective: CHEM 260 or above
3. The student must complete a research project in which:
  - a) The research is of sufficient quality to receive credit in CHEM 409 or CHEM 410;
  - b) The results are submitted for publication in a scientific journal or presentation at a scientific meeting (such as the South Carolina Academy of Science or the Western Carolinas Section of the American Chemical Society);
  - c) The results are presented in seminar format to the science faculty, students, and invited guests; and
  - d) The project may be completed entirely at Lander or initiated off campus during a summer research program.

Transfer students entering this program must have at least a 3.5 GPA overall and in chemistry program requirements from their former institution(s) and must meet the above guidelines.

### Chemistry Education Major

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The Chemical Education major is the fastest route to secondary chemistry certification. Individuals who want to teach chemistry rather than work in a laboratory will find that this program meets all their needs. Students will have the opportunity to engage with two different types of practitioners (scientists and experienced teachers) over the course of their education. A comprehensive chemistry education and state of the art technology will be introduced in classes such as inorganic, organic, instrumental, and biological chemistries. Classroom management, national science teaching standards, and educational technology will be introduced in education coursework. Students will participate in a series of clinical experiences beginning with observations of local high school classrooms and leading to a semester long student-teaching position as part of the education coursework.

This program adheres to the College of Education teacher disposition and screening requirements; students will be required to achieve all of the benchmarks for the Department of Teacher Education in order to successfully complete the program. State regulations regarding teacher certification may change during pursuit of the Chemical Education degree.

In order to ensure that appropriate progress is being made, students majoring in Chemical Education are encouraged to meet with their advisor regularly (at least twice each semester) to stay abreast on any changes in licensure requirements.

**Students enrolled in Secondary (History, English, Chemistry, Mathematics) or PK-12 (PE, Art, Music):**

**Initial Level (First Year)**

1. Participate in initial Advising and Induction.
2. Take PRAXIS Core or exempt with 22 ACT or 1100 SAT score.
3. Demonstrate professional behaviors and dispositions\* at all times.
4. Maintain a 3.0 GPA in all professional courses; achieve a grade of “B” or higher in each field experience; achieve a grade of “C” or higher in all EDUC, ECED, and SPED courses (see catalog for further details, including each department's GPA requirements within the specific content area).

**Provisional Level (Second Year)**

1. Complete Initial Level requirements.
2. Complete a SLED check.
3. Demonstrate professional behaviors and dispositions\* at all times.
4. Obtain a minimum 2.75 GPA on Lander coursework; maintain a 3.0 GPA in all professional courses; achieve a grade of “B” or higher in each field experience; achieve a grade of “C” or higher in all EDUC, and SPED courses (see catalog for further details, including each department's GPA requirements within the specific content area).
5. Pass PRAXIS Core or exempt with 22 ACT or 1100 SAT score.
6. Successfully complete an (April) oral interview with Teacher Education faculty.
7. Successfully complete other reviews as required by departments in specific content areas.

**Formal Level (Third Year)**

1. Complete Provisional Level requirements.
2. Demonstrate professional behaviors and dispositions\* at all times.
3. Obtain a minimum 2.75 GPA on Lander coursework; maintain a 3.0 GPA in all professional courses; achieve a grade of “B” or higher in each field experience; achieve a grade of “C” or higher in all EDUC, and SPED courses (see catalog for further details, including each department's GPA requirements within the specific content area).
4. Successfully complete departmental requirements for PRAXIS II.
5. Successfully complete other departmental requirements, reviews, projects, or milestones.

**Candidate Level (Fourth Year)**

1. Complete Formal Level requirements.
2. Complete FALS requirements before student teaching semester.
3. Enter candidacy with formal admission to the teacher education program.
4. Demonstrate professional behaviors and dispositions\* at all times.
5. Obtain a minimum 2.75 GPA on Lander coursework; maintain a 3.0 GPA in all professional courses; achieve a grade of “B” or higher in each field experience; achieve a grade of “C” or higher in all EDUC, and SPED courses (see catalog for further details, including each department's GPA requirements within the specific content area).
6. Successfully complete departmental requirements for PRAXIS II.
7. Successfully complete other departmental requirements, reviews, projects, or milestones.

Students not meeting one or more of the requirements will not progress to Candidate Status.

\*In order to ensure the quality of the Teacher Education program, Teacher Candidates who exhibit unacceptable dispositions may be removed from the program. Procedures for candidate removal are outlined within the Department of Teacher Education handbook.

**Chemistry/Engineering Dual Degree**

Students who wish to combine study in chemistry with further study in chemical engineering may do so under the Clemson University-Lander University Engineering Dual Degree Program. Under this cooperative agreement,

students will spend the first two years of their college career at Lander University in a chemistry program of study and the remaining three years at Clemson University in chemical engineering. Summer courses may be required.

A student who completes this five-year program of study will have had the experience of dividing his or her academic career between the liberal arts environment of a small university campus and the engineering climate of a large technically oriented university. This unique combination of study on two differently oriented campuses will provide a student with excellent engineering and chemistry training, complemented by study in the humanities and social sciences. Thus, a graduate from this dual degree program will be well trained to pursue a technical career strongly oriented to problems relevant to today's society.

Students apply to Clemson for admission in their second academic year at Lander. They must be recommended by the Lander faculty. Those students who do not maintain a GPA that would be competitive for entrance to Clemson may not be recommended. A grade of "C" or better is required in all courses transferred to Clemson.

Acceptance into the Clemson engineering program is at the discretion of Clemson University. Clemson recommends that the prospective student attend summer school at Clemson following the sophomore year at Lander.

All dual degree engineering majors will be able to enter Clemson University at a level competitive with students already at that university.

The student will have competency in the following areas prior to leaving for Clemson University:

1. Chemistry: Fundamental principles of analytical and organic chemistry.
2. Mathematics: Differential, integral, and multivariable calculus, and differential equations.
3. Physics: Mechanics, heat, electricity, atomic and nuclear physics, and magnetism.
4. Engineering: Engineering problem analysis, material and mass balances on chemical process systems, and engineering case studies.
5. Calculator: Proficiency in the use of an advanced scientific calculator.

### **Chemistry with an Emphasis in Forensic Science**

Students who pursue the forensic track will be able to obtain their Bachelor of Science degree in Chemistry while focusing on Crime lab applications. Coursework focuses on developing an understanding of how evidence collection and analysis can lead to conclusions about past actions, as well analytical skills that will not destroy trace evidence. Courses such as criminalistics, microscopical methods, and toxicology have been incorporated such that students have the hands-on experience and skills necessary to be competitive in the job market. Students that complete this major will be prepared to seek jobs with local, state, and federal criminalistics labs, as well as with museums and non-profit organizations.

### **Chemistry with an Emphasis in Health Sciences**

Chemistry majors interested in pursuing health profession careers, such as pharmacy and medicine, are encouraged to pursue the health sciences emphasis. It is designed to allow students to take those courses, which are pre-requisites for the various health professions, as part of the emphasis. This program offers flexibility in coursework so students are prepared for health-related entrance exams such as the MCAT.

### **Environmental Science Major**

Environmental science is the study of the myriad interactions between the world and us. As our population continues to grow, as technology advances and our needs and wants increase, our impacts on the world become more widespread and severe, despite improvement in some areas. Environmental impacts, in turn, affect human health and wellbeing.

Environmental challenges are multidisciplinary in nature. That is, in order to understand each environmental challenge sufficiently well to develop effective solutions, we must assemble expertise in several disciplines. It is also important that environmental scientists and decision makers understand the different sciences sufficiently well to communicate with those of other specialties and to appreciate the importance of other disciplines in addressing the challenges.

The environmental science major at Lander University is an interdisciplinary program drawing on courses in biology, chemistry, geology, environmental science, physics, mathematics, political science, and economics designed to meet the demand for workers with expertise in environmental science.

Graduates are qualified for careers with industry, governmental service, environmental consulting firms, and non-governmental environmental organizations, as well as entry into graduate or professional schools.

The core requirements for a Bachelor of Science degree in environmental science are BIOL 111, BIOL 306, BIOL 415, CHEM 111, CHEM 112, CHEM 221, CHEM 330, CHEM 420, ES 111, ES 301, ES 302, ES 310, ES 407 or ES 490, GEOL 111 or PSCI 112, GEOL 405, and PSCI 499. Also, two major electives from the following courses: BIOL 213, BIOL 303, BIOL 313, BIOL 421, CHEM 222, CHEM 260, CHEM 301, CHEM 331, CHEM 360, or CHEM 381.

The program features extensive student participation in experimental field and laboratory work. Field and lab work are often chosen to accommodate the interests or needs of individual students. It is the student's responsibility to be aware of the schedule of course offerings and to plan carefully so that all requirements for the degree can be completed in the desired time. Major courses, including major electives, are normally offered according to the following schedule.

<b><u>Every Fall Semester</u></b>	<b><u>Every Spring Semester</u></b>
BIOL 111	BIOL 303
BIOL 213	BIOL 306
BIOL 415	BIOL 313
BIOL 421	CHEM 112
CHEM 111	CHEM 222
CHEM 221	CHEM 301
CHEM 260	CHEM 331
CHEM 330	CHEM 360
CHEM 420	ES 111
ES 314	GEOL 111
PHYS 201 or PHYS 211	PSCI 499
PSCI 112	
<b><u>Even Year Fall</u></b>	<b><u>Odd Year Spring</u></b>
ES 301	ES 302
<b><u>Odd Year Fall</u></b>	<b><u>Even Year Spring</u></b>
ES 310	GEOL 405

Other specialized courses may be offered as needed, including ES 407 or ES 490.

### **Environmental Science Goals**

The goal of the environmental science program is to train environmental scientists and to produce graduates who are prepared for post-baccalaureate pursuits including graduate or professional schools or employment in the discipline.

#### **Students graduating with a BS Degree in Environmental Science will**

1. understand the scientific basis (chemistry, biology, geology, and environmental sciences) for environmental challenges and proposed solutions;
2. be able to use the scientific method and associated critical thinking skills to formulate questions, design experiments, and interpret and evaluate data to answer them;
3. have developed writing and presentation skills appropriate for students and practitioners in the discipline of environmental science; and
4. be able to develop and articulate well-informed and reasoned views on environmental issues that include an understanding of the legal, ethical, social, political, and economic ramifications of environmental problems, policy, and decisions.

### **Environmental Science with an Emphasis in Forensic Science**

Lander offers an environmental science major with an emphasis in environmental forensics for students interested in careers with environmental forensics components, such as determining or confirming environmental liability in working for environmental labs, regulatory agencies, industry, consulting firms, law firms and non-governmental organizations. The goal of this emphasis is to allow students to develop strong analytical skills and an understanding of the legal framework for this type of science.

### **Chemistry Minor**

A minor in chemistry consists of CHEM 111, CHEM 112, CHEM 221, plus a minimum of 6 hours of additional chemistry courses above CHEM 221, of which 3 hours are at the CHEM 260 or above level. (CHEM 381 may not be

used to satisfy the requirements of the chemistry minor.) A grade of “C” or better is required in all chemistry courses taken for the minor.

### **Environmental Science Minor**

A minor in environmental science consists of BIOL 111, CHEM 111, GEOL 111 or PSCI 112, ES 301, and ES 302. A grade of “C” or better is required in all courses taken for the minor.

### **Forensic Science Minor**

A minor in forensic science consists of CHEM 101, CHEM 111, CHEM 112, CHEM 221, CHEM 260, CHEM 360, and BIOL 112 for a total of 25 credit hours. A grade of “C” or better is required in all courses taken for the minor.

### **Pre-Professional Curricula**

Lander University offers curricular programs in the following areas: pre-medicine, pre-dentistry, pre-optometry, pre-veterinary medicine, pre-pharmacy, pre-physical therapy, and pre-occupational therapy. Because of the nature of the courses required to fulfill the requirements of these programs, most students in these programs major in Chemistry or Biology.

All pharmacy degree programs in the State of South Carolina are now 6-year Pharm. D. programs. As such, they require students to have a minimum of 66 credit hours before applying to pharmacy school.

Although most professional schools have common core curriculum requirements, there are variances. In addition, some schools have regular admission programs, early decision programs, and early admission programs. In the early admission program, the student can be accepted as early as the third semester of undergraduate study. There are variations in the number of hours and courses required by similar programs offered at different institutions. To better serve Lander’s students, each program has a designated faculty advisor. As soon as the decision to enter one of the health-related programs is made, the student and his/her advisement records will be turned over to the appropriate health program advisor in the Department of Physical Sciences.

Successful completion of the following Lander courses will allow a student to apply to pharmacy programs at the Medical University of South Carolina, the University of South Carolina, and Presbyterian College:

<b>Courses</b>	<b>Hours</b>
CHEM 111-112	8
BIOL 111-112	8
MATH 123 or 141	3 or 4
ENGL 101-102	6
MATH 211	3
CHEM 221-222	8
ECON 201 or ECON 202	3
PHYS 201-202 or 211-212	8
SPCH 101	3
BIOL 202	4
BIOL 203 or 311	4
BIOL 204 or 421	4
HISTORY	3
FINE ARTS	3
PSYC	3
SOCIAL SCIENCE ELECTIVES (including psychology and history)	9

Successful completion of the following Lander courses will prepare students to score well on the MCAT and will make the students very competitive once admitted to a school of medicine. The prerequisites for medical school include:

<b>Courses</b>	<b>Hours</b>
CHEM 111-112	8
BIOL 111-112	8
MATH	6

CHEM 221-222	8
PHYS 201-202 or 211-212	8
ENGL 101-102	6
PSYC 101	3
SOCI 101	3

Other science courses are recommended in order to better prepare the student.

## 2020-2021 PROGRAM REQUIREMENTS

**DEGREE: BACHELOR OF SCIENCE**  
**MAJOR: CHEMISTRY**

Credit Hours

### UNIVERSITY REQUIREMENT

FALS 101: Fine Arts and Lecture Series 0

### GENERAL EDUCATION REQUIREMENTS

(For approved courses, see the General Education: [www.lander.edu/gen-ed](http://www.lander.edu/gen-ed).)

#### A. Core Academic Skills (9 hours)

ENGL 101: Writing and Inquiry I 3

ENGL 102: Writing and Inquiry II 3

MATH 123: Calculus and its Applications or 3

MATH 141: Single Variable Calculus I

#### B. Humanities and Fine Arts 6

(6 hours selected from 2 different disciplines)

#### C. Behavioral and Social Perspectives 6

(6 hours selected from 2 different disciplines)

#### D. Scientific and Mathematical Reasoning

(7 hours selected from 2 different disciplines, 1 lab science required)

MATH 211: Statistical Methods I 3

PHYS 201: Introductory Physics I or 4

PHYS 211: General Physics I

#### E. Founding Documents of the United States 3

HIST 111: United States History to 1877 or

POLS 101: American National Government

#### F. World Cultures 3

#### G. LINK 101: Leadership, Involvement, Networking and Knowledge 1

LINK 101 is required of all new transfer students who have earned less than 24 credit hours of college-level work and all first-time freshmen.

TOTAL GENERAL EDUCATION REQUIREMENTS 35

If all of the General Education requirements are met and/or waived, and the credit hours do not add up to at least 30, the General Education requirements are not complete. If below 30, additional General Education courses from any category must be taken until the total hours add up to at least 30 hours.

### MAJOR PROGRAM CORE REQUIREMENTS

CHEM 111: General Chemistry I 4

CHEM 112: General Chemistry II 4

CHEM 198: Scientific Communications I 1

CHEM 199: Scientific Communications II 1

CHEM 221: Organic Chemistry I 4

CHEM 222: Organic Chemistry II 4

CHEM 299: Scientific Communications III 1

CHEM 330: Analytical Chemistry 5

CHEM 331: Chemical Instrumentation 4

CHEM 401: Physical Chemistry I 4

PSCI 499: Senior Seminar 3



**MAJOR PROGRAM ADDITIONAL REQUIREMENTS**

BIOL 112: Principles of Biology II	4
CHEM 260: Microscopical Methods or above (except CHEM 381)	3-4
CHEM 260: Microscopical Methods or above (except CHEM 381)	3-4
CHEM 260: Microscopical Methods or above (except CHEM 381)	3-4
CHEM 341: Inorganic Chemistry	4
CHEM 402: Physical Chemistry II	4
PHYS 202: Introductory Physics II or PHYS 212: General Physics II	4
Choose <b>three</b> from the following:	9-12
ASTR 101: Introduction to Astronomy (or higher)	
BIOL 111: Principles of Biology I (or higher)	
CHEM 260: Microscopical Methods (or higher)	
CIS 130: Problem Solving and Programming Methods (or higher)	
ES 111: Environmental Sustainability (or higher)	
GEOL 111: Physical Geology (or higher)	
MATH 141: Single Variable Calculus I (or higher)	
PHYS 203: Electronics	
PHYS 314: Fluids and Heat Transfer	
PSCI 451: Science Pedagogy	
<b>TOTAL MAJOR PROGRAM REQUIREMENTS</b>	<b>69-75</b>
<b>ADDITIONAL ELECTIVES</b>	<b>10-16</b>
Up to 6 credit hours may need to be 300-level or above The remaining hours may be at any level	
<b>TOTAL FOR BS DEGREE</b>	<b>120</b>

Coursework must include at least 30 credit hours earned in 300-level or above, of which 12 credit hours must be in the major.

See 4-year major guides for recommended order in which to take courses  
<https://www.lander.edu/academics/registrars-office/resources/major-guides>

## 2020-2021 PROGRAM REQUIREMENTS

**DEGREE: BACHELOR OF SCIENCE**  
**MAJOR: CHEMISTRY**  
**EMPHASIS: DUAL ENGINEERING**

Credit Hours

### UNIVERSITY REQUIREMENT

FALS 101: Fine Arts and Lecture Series 0

### GENERAL EDUCATION REQUIREMENTS

(For approved courses, see the General Education: [www.lander.edu/gen-ed](http://www.lander.edu/gen-ed).)

#### A. Core Academic Skills (9 hours)

ENGL 101: Writing and Inquiry I 3

ENGL 102: Writing and Inquiry II 3

MATH 141: Single Variable Calculus I 4

#### B. Humanities and Fine Arts

(6 hours selected from 2 different disciplines)

ART 101: Introduction to Art

or MUSI 101: Introduction to Music

or ENGL 200-level 3

Humanities and Fine Arts (Taken at Clemson) 3

#### C. Behavioral and Social Perspectives

(6 hours selected from 2 different disciplines)

ECON 101: Economics in Society

or POLS 103: Introduction to World Politics

or PSYC 101: General Psychology 3

Behavioral and Social Perspectives (Taken at Clemson) 3

#### D. Scientific and Mathematical Reasoning

(7 hours selected from 2 different disciplines, 1 lab science required)

MATH 142: Single Variable Calculus II 4

PHYS 211: General Physics I 4

#### E. Founding Documents of the United States

HIST 111: United States History to 1877

or POLS 101: American National Government

(Taken at Clemson as HIST 1010 or POSC 101) 3

#### F. World Cultures

ES 314: Cultural Perspectives of Global Climate Change 3

#### G. LINK 101: Leadership, Involvement, Networking and Knowledge

LINK 101 is required of all new transfer students who have earned less than 24 credit hours of college-level work and all first-time freshmen. 1

TOTAL GENERAL EDUCATION REQUIREMENTS 37

If all of the General Education requirements are met and/or waived, and the credit hours do not add up to at least 30, the General Education requirements are not complete. If below 30, additional General Education courses from any category must be taken until the total hours add up to at least 30 hours.

### MAJOR PROGRAM CORE REQUIREMENTS

CHEM 111: General Chemistry I 4

CHEM 112: General Chemistry II 4

CHEM 198: Scientific Communications I	1
CHEM 199: Scientific Communications II	1
CHEM 221: Organic Chemistry I	4
CHEM 222: Organic Chemistry II	4
CHEM 299: Scientific Communications III	1
CHEM 330: Analytical Chemistry	5
CHEM 331: Chemical Instrumentation	4
CHEM 401: Physical Chemistry I (Taken at Clemson)	4
PSCI 499: Senior Seminar (Taken at Clemson)	3

#### **MAJOR PROGRAM ADDITIONAL REQUIREMENTS**

CIS 130: Problem Solving and Programing Methods	4
CIS 202: Computer Applications for Engineers	3
MATH 241: Multivariable Calculus	4
MATH 242: Differential Equations	4
PHYS 212: General Physics II	4
PHYS 314: Fluids and Heat Transfer (Taken at Clemson)	4
CHEM 351: Mass And Energy Balance (Taken at Clemson):	4
CHEM 381: Technology, the Environment, and You	3
CHEM 402: Physical Chemistry II (Taken at Clemson)	4

**TOTAL MAJOR PROGRAM REQUIREMENTS** 69

**ADDITIONAL ELECTIVES** 14

**TOTAL FOR BS DEGREE** 120

Upon completion of the 2nd year at Lander, students will have completed 78 credit hours of coursework. However, students will have only completed 28 of the 37 hours of General Education requirements. In addition to transferring back the needed general education credits, students will also have to complete and transfer back: CHE 2110, CHE 2300, CHE 2200, CHE 3390, CHE 3320, CHE 3400, CHE 4430, CHE 4440. Furthermore, students must complete the Clemson degree requirements for a BS in chemical engineering to obtain the BS degree in chemistry from Lander. This option is available ONLY to students who pursue a degree in CHEMICAL Engineering at Clemson. Coursework must include at least 30 hours earned in 300 or above level courses, of which 12 hours must be in the major.

Coursework must include at least 30 credit hours earned at 300-level or above, of which 12 credit hours must be in the major.

See 4-year major guides for recommended order in which to take courses  
<https://www.lander.edu/academics/registrars-office/resources/major-guides>

## 2020-2021 PROGRAM REQUIREMENTS

**DEGREE: BACHELOR OF SCIENCE**  
**MAJOR: CHEMISTRY**  
**EMPHASIS: FORENSIC SCIENCE**

Credit Hours

### UNIVERSITY REQUIREMENT

FALS 101: Fine Arts and Lecture Series 0

### GENERAL EDUCATION REQUIREMENTS

(For approved courses, see the General Education: [www.lander.edu/gen-ed](http://www.lander.edu/gen-ed).)

**A. Core Academic Skills (9 hours)**

ENGL 101: Writing and Inquiry I 3

ENGL 102: Writing and Inquiry II 3

MATH 121: Mathematical Applications 3

or MATH 123: Calculus and its Applications

**B. Humanities and Fine Arts** 6

(6 hours selected from 2 different disciplines)

**C. Behavioral and Social Perspectives**

(6 hours selected from 2 different disciplines)

PSYC 101: General Psychology 3

Behavioral and Social Perspectives course 3

**D. Scientific and Mathematical Reasoning**

(7 hours selected from 2 different disciplines, 1 lab science required)

MATH 211: Statistical Methods I 3

PHYS 201: Introductory Physics I or 4

PHYS 211: General Physics I

**E. Founding Documents of the United States** 3

HIST 111: United States History to 1877 or

POLS 101: American National Government

**F. World Cultures** 3

**G. LINK 101: Leadership, Involvement, Networking and Knowledge** 1

LINK 101 is required of all new transfer students who have earned less than 24 credit hours of college-level work and all first-time freshmen.

**TOTAL GENERAL EDUCATION REQUIREMENTS 35**

If all of the General Education requirements are met and/or waived, and the credit hours do not add up to at least 30, the General Education requirements are not complete. If below 30, additional General Education courses from any category must be taken until the total hours add up to at least 30 hours.

### MAJOR PROGRAM CORE REQUIREMENTS

CHEM 111: General Chemistry I 4

CHEM 112: General Chemistry II 4

CHEM 198: Scientific Communications I 1

CHEM 199: Scientific Communications II 1

CHEM 221: Organic Chemistry I 4

CHEM 222: Organic Chemistry II 4

CHEM 299: Scientific Communications III 1

CHEM 330: Analytical Chemistry 5

CHEM 331: Chemical Instrumentation 4

CHEM 401: Physical Chemistry I	4
PSCI 499: Senior Seminar	3
<b>MAJOR PROGRAM EMPHASIS REQUIREMENTS</b>	
BIOL 112: Principles of Biology II	4
BIOL 312: Genetics	4
CHEM 101: Introduction to Criminalistics	3
CHEM 260: Microscopical Methods	3
CHEM 301: Biochemistry	3
CHEM 360: Toxicology	3
Choose <b>three</b> of the following:	9-12
BIOL 421: General Microbiology	
CHEM 311: Intermediate Organic Chemistry (or higher)	
GEOL 111: Physical Geology (or higher)	
PHYS 202: Introductory Physics II or 212: General Physics II	
POLS 217: Introduction to Public Administration	
POLS 313: Judicial Process	
<b>TOTAL MAJOR PROGRAM REQUIREMENTS</b>	<b>64-67</b>
<b>ADDITIONAL ELECTIVES</b>	<b>18-21</b>
Up to 4 credit hours may need to be 300-level or above	
The remaining hours may be at any level	
<b>TOTAL FOR BS DEGREE</b>	<b>120</b>

Coursework must include at least 30 credit hours earned in 300-level or above, of which 12 credit hours must be in the major.

See 4-year major guides for recommended order in which to take courses  
<https://www.lander.edu/academics/registrars-office/resources/major-guides>

## 2020-2021 PROGRAM REQUIREMENTS

**DEGREE: BACHELOR OF SCIENCE**  
**MAJOR: CHEMISTRY**  
**EMPHASIS: HEALTH SCIENCES**

Credit Hours

### UNIVERSITY REQUIREMENT

FALS 101: Fine Arts and Lecture Series 0

### GENERAL EDUCATION REQUIREMENTS

(For approved courses, see the General Education: [www.lander.edu/gen-ed](http://www.lander.edu/gen-ed).)

- A. Core Academic Skills (9 hours)**
- ENGL 101: Writing and Inquiry I 3
  - ENGL 102: Writing and Inquiry II 3
  - MATH 121: Mathematical Applications 3  
or MATH 123: Calculus and its Applications
- B. Humanities and Fine Arts 6**  
(6 hours selected from 2 different disciplines)
- C. Behavioral and Social Perspectives**  
(6 hours selected from 2 different disciplines)
- PSYC 101: General Psychology 3
  - SOCI 101: Introduction to Sociology 3
- D. Scientific and Mathematical Reasoning**  
(7 hours selected from 2 different disciplines, 1 lab science required)
- MATH 211: Statistical Methods I 3
  - PHYS 201: Introductory Physics I or  
PHYS 211: General Physics I 4
- E. Founding Documents of the United States 3**  
HIST 111: United States History to 1877 or  
POLS 101: American National Government
- F. World Cultures 3**
- G. LINK 101: Leadership, Involvement, Networking and Knowledge 1**  
LINK 101 is required of all new transfer students who have earned less than 24 credit hours of college-level work and all first-time freshmen.

TOTAL GENERAL EDUCATION REQUIREMENTS 35

If all of the General Education requirements are met and/or waived, and the credit hours do not add up to at least 30, the General Education requirements are not complete. If below 30, additional General Education courses from any category must be taken until the total hours add up to at least 30 hours.

### MAJOR PROGRAM CORE REQUIREMENTS

CHEM 111: General Chemistry I 4  
CHEM 112: General Chemistry II 4  
CHEM 198: Scientific Communications I 1  
CHEM 199: Scientific Communications II 1  
CHEM 221: Organic Chemistry I 4  
CHEM 222: Organic Chemistry II 4  
CHEM 299: Scientific Communications III 1  
CHEM 330: Analytical Chemistry 5  
CHEM 331: Chemical Instrumentation 4

CHEM 401: Physical Chemistry I	4
PSCI 499: Senior Seminar	3

**MAJOR PROGRAM EMPHASIS REQUIREMENTS**

BIOL 111: Principles of Biology I	4
BIOL 112: Principles of Biology II	4
BIOL 202: Human Anatomy	4
BIOL 203: Human Physiology	4
PHYS 202: Introductory Physics II or PHYS 212: General Physics II	4
Choose <b>three</b> of the following: (depends on professional school)	9-10
SPCH 101: Speech Fundamentals	
PHIL 302: Ethics	
BIOL 204: Microbiology	
PSYC 203: Developmental Psychology	
CHEM 301: Biochemistry	
PEES 310: Kinesiology and Exercise Biomechanics	

TOTAL MAJOR PROGRAM REQUIREMENTS	64-65
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<b>ADDITIONAL ELECTIVES</b>	20-21
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Up to 14 credit hours may need to be 300-level or above  
The remaining hours may be at any level

TOTAL FOR BS DEGREE	120
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Coursework must include at least 30 credit hours earned in 300-level or above, of which 12 credit hours must be in the major.

See 4-year major guides for recommended order in which to take courses  
<https://www.lander.edu/academics/registrars-office/resources/major-guides>

## 2020-2021 PROGRAM REQUIREMENTS

**DEGREE: BACHELOR OF SCIENCE**  
**MAJOR: CHEMISTRY EDUCATION**  
**PROGRAM: SECONDARY CERTIFICATION**

Credit Hours

### UNIVERSITY REQUIREMENT

FALS 101: Fine Arts and Lecture Series 0

### GENERAL EDUCATION REQUIREMENTS

(For approved courses, see the General Education: [www.lander.edu/gen-ed](http://www.lander.edu/gen-ed).)

- A. Core Academic Skills** (9 hours)
- ENGL 101: Writing and Inquiry I 3  
ENGL 102: Writing and Inquiry II 3  
MATH 121: Mathematical Applications 3  
or MATH 123: Calculus and its Applications
- B. Humanities and Fine Arts** 6  
(6 hours selected from 2 different disciplines)
- C. Behavioral and Social Perspectives** 6  
(6 hours selected from 2 different disciplines)
- D. Scientific and Mathematical Reasoning**  
(7 hours selected from 2 different disciplines, 1 lab science required)
- MATH 211: Statistical Methods I 3  
PHYS 201: Introductory Physics I or 4  
PHYS 211: General Physics I
- E. Founding Documents of the United States** 3  
HIST 111: United States History to 1877 or  
POLS 101: American National Government
- F. World Cultures** 3
- G. LINK 101: Leadership, Involvement, Networking and Knowledge** 1  
LINK 101 is required of all new transfer students who have earned less than 24 credit hours of college-level work and all first-time freshmen.

TOTAL GENERAL EDUCATION REQUIREMENTS 35

If all of the General Education requirements are met and/or waived, and the credit hours do not add up to at least 30, the General Education requirements are not complete. If below 30, additional General Education courses from any category must be taken until the total hours add up to at least 30 hours.

### MAJOR PROGRAM CORE REQUIREMENTS

BIOL 112: Principles of Biology II 4  
CHEM 111: General Chemistry I 4  
CHEM 112: General Chemistry II 4  
CHEM 221: Organic Chemistry I 4  
CHEM 331: Chemical Instrumentation 4  
CHEM 401: Physical Chemistry I 4  
CHEM 420: Environmental Chemistry 3  
PHYS 202: Introductory Physics II or PHYS 212: General Physics II 4



## MAJOR PROGRAM EMPHASIS REQUIREMENTS

Choose <b>two</b> from the following:	6-8
ASTR 101: Introduction to Astronomy or higher	
BIOL 111: Principles of Biology I or higher	
CHEM 222: Organic Chemistry II or higher	
CIS 130: Problem Solving and Programming Methods or higher	
ES 111: Environmental Sustainability or higher	
GEOL 111: Physical Geology or higher	
MATH 141: Single Variable Calculus I or higher	
PHYS 203: Electronics	
<b>TOTAL MAJOR PROGRAM REQUIREMENTS</b>	<b>37-39</b>

## TEACHER CERTIFICATION REQUIREMENTS

*PSCI 451: Science Pedagogy	3
*EDUC 203: Field Experience I	0.5
*EDUC 204: Instructional Technology for Teachers	3
*EDUC 223: General Pedagogy	3
*EDUC 240: Child Growth and Educational Process	3
*EDUC 320: Reading and Writing in the Content Area	3
*EDUC 321: Foundations of Reading	3
*EDUC 329: Field Experience II	0.5
*EDUC 429: Clinical Practice A	1
*EDUC 461: Clinical Practice B	11
*EDUC 499: Teacher Education Seminar	1
*SPED 223: PreK-12 Students with Diverse Learning Needs	3
<b>TOTAL TEACHER CERTIFICATION REQUIREMENTS</b>	<b>35</b>

## ADDITIONAL ELECTIVES 11-13

TOTAL FOR BS DEGREE 120

\* Must earn a C or better in courses marked with a single asterisk.

**Freshman Year:** Students must pass the State Skills Exam (Praxis CORE) during their freshman year, earn a C or better in all courses marked with an asterisk (see the 4-Year Major Guide for recommended sequence), and maintain a cumulative GPA of 2.75.

**Sophomore Year:** Students must file their application for admission to Teacher Education, pass the Screening Interview for Teacher Education, earn a C or better in all courses marked with an asterisk (see the 4-Year Major Guide for recommended sequence), and maintain a cumulative GPA of 2.75.

**Junior Year:** Students must file their application for student teaching, maintain a GPA of 3.00 or higher in all professional education coursework, earn a C or better in all courses marked with an asterisk (see the 4-Year Major Guide for recommended sequence), and maintain a cumulative GPA of 2.75. Students must pass the Praxis II content area exam prior to taking EDUC 461: Clinical Practice B and are advised to take the exam during the summer between their Junior and Senior Year.

**Senior Year:** Students must pass the Praxis II content area exam prior to taking EDUC 461: Clinical Practice B, complete the PPAT Teacher Certification Assessment during Clinical Practice, maintain a GPA of 3.0 or higher in all professional education coursework, earn a C or better in all courses marked with an asterisk (see the 4 Year Major Guide for recommended sequence), earn a 3.0 or better in EDUC 461: Clinical Practice and EDUC 499: Teacher Education Seminar, maintain a cumulative GPA of 2.75, submit Graduation Application, and complete any remaining FALS requirements. Coursework must include at least 30 credit hours earned in 300-level or above, of which 12 credit hours must be in the major.

See 4-year major guides for recommended order in which to take courses  
<https://www.lander.edu/academics/registrars-office/resources/major-guides>

## 2020-2021 PROGRAM REQUIREMENTS

**DEGREE: BACHELOR OF SCIENCE**  
**MAJOR: ENVIRONMENTAL SCIENCE**

Credit Hours

### UNIVERSITY REQUIREMENT

FALS 101: Fine Arts and Lecture Series 0

### GENERAL EDUCATION REQUIREMENTS

(For approved courses, see the General Education: [www.lander.edu/gen-ed](http://www.lander.edu/gen-ed).)

#### A. Core Academic Skills (9 hours)

ENGL 101: Writing and Inquiry I 3

ENGL 102: Writing and Inquiry II 3

MATH 123: Calculus and its Applications 3

or MATH 141: Single Variable Calculus I

#### B. Humanities and Fine Arts 6

(6 hours selected from 2 different disciplines)

#### C. Behavioral and Social Perspectives 6

(6 hours selected from 2 different disciplines)

#### D. Scientific and Mathematical Reasoning

(7 hours selected from 2 different disciplines, 1 lab science required)

MATH 211: Statistical Methods I 3

PHYS 201: Introductory Physics I or

PHYS 211: General Physics I 4

#### E. Founding Documents of the United States 3

HIST 111: United States History to 1877 or

POLS 101: American National Government

#### F. World Cultures

ES 314: Cultural Perspectives of Global Climate Change 3

#### G. LINK 101: Leadership, Involvement, Networking and Knowledge 1

LINK 101 is required of all new transfer students who have earned less than 24 credit hours of college-level work and all first-time freshmen.

TOTAL GENERAL EDUCATION REQUIREMENTS 35

If all of the General Education requirements are met and/or waived, and the credit hours do not add up to at least 30, the General Education requirements are not complete. If below 30, additional General Education courses from any category must be taken until the total hours add up to at least 30 hours.

### MAJOR PROGRAM CORE REQUIREMENTS

BIOL 111: Principles of Biology I 4

BIOL 306: Ecology 4

BIOL 415: Limnology 4

CHEM 111: General Chemistry I 4

CHEM 112: General Chemistry II 4

CHEM 221: Organic Chemistry I 4

CHEM 330: Analytical Chemistry 5

CHEM 420: Environmental Chemistry 3

ES 111: Environmental Sustainability 3

ES 301: Introduction to Environmental Science 1 4

ES 302: Introduction to Environmental Science 2 4

ES 310: Environmental Geology	3
ES 407: Research in Environmental Science or ES 490: Internship in Environmental Science	3
GEOL 111: Physical Geology or PSCI 112: Earth and Space Science	4
GEOL 405: Hydrogeology	3
PSCI 499: Senior Seminar	3
<b>MAJOR PROGRAM ELECTIVES</b>	6-8
(Choose 2 from the following)	
BIOL 213: Botany	
BIOL 303: Evolution	
BIOL 313: Plant Anatomy	
BIOL 421: General Microbiology	
CHEM 222: Organic Chemistry	
CHEM 260: Microscopical Methods	
CHEM 301: Biochemistry	
CHEM 331: Chemical Instrumentation	
CHEM 360: Toxicology	
CHEM 381: Technology, The Environment, and You	
<b>TOTAL MAJOR PROGRAM REQUIREMENTS</b>	65-67
<b>ADDITIONAL ELECTIVES</b>	18-20
<b>TOTAL FOR BS DEGREE</b>	120

Coursework must include at least 30 credit hours earned in 300-level or above, of which 12 credit hours must be in the major.

See 4-year major guides for recommended order in which to take courses  
<https://www.lander.edu/academics/registrars-office/resources/major-guides>

## 2020-2021 PROGRAM REQUIREMENTS

**DEGREE: BACHELOR OF SCIENCE**  
**MAJOR: ENVIRONMENTAL SCIENCE**  
**EMPHASIS: FORENSIC SCIENCE**

Credit Hours

### UNIVERSITY REQUIREMENT

FALS 101: Fine Arts and Lecture Series 0

### GENERAL EDUCATION REQUIREMENTS

(For approved courses, see the General Education: [www.lander.edu/gen-ed](http://www.lander.edu/gen-ed).)

- A. Core Academic Skills (9 hours)**
- ENGL 101: Writing and Inquiry I 3
  - ENGL 102: Writing and Inquiry II 3
  - MATH 123: Calculus and its Applications or  
MATH 141: Single Variable Calculus I 3
- B. Humanities and Fine Arts 6**  
(6 hours selected from 2 different disciplines)
- C. Behavioral and Social Perspectives 6**  
(6 hours selected from 2 different disciplines)
- ANTH 104: Cultural Anthropology 3
  - Behavioral and Social Perspectives course 3
- D. Scientific and Mathematical Reasoning**  
(7 hours selected from 2 different disciplines, 1 lab science required)
- MATH 211: Statistical Methods I 3
  - PHYS 201: Introductory Physics I or  
PHYS 211: General Physics I 4
- E. Founding Documents of the United States 3**  
HIST 111: United States History to 1877 or  
POLS 101: American National Government
- F. World Cultures 3**  
ES 314: Cultural Perspectives of Global Climate Change
- G. LINK 101: Leadership, Involvement, Networking and Knowledge 1**  
LINK 101 is required of all new transfer students who have earned less than 24 credit hours of college-level work and all first-time freshmen.

TOTAL GENERAL EDUCATION REQUIREMENTS 35

If all of the General Education requirements are met and/or waived, and the credit hours do not add up to at least 30, the General Education requirements are not complete. If below 30, additional General Education courses from any category must be taken until the total hours add up to at least 30 hours.

### MAJOR PROGRAM CORE REQUIREMENTS

- BIOL 111: Principles of Biology I 4
- BIOL 306: Ecology 4
- BIOL 415: Limnology 4
- CHEM 111: General Chemistry I 4
- CHEM 112: General Chemistry II 4
- CHEM 221: Organic Chemistry I 4
- CHEM 330: Analytical Chemistry 5
- CHEM 420: Environmental Chemistry 3

ES 111: Environmental Sustainability	3
ES 301: Introduction to Environmental Science 1	4
ES 302: Introduction to Environmental Science 2	4
ES 310: Environmental Geology	3
ES 407: Research in Environmental Science or ES 490: Internship in Environmental Science	3
GEOL 111: Physical Geology or PSCI 112: Earth and Space Science	4
GEOL 405: Hydrogeology	3
PSCI 499: Senior Seminal	3

**MAJOR PROGRAM EMPHASIS REQUIREMENTS**

CHEM 101: Introduction to Criminalistics	3
CHEM 260: Microscopical Methods	3
CHEM 360: Toxicology	3
Choose two from the following:	6-8
BIOL 213: Botany	
BIOL 303: Evolution	
BIOL 312: Genetics	
BIOL 313: Plant Anatomy	
BIOL 421: General Microbiology	
CHEM 222: Organic Chemistry	
CHEM 301: Biochemistry	
CHEM 331: Chemical Instrumentation	
CHEM 381: Technology, the Environment and You	
POLS 313: Judicial Process	

TOTAL MAJOR PROGRAM REQUIREMENTS 74-76

**ADDITIONAL ELECTIVES** 9-11

TOTAL FOR BS DEGREE 120

Coursework must include at least 30 credit hours earned in 300-level or above, of which 12 credit hours must be in the major.

See 4-year major guides for recommended order in which to take courses  
<https://www.lander.edu/academics/registrars-office/resources/major-guides>