

# CHEMISTRY, B.S.

## Program Description

The Department of Chemistry and Biochemistry embraces and supports the overall mission of La Salle University. We strive to create and maintain a nurturing, supportive environment for both students and faculty as we advance our understanding of chemistry and its application to the world around us. Our goal is to establish a community of curious and knowledgeable active learners. Implicit in the mission is a profound respect for the individual learner and an emphasis on the ethical responsibility of scientific inquiry towards the broader local, national and global communities.

Since 1963, The Chemistry major has been continually approved by the of the American Chemical Society illustrating the consistent high quality of the program.

## Why Take This Major?

Our graduates have attended some of the best graduate schools in the country including Princeton, Harvard, Berkeley, Johns Hopkins, Georgetown, and Cal Tech. Many of our students have become physicians, lawyers, or teachers, while other graduates have obtained lucrative employment in the chemical industry.

No matter what their chosen career path, our graduates excel because our department trains them in the critical thinking and problem solving. As a liberal arts university, La Salle has a curriculum that offers a solid background in the fundamentals of chemical science coupled with a broad-based education. Students are made aware of the interconnections of chemistry with the other sciences and also with the social sciences, business, and the humanities. With such an education, our graduates leave La Salle as dynamic, adaptable, and prepared individuals ready for almost anything they will face in the future.

## Degree Earned

B.S.

## Required for Graduation

- Courses
  - Major: 17 Courses: 12 Chemistry, 2 Math, 2 Physics, 1 Computer Science
  - Total: 38
- Credits
  - Major: 67
  - Total: minimum 130
- GPA
  - Major: 2.0
  - Cumulative: 2.0

## Student Learning Outcomes

- Students will execute chemical experimental laboratory techniques.
- Students will communicate scientific ideas and research both orally and in writing to both general and scientific audiences.
- Students will persist, think critically, and problem solve in tackling complex scientific problems.
- Students will explain the importance of biochemistry in addressing societal issues.

- Students will explain, visualize, and interpret chemistry at a macroscopic or (molecular) microscopic level.

## Progress Chart

### Level One - Core Courses

12 courses and 2 modules required.

### Major Requirements

*Major requirements include 4 Level Two ILO requirements, fulfilled through the major.*

Students in this major must complete **38** courses in total in order to graduate. **17 Courses: 12 Chemistry, 2 Math, 2 Physics, 1 Computer Science** courses will be from this major program.

Code	Title	Credits
<b>Level One - Core Courses</b>		
<i>Universal Required Courses</i>		
Students must complete the following 4 courses.		
ILO 8.1: Written Communication ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )		
ENG 110	College Writing I: Persuasion	3
ILO 5.1: Information Literacy ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )		
ENG 210	College Writing II: Research	3
ILO 1.1: Understanding Diverse Perspectives ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )		
FYS 130	First-Year Academic Seminar <sup>1</sup>	3
ILO 2.1: Reflective Thinking and Valuing ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )		
REL 100	Religion Matters	3
<i>Elective Core Courses</i>		
Students must complete 1 course in each of the following 4 ILOs.		
ILO 3.1a: Scientific Reasoning ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )		
CHM 111	General Chemistry I	4
ILO 3.1b: Quantitative Reasoning ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )		
MTH 120	Calculus I	4
ILO 6.1: Technological Competency ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )		
CSC 152	Introduction to Computing: Mathematics/Science Applications	3
ILO 8.1a/12.1: Oral Communication/Collaborative Engagement ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )		
Choose course within ILO ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )		3
<i>Distinct Discipline Core Courses</i>		
Students must complete 1 course in each of the following 4 ILOs. Each course must be from a different discipline. (A "discipline" is represented by the 3- or 4-letter prefix attached to each course.)		
ILO 4.1: Critical Analysis and Reasoning ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )		
Choose course within ILO ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )		4

ILO 9.1: Creative and Artistic Expression ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )	
Choose course within ILO ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )	3
ILO 10.1: Ethical Understanding and Reasoning ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )	
Choose course within ILO ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )	3
ILO 11.1: Cultural and Global Awareness and Sensitivity ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )	
Choose course within ILO ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )	3
<i>Universal Required Modules</i>	
Students must complete the following 2 non-credit modules. <sup>2</sup>	
ILO 7.1a ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )	
Health Literacy Module	
ILO 7.1b ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )	
Financial Literacy Module	
<b>Major Requirements</b>	
<i>Level Two</i>	
Students must complete 1 course/learning experience in each of the 4 commitments.	
ILO 2.2: Broader Identity (Capstone Course/Experience) ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )	
CHM 480 Chemical Research (ILO 2.2)	3-4
or CHM 499 Chemistry Capstone	
Select one ILO from 3.2a, 3.2b, 4.2, 5.2, 6.2, 7.2a, or 7.2b: Expanded Literacies ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )	
CHM 202 Organic Chemistry II (ILO 3.2a)	4
or CHM 331 Thermodynamics and Kinetics	
ILO 8.2b: Effective Expression (Writing-Intensive Course) ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )	
CHM 320 Organic Laboratory Methods (ILO 8.2b)	4
Select one ILO from 10.2, 11.2, or 12.2: Active Responsibility ( <a href="https://catalog.lasalle.edu/undergraduate/ilo/">https://catalog.lasalle.edu/undergraduate/ilo/</a> )	
CHM 212 Quantitative Analysis (ILO 12.2)	4
<i>All Other Required Courses</i>	
CHM 111 General Chemistry I	4
CHM 112 General Chemistry II	4
CHM 201 Organic Chemistry I	4
CHM 202 Organic Chemistry II	4
CHM 212 Quantitative Analysis	4
CHM 311 Instrumental Analysis	4
CHM 320 Organic Laboratory Methods	4
CHM 332 Quantum Mechanics and Spectroscopy	4
CHM 331 Thermodynamics and Kinetics	4
CHM 403 Advanced Inorganic Chemistry	4
CHM 411 Biochemistry I	4
CHM 499 Chemistry Capstone	1
CSC 152 Introduction to Computing: Mathematics/Science Applications	3
MTH 120 Calculus I	4
MTH 121 Calculus II	4
PHY 105 General Physics I	4

PHY 106	General Physics II	4
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*Free Electives*

In addition to the requirements listed above, students must take enough courses to fulfill graduation credit requirements for their School and major.

<b>Total Credits</b>	<b>118-119</b>
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1

NOTE. The following students use Level 2 Capstone Experience in Major instead of FYS 130 First-Year Academic Seminar: Honors, BUSCA, Core-to-Core, Transfer, and Non-Traditional/Evening.

2

The Modules are **not** required for Transfer Students, Core-to-Core Students, or BUSCA Students. BUSCA students are required to take modules if/when they pursue a bachelor's degree.

## Recommended Course Sequence

Course	Title	Credits
<b>First Year</b>		
<b>First Semester</b>		
CHM 111	General Chemistry I	4
MTH 120	Calculus I	4
<b>Credits</b>		<b>8</b>
<b>Second Semester</b>		
CHM 112	General Chemistry II	4
MTH 221	Calculus & Anal Geom II	4
<b>Credits</b>		<b>8</b>
<b>Second Year</b>		
<b>First Semester</b>		
CHM 201	Organic Chemistry I	4
PHY 105	General Physics I	4
<b>Credits</b>		<b>8</b>
<b>Second Semester</b>		
CHM 202	Organic Chemistry II	4
PHY 106	General Physics II	4
CHM 212	Quantitative Analysis	4
<b>Credits</b>		<b>12</b>
<b>Third Year</b>		
<b>First Semester</b>		
CHM 332	Quantum Mechanics and Spectroscopy	4
CHM 311	Instrumental Analysis	4
<b>Credits</b>		<b>8</b>
<b>Second Semester</b>		
CHM 331	Thermodynamics and Kinetics	4
CHM 320	Organic Laboratory Methods	4
<b>Credits</b>		<b>8</b>
<b>Fourth Year</b>		
<b>First Semester</b>		
CHM 403	Advanced Inorganic Chemistry	4
CHM 411	Biochemistry I	4
<b>Credits</b>		<b>8</b>
<b>Second Semester</b>		
CHM 499	Chemistry Capstone	1
<b>Credits</b>		<b>1</b>
<b>Total Credits</b>		<b>61</b>

## Dual Major Requirements

Chemistry majors wishing to double major in Biochemistry, their two elective courses in Biochemistry should be BIO courses.

## Minors

- Chemistry, Minor (<https://catalog.lasalle.edu/undergraduate/arts-sciences/chemistry-biochemistry/chemistry-bs/chemistry-minor/>)

## Course Descriptions

### Chemistry

#### CHM 105 Principles of Chemistry

This three-credit course introduces the basic principles of chemistry with a focus on mathematics and problem solving skills. Equal emphasis is given to the acquisition of correct conceptual understandings and the development of computational skills related to selected chemistry topics. This intent of this course is to prepare students for success in general chemistry (CHM 111-112). This course does not count towards the major. No pre-requisite classes are required to take this course.

#### CHM 111 General Chemistry I

General Chemistry I provides a firm basis for understanding the fundamentals of chemistry. This course covers atomic and molecular structure, stoichiometry, thermochemistry, and the periodic table. The descriptive chemistry is principally concerned with the reactions of nonmetals and of ions in solution. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): MTH 101 (C+ or better) or equivalent

#### CHM 112 General Chemistry II

General Chemistry II builds on the concepts of General Chemistry I and focuses on gasses, properties of solutions, kinetics, equilibrium, acid-base chemistry, and electrochemistry. The laboratory experiments reinforce the concepts covered in lecture. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 111 (C- or better)

#### CHM 150 Consumer Chemistry

Consumer Chemistry is a non-mathematical examination of the development of fact and theory in chemistry and the utilization of chemistry by society. Topics may include energy, pharmaceuticals, environmental effects, food additives, or synthetic materials. No prior knowledge of chemistry required. The course consists of three hours of lecture/laboratory sessions.

#### CHM 152 Criminalistics for Non-Physical Science Majors

This course is for non-science majors who are interested in learning more about how evidence from a crime scene is collected, analyzed, and evaluated. Of necessity, the course will be numerical in nature, but not math-intensive. As a multidisciplinary area of study, the course will use concepts from chemistry, biology, biochemistry, physics, toxicology, statistics, and other fields and will employ hands-on learning activities and laboratories, group work, and the traditional lecture format to convey the course material. The course consists of four hours of lecture/laboratory sessions.

#### CHM 161 Chemistry of The Life Sciences

Chemistry for the Life Sciences is a course for students typically majoring in nursing or nutrition. The course gives a general knowledge of chemistry (mostly inorganic) with an emphasis on health-related topics and problem-solving strategies. Descriptive and quantitative principles are discussed. This course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): High School Algebra

#### CHM 170 Special Topics

#### CHM 171 Special Topics

#### CHM 201 Organic Chemistry I

Organic Chemistry is the study of compounds containing carbon. This course is focused on the structure, bonding, and stereochemistry of these compounds together with an introduction to reactions, reaction mechanisms, and synthesis. This course, as well as CHM 202, is intended for students majoring in chemistry, biochemistry, and biology as well as those pursuing a career in the health professions. The laboratory introduces techniques used in organic synthesis, separation, purification, and structure elucidation. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 112 (C- or better)

#### CHM 202 Organic Chemistry II

The second semester of Organic Chemistry builds on the foundation established in CHM 201. The functional group and mechanistic approach to organic reactions allows for a more in-depth approach to organic synthesis. The use of basic spectral methods as a means of structure elucidation is also covered in this course. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 201 (C- or better)

#### CHM 212 Quantitative Analysis

This course covers important areas of analytical chemistry, including statistics, error analysis, chemical equilibria, electrochemistry, and colorimetry. This course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 112 (C- or better)

#### CHM 262 Organic Chemistry for The Life Sciences

CHM 262 is a one-semester course in organic chemistry designed to be particularly applicable to students majoring in nutrition and other health sciences. The subject matter includes organic chemistry principles: the naming of compounds, identification of functional groups, and chemical reactions. A particular emphasis is made in the coverage of reactions that are common to both organic and biochemistry. An effort will be made to make the examples and problems as health-related as possible. This course consists of three hours of lecture. Prerequisite(s): CHM 161 (C- or better)

#### CHM 263 Biochemistry for the Life Sciences

CHM 263 is a one-semester course in biochemistry designed to be particularly applicable to students majoring in nutrition. The subject matter includes biochemical principles (identification and properties of proteins, carbohydrates, lipids, nucleic acids, metabolic pathways, etc.). An effort will be made to make the examples and problems as health-related as possible. This course consists of three hours of lecture. Prerequisite(s): CHM 262 (C- or better)

#### CHM 265 Criminalistics for Physical Science Majors

Criminalistics for Physical Science Majors is a course for physical science majors who are interested in learning more about how evidence from a crime scene is collected, analyzed, and evaluated. The course employs hands-on learning activities, group work, and the traditional lecture format to convey the course material. Forensic science is a multidisciplinary field, and, as such, the course touches on areas of chemistry, biology, biochemistry, physics, toxicology, statistics, and other fields. The course consists of four hours of lecture/laboratory sessions. Prerequisite(s): CHM 201 (C- or better)

## CHM 270 Special Topics

## CHM 306 Quantum Chemistry

This elective course emphasizes chemical applications of group theory and quantum mechanics applied to molecular structure. Discussion of spectroscopic selection rules, symmetry and chemical bonding, and the spectroscopy of transition metal complexes are also included. The prerequisite for this course is CHM 332 or permission of the instructor.

This course has three hours of lecture. (S)

## CHM 311 Instrumental Analysis

CHM 311 covers the theory and practice of physical measurements with modern chemical instrumentation. The course is divided into two parts: spectroscopic and separation methods. Topics include UV-visible, FT-IR, fluorescence, and magnetic resonance spectroscopies as well as mass spectrometry, gas and liquid chromatographies. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 112 (C- or better) or permission from instructor

## CHM 320 Organic Laboratory Methods

This is a course in modern methods of organic synthesis and structure elucidation. This laboratory-intensive course emphasizes asymmetric synthesis, green chemistry, advanced spectral methods, and literature searching. The course consists of 75 minutes of lecture and six hours of laboratory. Prerequisite(s): CHM 202 (C- or better)

## CHM 331 Thermodynamics and Kinetics

This course applies the principles of thermodynamics and kinetics to explain the behavior of gases, liquids, solids, and solutions. Topics include the elucidation of chemical equilibria, phase transitions, reaction mechanisms, and statistical ensembles of energy states. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 202, MTH 221, PHY 106 (C- or better in all)

## CHM 332 Quantum Mechanics and Spectroscopy

This course uses the formalism of quantum mechanics to understand fundamental chemical systems. It explores atomic and molecular structures, molecular vibrations, and molecular rotations. It also explores the use of spectroscopy to probe these chemical processes. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 112, MTH 221, PHY 106 (C- or better in all)

## CHM 350 Cooperative Education

This course normally involves full-time, paid employment in a cooperating firm to provide on-the-job training (part-time positions at least six months in duration may qualify). The experience involves appropriate job-related learning assignments under faculty supervision. The position must be approved by the Department Chair. Consult the Associate Director for Experiential Education in Career Services before registering or for further information.

## CHM 360 Part-Time Internship

## CHM 370 Special Topics

## CHM 403 Advanced Inorganic Chemistry

This course covers theoretical and practical aspects of chemical bonding, descriptive periodic trends, and molecular structure and symmetry of molecules. A special emphasis is given to the chemistry of the transition metals, including coordination and organometallic chemistry. This course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 202

## CHM 404 Adv Organic Topics

This is a course designed to extend the knowledge of organic chemistry with an emphasis on more advanced and modern synthetic topics not fully developed in the elementary courses. An emphasis on the literature of chemistry is also included. Prerequisites: CHM 201, 202, and 320 are prerequisites for this course. The course consists of three hours of lecture. (S)

## CHM 411 Biochemistry I

Biochemistry I examines the biochemistry of proteins, carbohydrates, fats, vitamins, enzymes, and hormones from a chemist's perspective and emphasizes their role in metabolic processes. Laboratory work illustrates common techniques used to isolate, identify, and assay these molecules, such as chromatography, electrophoresis, and kinetic analysis. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 202

## CHM 412 Biochemistry II

Biochemistry II focuses on the storage, replication, transmission, and expression of genetic information. It also examines recombinant DNA methodology and physiological processes at the molecular level. Laboratory work includes the isolation and analysis of plasmid DNA, creation of a new plasmid, and transformation into bacterial cells. The course consists of three hours of lecture and three hours of laboratory. Prerequisite(s): CHM 411

## CHM 444 Research in Chemistry I

This course provides the student with an opportunity to do research with a faculty member. The student and the faculty member agree on the research project before the student registers for the course.

## CHM 445 Research in Chemistry II

This course is a continuation of the CHM 444 Research in Chemistry. It provides the student with an opportunity to continue to conduct research with a faculty member.

## CHM 450 Cooperative Education

This course normally involves full-time, paid employment in a cooperating firm to provide on-the-job training (part-time positions at least six months in duration may qualify). The experience involves appropriate job-related learning assignments under faculty supervision. The position must be approved by the Department Chair. Consult the Associate Director for Experiential Education in Career Services before registering or for further information.

## CHM 470 Special Topics

Occasionally, courses in "Bioinorganic Chemistry," "Advanced Organic and Organometallic Chemistry," or "Polymer Chemistry" may be offered as Special Topics. These courses are designed for juniors and seniors majoring in chemistry and/or biochemistry.

## CHM 471 Special Topics

## CHM 474 Special Topics

## CHM 480 Chemical Research

These courses provide students with the opportunity to engage in individual chemical or biochemical research. The research can be either laboratory-based or theoretical in nature. The work is done under the supervision of a staff member. The courses are restricted to chemistry and biochemistry majors unless otherwise approved by the chair of the Chemistry and Biochemistry Department. The specific hours for the course are arranged with the supervising staff member with a minimum of six research hours per week.

#### CHM 481 Chemical Research

These courses provide students with the opportunity to engage in individual chemical or biochemical research. The research can be either laboratory-based or theoretical in nature. The work is done under the supervision of a staff member. The courses are restricted to chemistry and biochemistry majors unless otherwise approved by the chair of the Chemistry and Biochemistry Department. The specific hours for the course are arranged with the supervising staff member with a minimum of six research hours per week.

#### CHM 482 Chem Research III

#### CHM 483 Chem Research III

#### CHM 499 Chemistry Capstone

This is the capstone course for senior-level chemistry and biochemistry majors. It is intended to broadly expose students to select topics that span sub-disciplines in chemistry and current trends in chemical science. The course is discussion-based and student-driven, and students will be required to examine their scientific ideas through research, reflection, and communication of topics in the chemical sciences.

## Program Contact Information

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