

# Chemistry

## Chemistry

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The chemistry major is designed to guide students toward understanding the principles underlying the composition, structure, and properties of substances—both natural and man-made—and the transformations they undergo. The program emphasizes helping students become knowledgeable observers and independent, imaginative problem-solvers, using state-of-the-art equipment in a laboratory setting.

The chemistry program offers three degrees of Bachelor of Science with the emphases listed below:

1. B.S. Major in Chemistry with Chemical Careers Emphasis
2. B.S. Major in Chemistry with Health Sciences Emphasis
3. B.S. Major in Chemistry with Material Science Emphasis

The B.S. in Chemistry with Chemical Careers Emphasis is designed primarily for students who wish to pursue graduate studies within the chemical sciences or seek employment in chemistry-related fields. Students planning to enter health-allied professional schools may choose a B.S. in Chemistry with Health Sciences Emphasis or B.S. in Chemistry with Material Science Emphasis degree. Further information and course requirements are listed under each emphasis.

- Students may take CHM 105, CHM 110, MTH 210, and PHY 240/241 to satisfy core requirements.
- CHM 105 is not required for students who enter Lyon College with a score of 25 or better on the ACT mathematics section (or equivalent SAT score) and a grade of "C" or better in high school chemistry.

**NOTE: To graduate with a Bachelor of Arts or Bachelor of Science degree from Lyon College, students must successfully complete a minimum of 120 semester credit hours comprising of our required Core curriculum (44-48 hours), the requirements of at least one major (credit hours vary per major), and a selection of our Liberal Arts electives. They must also earn at least a 2.00 cumulative grade point average for all work taken at Lyon College and a 2.00 cumulative grade point average in their major, minor, and concentration.**

## Chemistry Degrees

### Chemistry Major with Chemical Careers Emphasis (BS)

\*Students may use this course to satisfy core requirements.

CHM 105 is not required for students who enter Lyon College with a score of 25 or better on the ACT mathematics section (or equivalent SAT score) and a grade of "C" or better in high school chemistry.

Methods of Chemical Research can be completed by taking CHM 280 or CHM 480 credit/s.

Meet 3 hours a week of chemical research for a minimum of two semesters.

## Summary of Requirements for a Major in Chemistry (BS)

Item #	Title	Credits
CHM 105	Introduction to Chemistry *	4
CHM 110	General Chemistry I	4
CHM 120	General Chemistry II	4
CHM 210	Organic Chemistry I	4
CHM 220	Organic Chemistry II	4
CHM 224	Quantitative Analysis	2
CHM 302	Instrumental Analysis	4
CHM 355	Physical Chemistry I	3
CHM 370	Junior Seminar	1
CHM 413	Advanced Inorganic Chemistry	3
CHM 490	Senior Seminar	1
MTH 210	Calculus I	4
MTH 220	Calculus II	4
	Fundamentals of Physics	8
	Chemistry Elective: Chemical Careers (3-4 credits)	3-4
	2 Semesters of Methods of Chemical Research	2

## CORE CURRICULUM

Item #	Title	Credits
	Core Curriculum Requirements (In addition to Major hours)	44-48
	<b>Total Credits</b>	<b>95-104</b>

## Fundamentals of Physics

Select one of the following course sequences:

### Fundamentals of Physics

Item #	Title	Credits
PHY 240	Fundamentals of Physics I	3
PHY 241	Fundamentals of Physics I Laboratory	1
PHY 250	Fundamentals of Physics II	3
PHY 251	Fundamentals of Physics II Laboratory	1

## Chemistry Elective: Chemical Careers (3-4 credits)

Select one of the following:

Item #	Title	Credits
CHM 356	Biochemistry	4
CHM 365	Physical Chemistry II	3
CHM 482	Topics in Chemistry	3

## 2 Semesters of Methods of Chemical Research

## Chemistry Major with Health Sciences Emphasis (BS)

The other course option can be substituted to fulfill the chemistry elective requirement.

\*Students may use this course to satisfy core requirements.

CHM 105 is not required for students who enter Lyon College with a score of 25 or better on the ACT mathematics section (or equivalent SAT score) and a grade of "C" or better in high school chemistry.

Methods of Chemical Research can be completed by taking CHM 280 or CHM 480 credit/s.

Meet 3 hours a week of chemical research for a minimum of two semesters.

CHM 365 has a pre-requisite of MTH 220 Calculus II.

### Summary of Requirements for a Major in Chemistry (BS)

Item #	Title	Credits
CHM 105	Introduction to Chemistry *	4
CHM 110	General Chemistry I	4
CHM 120	General Chemistry II	4
CHM 210	Organic Chemistry I	4
CHM 220	Organic Chemistry II	4
	Chemistry: Health Sciences Options	4
CHM 356	Biochemistry	4
CHM 370	Junior Seminar	1
CHM 490	Senior Seminar	1
MTH 210	Calculus I	4
	Fundamentals of Physics	8
	Chemistry Elective: Health Sciences (3-4 credits)	3-4

### CORE CURRICULUM

Item #	Title	Credits
	Core Curriculum Requirements (In addition to Major hours)	44-48
	<b>Total Credits</b>	<b>85-94</b>

### Chemistry: Health Sciences Options

Choose CHM 224 **and** 2 Semesters of Methods of Chemical Research in Biomedical Sciences

**OR**

CHM 302

Item #	Title	Credits
	CHM 224 and Methods of Chemical Research in Biomedical Sciences	4
CHM 302	Instrumental Analysis	4

## Fundamentals of Physics

Select one of the following course sequences:

### Fundamentals of Physics

<b>Item #</b>	<b>Title</b>	<b>Credits</b>
PHY 240	Fundamentals of Physics I	3
PHY 241	Fundamentals of Physics I Laboratory	1
PHY 250	Fundamentals of Physics II	3
PHY 251	Fundamentals of Physics II Laboratory	1

## Chemistry Elective: Health Sciences (3-4 credits)

<b>Item #</b>	<b>Title</b>	<b>Credits</b>
CHM 355	Physical Chemistry I	3
CHM 365	Physical Chemistry II	3
CHM 413	Advanced Inorganic Chemistry	3
CHM 482	Topics in Chemistry	3

## Chemistry Major with Material Science Emphasis (BS)

The other course option can be substituted to fulfill the chemistry elective requirement.

\*Students may use this course to satisfy core requirements.

CHM 105 is not required for students who enter Lyon College with a score of 25 or better on the ACT mathematics section (or equivalent SAT score) and a grade of "C" or better in high school chemistry.

Methods of Chemical Research can be completed by taking CHM 280 or CHM 480 credit/s.

Meet 3 hours a week of chemical research for a minimum of two semesters.

CHM 365 has a pre-requisite of MTH 220 Calculus II.

## Summary of Requirements for a Major in Chemistry with Material Science Emphasis

<b>Item #</b>	<b>Title</b>	<b>Credits</b>
CHM 105	Introduction to Chemistry *	4
CHM 110	General Chemistry I	4
CHM 120	General Chemistry II	4
CHM 210	Organic Chemistry I	4
CHM 220	Organic Chemistry II	4
	Chemistry: Material Sciences Options	4
CHM 482	Topics in Chemistry	3
CHM 370	Junior Seminar	1
CHM 490	Senior Seminar	1
MTH 210	Calculus I	4
	Fundamentals of Physics	8
	Chemistry: Material Sciences Electives	3-4

## CORE CURRICULUM

Item #	Title	Credits
	Core Curriculum Requirements (In addition to Major hours)	44-48
	<b>Total Credits</b>	<b>84-94</b>

## Chemistry: Material Sciences Options

Choose CHM 224 **and** 2 Semesters of Methods of Chemical Research in Biomedical Sciences

OR

CHM 302

Item #	Title	Credits
CHM 224	Quantitative Analysis	2
	2 Semesters of Methods of Chemical Research in Material Science	2
CHM 302	Instrumental Analysis	4

## Fundamentals of Physics

Select one of the following course sequences:

### Fundamentals of Physics

Item #	Title	Credits
PHY 240	Fundamentals of Physics I	3
PHY 241	Fundamentals of Physics I Laboratory	1
PHY 250	Fundamentals of Physics II	3
PHY 251	Fundamentals of Physics II Laboratory	1

## Chemistry: Material Sciences Electives

Item #	Title	Credits
CHM 355	Physical Chemistry I	3
CHM 356	Biochemistry	4
CHM 365	Physical Chemistry II	3
CHM 413	Advanced Inorganic Chemistry	3
CHM 482	Topics in Chemistry	3

## Chemistry Minor

The chemistry minor is a course of study designed as a second field for students who wish to explore the scientific investigation of the composition, structure, properties, and transformation of natural and man-made substances.

## NOTES

The other course option can be substituted to fulfill the chemistry elective requirement.

\*\*This course is not required for students who enter Lyon College with a score of 25 or better on the ACT mathematics section (or equivalent SAT score) and a grade of "C" or better in high school chemistry.

Methods of Chemical Research can be completed by taking CHM 280 or CHM 480 credit/s.

Meet 3 hours a week of chemical research a semester. This course can be repeated to receive chemistry elective credit for up to a maximum of 2 semesters.

## Summary of Requirements for a Minor in Chemistry

Item #	Title	Credits
CHM 105	Introduction to Chemistry *	4
CHM 110	General Chemistry I	4
CHM 120	General Chemistry II	4
CHM 210	Organic Chemistry I	4
CHM 220	Organic Chemistry II	4
	Chemistry Minor Electives	6-8
	<b>Total Credits</b>	<b>26-28</b>

## Chemistry Minor Electives

Two of the following courses:

Item #	Title	Credits
CHM 224	Quantitative Analysis	2
CHM 302	Instrumental Analysis	4
CHM 356	Biochemistry	4
CHM 355	Physical Chemistry I	3
CHM 365	Physical Chemistry II	3
CHM 482	Topics in Chemistry	3

## Chemistry (CHM) Courses

### CHM 105: Introduction to Chemistry \*

An introductory course for students with little or no background in chemistry who wish to pursue further study in the sciences. Topics focus on basic mathematical skills, estimation, chemical nomenclature, stoichiometry, acids and bases, and data analysis. Students will exercise their problem-solving skills throughout the course. Course consists of lecture and laboratory components.

**Within the Biology and Chemistry Majors and Minors, \* CHM 105 is not required for students who enter Lyon College with a score of 25 or better on the ACT mathematics section (or equivalent SAT score) and a grade of "C" or better in high school chemistry.**

**Credits** 4

**Corequisites**

MTH 101 or MTH 103

## CHM 110: General Chemistry I

Fundamental concepts of chemistry, including stoichiometry, atomic structure, chemical bonding, periodic properties, energetics, chemical reactivity, and descriptive chemistry of the elements. Course consists of both lecture and laboratory components.

**Credits** 4

**Prerequisites**

Either MTH 110 or a 25 or better on the ACT mathematics section (or equivalent SAT score) and a “C” or better in high school chemistry, or a grade of “C” or better in CHM 105

## CHM 120: General Chemistry II

Fundamental concepts of chemistry, including the behavior of matter, solutions, acids and bases, molecular and ionic equilibria, electrochemistry, and kinetics. Course consists of both lecture and laboratory components.

**Credits** 4

**Prerequisites**

“C” or better in CHM 110

## CHM 182: Topics in Chemistry

Exploration of the modern aspects of classical chemistry, including organic, inorganic, analytical, and physical chemistry and biochemistry. Appropriate for all students. Elective credit. May be taken more than once for credit with permission of instructor.

**Credits** 1-4

## CHM 210: Organic Chemistry I

Study of carbon compounds with emphasis on fundamental types of aliphatic and aromatic compounds and their structure, nomenclature, preparations, reactions, and practical applications. Course consists of both lecture and laboratory components.

**Credits** 4

**Prerequisites**

CHM 120

## CHM 220: Organic Chemistry II

Continuation of CHM 210 with emphasis on aliphatic and aromatic compounds and their structure, nomenclature, preparations, reactions, and practical applications. Course consists of both lecture and laboratory components.

**Credits** 4

**Prerequisites**

CHM 210

## CHM 224: Quantitative Analysis

ation of the physical principles of analytical chemistry that further develop the classical (non-instrumental) methods of chemical analyses. Course consists of lecture on possibly a few hands-on experiences, if any. Topics

include basic data handling, statistics, error propagation, acids and bases, redox chemistry, and chemical equilibrium as they apply to the methods to be treated in the laboratory setting using case studies. Students will examine applications of volumetric analysis, redox titrimetry, potentiometry, and gravimetry and complete qualitative analysis.

**Credits** 2

**Prerequisites**

CHM 120

## CHM 280: Introduction to Chemical Research

An introduction to independent research, including literature searches, experimental methods, and proper recording and reporting of experimental results.

**Credits** 1-3

**Prerequisites**

CHM 110 and permission of instructor.

## CHM 302: Instrumental Analysis

Theory, operation, and application of various instruments used in a laboratory. Topics include infrared spectroscopy, ultraviolet-visible spectrophotometry, spectrophotofluorometry, atomic absorption spectroscopy, emission spectroscopy, nuclear magnetic resonance spectroscopy, mass spectroscopy, gas chromatography, and high performance liquid chromatography. Course consists of both lecture and laboratory components.

**Credits** 4

**Prerequisites**

CHM 220 or permission of instructor.

## CHM 304: Environmental Chemistry

Study of chemistry and the environment. Topics include toxicology, common pollutants, sampling for pollutants in air and water, and techniques used in analysis. Course consists of lectures, demonstrations, laboratory experiments, and field work.

**Credits** 4

**Prerequisites**

CHM 120

## CHM 355: Physical Chemistry I

An introduction to the basic principles of physical chemistry with emphasis on the kinetics and molecular dynamics of chemical reactions and the laws of thermodynamics and their relationship to equilibria in chemistry. Students will analyze experimental data using case studies, solve complex problems, and develop scientific data reporting skills. Course consists of lecture on possibly a few hands-on experiences, if any.

**Credits** 3

**Prerequisites**

CHM 120, MTH 210, and either PHY 210 or PHY 240

## CHM 356: Biochemistry

Study of the chemical basis of life with emphasis on the major biomolecules—proteins, carbohydrates, lipids, and nucleic acids—and their reactions and roles in living cells. Course consists of both lecture and laboratory components.

**Credits** 4

**Prerequisites**

CHM 220 or permission of instructor. (Same as BIO 356)

## CHM 365: Physical Chemistry II

Introduction to the physical chemistry principles that concern the structure of individual atoms and molecules, concentrating on quantum mechanics and spectroscopy. This course will examine how the viewpoints of quantum mechanics and thermodynamics are brought together to discuss statistical thermodynamics with emphasis on the analysis of complex problems and experimental data using case studies, and the improvement of scientific communication skills. Course consists of lecture on possibly a few hands-on experiences, if any.

**Credits** 3

**Prerequisites**

CHM 220

MTH 220

PHY 250

## CHM 370: Junior Seminar

The junior seminar allows students to develop their research and oral skills by reading and presenting information from current primary chemical literature. Each student must deliver a series of oral presentations on topics from the literature. Attendance at weekly departmental seminars and discussions is required.

**Credits** 1

**Prerequisites**

Junior standing or permission of instructor.

## CHM 390: Internship in Chemistry

Practical experience in chemistry or a related field of the student's choosing, with supervision by professionals. Offered every semester and in the summer as an elective for upper-class students who are interested in sampling a particular field of chemistry as a career opportunity.

**Credits** 1–3

**Prerequisites**

Junior or senior standing and permission of instructor.

## CHM 399: Chemistry International Studies Course: Variable Topics

Study of varying topics in chemistry. Includes a two-week Nichols trip. Prerequisites will vary.

**Credits** 1

## CHM 413: Advanced Inorganic Chemistry

Examination of quantum theory, symmetry and group theory, electronic structure, chemical bonding, the periodic table and periodic properties, crystalline structure, coordination chemistry, and some descriptive chemistry of the transition elements. Course consists of lecture on possibly a few hands-on experiences, if any.

**Credits** 3

**Prerequisites**

CHM 365 or permission of instructor.

## CHM 425: Advanced Biochemistry

In-depth study of selected biochemical reactions and pathways of major biological and physiological significance. Topics include synthesis and breakdown of important biomolecules, cell signaling pathways, and second messengers. Course consists of both lecture and laboratory components.

**Credits** 4

**Prerequisites**

CHM 356 or BIO 356. (Same as BIO 425)

## CHM 450: Directed Study

Individual work on special topics in chemistry.

**Credits** 1-3

## CHM 480: Directed Research

Independent research to acquaint students with the methods and techniques of chemical research.

**Credits** 1-3

**Prerequisites**

CHM 220

## CHM 482: Topics in Chemistry

Exploration of the modern aspects of classical chemistry, including organic, inorganic, and physical chemistry and biochemistry.

**Credits** 3

**Prerequisites**

Junior standing or permission of instructor.

## CHM 490: Senior Seminar

Taken in the final semester of the senior year, this course is designed to review the competency of each student in chemistry. Students will deliver a formal presentation consisting of an oral lecture and a written paper. Seminar topics for the presentation are chosen by the students in consultation with the faculty. All presentations are to be prepared under the supervision of a faculty member. Attendance at weekly departmental seminars and discussions is required.

**Credits** 1

**Prerequisites**

CHM 370 and senior standing.