

# Bachelor of Science in Chemistry

## Why study chemistry?

At KU Chemistry, we have faculty dedicated to mentoring both undergraduate and graduate students and to helping each student achieve scientific maturity. In addition to required classroom and laboratory courses, options exist for doing research in exciting areas of mainstream chemistry, including emerging fields of microfluidics, precision medicine and sustainable catalysis.

## Undergraduate Program

The undergraduate program in the Department of Chemistry has two primary missions. One of these is to help its majors attain a mastery of the discipline in preparation for further study in chemistry or a chemical science, or for immediate employment in chemistry. The other is to provide an opportunity for students majoring in other disciplines to acquire a basic knowledge of the fundamental areas of chemistry.

The curriculum leading to the **Bachelor of Science (B.S.)** degree, a rigorous program certified by the American Chemical Society, consists of a full spectrum of chemistry courses as well as supporting courses in mathematics and physics, and is designed to prepare students for a professional career in chemistry. The **Bachelor of Arts (B.A.)** degree program, with fewer required courses, allows students to obtain a broader knowledge of areas outside of chemistry, or to tailor their chemistry program for specific or unique objectives. We also offer a **Minor** in chemistry for those seeking a secondary area of study.

## Undergraduate Admission

### Admission to KU

All students applying for admission must send high school and college transcripts to the Office of Admissions. Unless they are college transfer students with at least 24 hours of credit, prospective students must send ACT or SAT scores to the Office of Admissions. Prospective first-year students should be aware that KU has qualified admission requirements that all new first-year students must meet to be admitted. Consult the Office of Admissions (<http://admissions.ku.edu>) for application deadlines and specific admission requirements.

Visit the Office of International Student and Scholar Services (<http://www.iss.ku.edu>) for information about international admissions.

Students considering transferring to KU may see how their college-level course work will transfer on the Office of Admissions (<http://credittransfer.ku.edu>) website.

## Admission to the College of Liberal Arts and Sciences

Admission to the College is a different process from admission to a major field. Some CLAS departments have admission requirements. See individual department/program sections for departmental admission requirements.

## Chemistry Programs

The B.S. degree prepares students for graduate school and professional careers. The B.A. degree is for the student who wants to understand the fundamental principles of chemistry and to study a number of other fields. Both are based on a high school background that includes at least 1½ years of algebra and 1 year of geometry. High school courses in chemistry and physics are desirable but are not required. Many chemistry majors are preparing for medical school or for graduate study in chemistry and related fields. For graduate school, the common body of knowledge in the B.A. program is the minimum prerequisite. For premedical students, much of the knowledge will be important in their careers. Even more important, however, is the training in logical thinking, drawing conclusions from experimental observations, and digesting and understanding scientific information.

## First- and Second-Year Preparation

Because study in chemistry requires preparation in mathematics and physics as well as a structured series of courses in chemistry, students should begin meeting major requirements in the first year. Students planning to major in chemistry should consult a chemistry department major advisor during their first semester to develop a 4-year plan for degree completion. It is particularly important to take CHEM 170 (or CHEM 130 or CHEM 190 & CHEM 191) and CHEM 175 (or CHEM 135 or CHEM 195 & CHEM 196) in the first year and CHEM 201, CHEM 330 (or CHEM 380) and CHEM 331 in the second year. For those seeking a B.S. degree it is also important to complete CHEM 335 (or CHEM 385) and CHEM 336 in the second year as well as their mathematics preparation (MATH 125, 126, 127 and CHEM 250) and physics preparation (PHSX 211 & PHSX 216, and PHSX 212 & PHSX 236) in the first 2 years.

## Requirements for the B.S. Degree

### General Education Requirements

All students must complete the KU Core.

### Chemistry Prerequisite or Co-requisite Knowledge (27-28)

Majors must complete courses as specified in each of the following areas. Majors are advised to take honors courses when eligible. These hours do not contribute to the minimum number of hours required for the major.

Calculus I. Satisfied by one of the following:	4
MATH 125    Calculus I or MATH 14: Calculus I, Honors	
Calculus II. Satisfied by one of the following:	4
MATH 126    Calculus II or MATH 14: Calculus II, Honors	
Calculus III. Satisfied by one of the following:	4
MATH 127    Calculus III or MATH 14: Calculus III, Honors	
Mathematical Methods for the Chemical Sciences. Satisfied by:	3
CHEM 250    Mathematical Methods for the Chemical Sciences	
General Physics I. Satisfied by one of the following:	5
PHSX 211    General Physics I & PHSX 216    and General Physics I Laboratory	
PHSX 213    General Physics I Honors	
General Physics II. Satisfied by one of the following:	4

PHSX 212 & PHSX 236	General Physics II and General Physics II Laboratory	
PHSX 214	General Physics II Honors	
Biochemistry. Satisfied by one of the following:		3-4
BIOL 600	Introductory Biochemistry, Lectures	
BIOL 636	Biochemistry I	

**Chemistry Core Knowledge and Skills (47)**

Majors must complete courses as indicated in the following areas:

Chemistry for the Chemical Sciences I. Satisfied by one of the following:		5
CHEM 170	Chemistry for the Chemical Sciences I	
CHEM 130	General Chemistry I	
CHEM 190 & CHEM 191	Foundations of Chemistry I, Honors and Foundations of Chemistry I Laboratory, Honors	
Chemistry for the Chemical Sciences II. Satisfied by one of the following:		5
CHEM 175	Chemistry for the Chemical Sciences II	
CHEM 135	General Chemistry II	
CHEM 195 & CHEM 196	Foundations of Chemistry II, Honors and Foundations of Chemistry II Laboratory, Honors	
Seminar I. Satisfied by:		0.5
CHEM 180	Seminar I	
Laboratory Safety in the Chemical Sciences. Satisfied by:		1
CHEM 201	Laboratory Safety in the Chemical Sciences	
Organic Chemistry I (Lecture and Lab). Satisfied by:		5
CHEM 330	Organic Chemistry I	
	or CHEM 380 Organic Chemistry I, Honors	
CHEM 331	Organic Chemistry I Laboratory	
Organic Chemistry II (Lecture and Lab). Satisfied by:		5
CHEM 335	Organic Chemistry II	
	or CHEM 380 Organic Chemistry II, Honors	
CHEM 336	Organic Chemistry II Laboratory	
Analytical Chemistry (Lecture and Lab). Satisfied by:		5
CHEM 400 & CHEM 401	Analytical Chemistry and Analytical Chemistry Laboratory	
Physical Chemistry I Satisfied by:		4
CHEM 530	Physical Chemistry I	
Physical Chemistry II (Lecture and Lab). Satisfied by:		6
CHEM 535 & CHEM 537	Physical Chemistry II and Physical Chemistry Laboratory	
Instrumental Methods of Analysis, Satisfied by:		2
CHEM 635	Instrumental Methods of Analysis	
Systematic Inorganic Chemistry. Satisfied by:		3
CHEM 660	Systematic Inorganic Chemistry	
Advanced Inorganic Laboratory. Satisfied by:		2
CHEM 661	Advanced Inorganic Laboratory	
Seminar II. Satisfied by:		0.5
CHEM 695	Seminar II	
Select one of the following: (Fulfills KU Core Goal 6)		3
CHEM 636	Instrumental Methods of Analysis Laboratory	
	or CHEM 698 Undergraduate Research Problems	
	or CHEM 699 Undergraduate Honors Research	

**Major Hours & Major GPA**

KU Core Goal 6 is satisfied by either CHEM 636 Instrumental Methods of Analysis Laboratory, or 3 credit hours of CHEM 698 or CHEM 699.

While completing all required courses, majors must also meet each of the following hour and grade-point average minimum standards:

**Major Hours**

Satisfied by 47 hours of major courses.

**Major Hours in Residence**

Satisfied by a minimum of 15 hours of KU resident credit in the major.

**Major Junior/Senior Hours**

Satisfied by a minimum of 35.5 hours from junior/senior courses (300+) in the major.

**Major Junior/Senior Graduation GPA**

Satisfied by a minimum of a 2.0 KU GPA in junior/senior courses (300+) in the major. GPA calculations include all junior/senior courses in the field of study including F's and repeated courses. See the Semester/Cumulative GPA Calculator. (<http://clas.ku.edu/undergrad/tools/gpa>)

**Biological Chemistry Option**

This option is available to students interested in the biological applications of chemistry. The curriculum is compatible with many pre-health-professions programs and prepares the student for graduate study or career opportunities.

**General Education Requirements**

All students must complete the KU Core.

**Chemistry Prerequisite or Co-requisite Knowledge (24)**

Majors must complete courses as specified in each of the following areas. Majors are advised to take honors courses when eligible. These hours do not contribute to the minimum number of hours required for the major.

Calculus I. Satisfied by one of the following:		4
MATH 125	Calculus I	
	or MATH 141 Calculus I, Honors	
Calculus II. Satisfied by one of the following:		4
MATH 126	Calculus II	
	or MATH 141 Calculus II, Honors	
Calculus III. Satisfied by one of the following:		4
MATH 127	Calculus III	
	or MATH 141 Calculus III, Honors	
Mathematical Methods for the Chemical Sciences. Satisfied by:		3
CHEM 250	Mathematical Methods for the Chemical Sciences	
General Physics I. Satisfied by one of the following:		5
PHSX 211 & PHSX 216	General Physics I and General Physics I Laboratory	
PHSX 213	General Physics I Honors	
General Physics II. Satisfied by one of the following:		4
PHSX 212 & PHSX 236	General Physics II and General Physics II Laboratory	
PHSX 214	General Physics II Honors	

**Chemistry Core Knowledge and Skills (47)**

Majors must complete courses as indicated in the following areas:

Chemistry for the Chemical Sciences I. Satisfied by one of the following: 5

CHEM 170	Chemistry for the Chemical Sciences I
CHEM 130	General Chemistry I
CHEM 190 & CHEM 191	Foundations of Chemistry I, Honors and Foundations of Chemistry I Laboratory, Honors

Chemistry for the Chemical Sciences II. Satisfied by one of the following: 5

CHEM 175	Chemistry for the Chemical Sciences II
CHEM 135	General Chemistry II
CHEM 195 & CHEM 196	Foundations of Chemistry II, Honors and Foundations of Chemistry II Laboratory, Honors

Seminar I. Satisfied by: 0.5

CHEM 180	Seminar I
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Laboratory Safety in the Chemical Sciences. Satisfied by: 1

CHEM 201	Laboratory Safety in the Chemical Sciences
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Organic Chemistry I (Lecture and Lab). Satisfied by: 5

CHEM 330	Organic Chemistry I
	or CHEM 38 Organic Chemistry I, Honors
CHEM 331	Organic Chemistry I Laboratory

Organic Chemistry II (Lecture and Lab). Satisfied by: 5

CHEM 335	Organic Chemistry II
	or CHEM 38 Organic Chemistry II, Honors
CHEM 336	Organic Chemistry II Laboratory

Analytical Chemistry (Lecture and Lab). Satisfied by: 5

CHEM 400 & CHEM 401	Analytical Chemistry and Analytical Chemistry Laboratory
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Physical Chemistry I Satisfied by: 4

CHEM 530	Physical Chemistry I
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Physical Chemistry II (Lecture and Lab). Satisfied by: 6

CHEM 535 & CHEM 537	Physical Chemistry II and Physical Chemistry Laboratory
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Instrumental Methods of Analysis Satisfied by: 2

CHEM 635	Instrumental Methods of Analysis
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Systematic Inorganic Chemistry. Satisfied by: 3

CHEM 660	Systematic Inorganic Chemistry
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Advanced Inorganic Laboratory. Satisfied by: 2

CHEM 661	Advanced Inorganic Laboratory
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Seminar II. Satisfied by: 0.5

CHEM 695	Seminar II
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Select one of the following: (Fulfills KU Core Goal 6) 3

CHEM 636	Instrumental Methods of Analysis Laboratory
	or CHEM 69 Undergraduate Research Problems
	or CHEM 69 Undergraduate Honors Research

### Biological Chemistry Core Knowledge and Skills (16)

Principles of Molecular and Cellular Biology. Satisfied by: 4

BIOL 150	Principles of Molecular and Cellular Biology
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Biochemistry. Satisfied by: 7

BIOL 636	Biochemistry I
BIOL 638	Biochemistry II

Biochemistry Laboratory. Satisfied by: 2

BIOL 637	Introductory Biochemistry Laboratory
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### Biological Chemistry Required Electives

Majors choosing this option should select 1 elective (3 hours) from the following: 3

BIOL 350	Principles of Genetics
BIOL 400	Fundamentals of Microbiology
BIOL 416	Cell Structure and Function

## Major Hours & Major GPA

While completing all required courses, majors must also meet each of the following hour and grade-point average minimum standards:

### Major Hours

Satisfied by 47 hours of major courses.

### Major Hours in Residence

Satisfied by a minimum of 15 hours of KU resident credit in the major.

### Major Junior/Senior Hours

Satisfied by a minimum of 35.5 hours from junior/senior courses (300+) in the major.

### Major Junior/Senior Graduation GPA

Satisfied by a minimum of a 2.0 KU GPA in junior/senior courses (300+) in the major. GPA calculations include all junior/senior courses in the field of study including F's and repeated courses. See the Semester/Cumulative GPA Calculator (<http://clas.ku.edu/undergrad/tools/gpa>).

## Chemical Physics Option

This option allows students to focus on the theoretical basis of chemistry. Students are prepared for graduate programs or employment.

## General Education Requirements

All students must complete the KU Core.

### Chemistry Prerequisite or Co-requisite Knowledge (29-30)

Majors must complete courses as specified in each of the following areas. Majors are advised to take honors courses when eligible. These hours do not contribute to the minimum number of hours required for the major.

Calculus I. Satisfied by one of the following: 4

MATH 125	Calculus I
	or MATH 14 Calculus I, Honors

Calculus II. Satisfied by one of the following: 4

MATH 126	Calculus II
	or MATH 14 Calculus II, Honors

Calculus III. Satisfied by one of the following: 4

MATH 127	Calculus III
	or MATH 14 Calculus III, Honors

Differential Equations. Satisfied by one of the following: 3

MATH 220	Applied Differential Equations
MATH 320	Elementary Differential Equations

Elementary Linear Algebra. Satisfied by: 2

MATH 290	Elementary Linear Algebra
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General Physics I. Satisfied by one of the following: 5

PHSX 211 & PHSX 216	General Physics I and General Physics I Laboratory
PHSX 213	General Physics I Honors

General Physics II. Satisfied by one of the following: 4

PHSX 212 General Physics II  
& PHSX 236 and General Physics II Laboratory

PHSX 214 General Physics II Honors

Biochemistry. Satisfied by one of the following: 3-4

BIOL 600 Introductory Biochemistry, Lectures

BIOL 636 Biochemistry I

### Chemistry Core Knowledge and Skills (47)

Majors must complete courses as indicated in the following areas:

Chemistry for the Chemical Sciences I. Satisfied by one of the following: 5

CHEM 170 Chemistry for the Chemical Sciences I

CHEM 130 General Chemistry I

CHEM 190 Foundations of Chemistry I, Honors  
& CHEM 191 and Foundations of Chemistry I Laboratory, Honors

Chemistry for the Chemical Sciences II. Satisfied by one of the following: 5

CHEM 175 Chemistry for the Chemical Sciences II

CHEM 135 General Chemistry II

CHEM 195 Foundations of Chemistry II, Honors  
& CHEM 196 and Foundations of Chemistry II Laboratory, Honors

Seminar I. Satisfied by: 0.5

CHEM 180 Seminar I

Laboratory Safety in the Chemical Sciences. Satisfied by: 1

CHEM 201 Laboratory Safety in the Chemical Sciences

Organic Chemistry I (Lecture and Lab). Satisfied by: 5

CHEM 330 Organic Chemistry I

or CHEM 38 Organic Chemistry I, Honors

CHEM 331 Organic Chemistry I Laboratory

Organic Chemistry II (Lecture and Lab). Satisfied by: 5

CHEM 335 Organic Chemistry II

or CHEM 38 Organic Chemistry II, Honors

CHEM 336 Organic Chemistry II Laboratory

Analytical Chemistry (Lecture and Lab). Satisfied by: 5

CHEM 400 Analytical Chemistry  
& CHEM 401 and Analytical Chemistry Laboratory

Physical Chemistry I Satisfied by: 4

CHEM 530 Physical Chemistry I

Physical Chemistry II (Lecture and Lab). Satisfied by: 6

CHEM 535 Physical Chemistry II  
& CHEM 537 and Physical Chemistry Laboratory

Instrumental Methods of Analysis Satisfied by 2

CHEM 635 Instrumental Methods of Analysis

Systematic Inorganic Chemistry. Satisfied by: 3

CHEM 660 Systematic Inorganic Chemistry

Advanced Inorganic Laboratory. Satisfied by: 2

CHEM 661 Advanced Inorganic Laboratory

Seminar II. Satisfied by: 0.5

CHEM 695 Seminar II

Select one of the following: (Fulfills KU Core Goal 6) 3

CHEM 636 Instrumental Methods of Analysis Laboratory  
or CHEM 69 Undergraduate Research Problems

or CHEM 69 Undergraduate Honors Research

### Chemical Physics Core Knowledge and Skills (12) 12

Majors must complete 2 courses from each of the following groups:

#### Group I

PHSX 313 General Physics III  
& PHSX 316 and Intermediate Physics Laboratory I (PHSX 313 and PHSX 316 should be taken concurrently)

PHSX 518 Mathematical Physics

PHSX 521 Mechanics I

PHSX 615 Numerical and Computational Methods in Physics

PHSX 655 Optics

PHSX 681 Concepts in Solids

#### Group II

PHSX 531 Electricity and Magnetism

PHSX 621 Mechanics II

MATH 646 Complex Variable and Applications

MATH 647 Applied Partial Differential Equations

CHEM 698 Undergraduate Research Problems

CHEM 750 Introduction to Quantum Mechanics

## Major Hours & Major GPA

While completing all required courses, majors must also meet each of the following hour and grade-point average minimum standards:

### Major Hours

Satisfied by 47 hours of major courses.

### Major Hours in Residence

Satisfied by a minimum of 15 hours of KU resident credit in the major.

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Satisfied by a minimum of 35.5 hours from junior/senior courses (300+) in the major.

### Major Junior/Senior Graduation GPA

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## Departmental Honors

Undergraduates may apply for admission to the departmental honors program after completion of an analytical, organic, and physical chemistry course but no sooner than the beginning of the junior year. Highly motivated and superior B.A. and B.S. students are admitted to the honors program. Honors in chemistry are awarded to students who have been admitted to the program and who have completed the following requirements with superior performance, including an overall KU GPA 3.25 and a major GPA of 3.5.

1. At least 2 semesters of CHEM 699 (4-8 hours total) resulting in a written thesis.
2. Evaluation and approval of the thesis by a faculty advisory committee.
3. Oral presentation of the thesis results at a special departmental seminar or other approved forum.

For an application form and further information, consult the department office.