

Chemistry, B.A.

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B.A. in Chemistry

The Bachelor of Arts (B.A.) in Chemistry offers a strong foundation in chemical principles while allowing for greater curricular flexibility. Compared to the B.S. degree, several chemistry, math, and other technical course requirements are replaced by free electives. This structure makes the B.A. an excellent choice for students interested in double majoring, particularly with departments in the College of Humanities and Social Sciences, College of Fine Arts, or the Tepper School of Business, though a second major is not required.

The B.A. is also well-suited for students pursuing careers in dentistry, pharmacy, or other fields that benefit from broader undergraduate preparation and more coursework outside of chemistry. Students may pursue one or more of the optional tracks available to B.S. degree candidates, provided they complete the necessary coursework.

Curriculum Planning and Course Scheduling

The curriculum and sample schedule presented here are intended for students who matriculate in Fall 2025. Students who entered in prior years should consult their degree audit and speak with the Director of Undergraduate Studies to confirm the requirements that apply to them.

The B.A. in Chemistry curriculum provides flexibility in designing personalized academic pathways, especially for students exploring minors, additional majors, or study abroad. While it is recommended to complete core technical courses early, students may choose to delay certain requirements to meet broader academic goals.

When planning your schedule, note that several key chemistry courses are offered only once per year. For example:

Fall-only courses:

- 09-219 Modern Organic Chemistry
- 09-321 Laboratory III: Molecular Design and Synthesis
- 09-323 Bioorganic Chemistry Laboratory

Spring-only courses:

- 09-220 Modern Organic Chemistry II
- 09-331 Modern Analytical Instrumentation
- 09-348 Inorganic Chemistry

Course Scheduling Note: Occasionally, a course that is typically offered in the fall may be shifted to the spring (or vice versa) due to departmental curriculum changes or faculty availability. Students are encouraged to consult the department and their advisor each semester to confirm course timing and build a long-term plan that anticipates such changes and accommodates personal goals such as study abroad, research, or double majoring.

Technical and Non-Technical Requirements

MCS Core Technical Requirements

To fulfill the MCS technical breadth requirement, chemistry majors must complete a minimum of four non-chemistry technical courses. Approved options include:

Technical Breadth Requirements	Units
33-121 Physics I for Science Students	12
33-122 Physics II for Biological Sciences and Chemistry Students	9
15-110 Principles of Computing	10
or 15-112 Fundamentals of Programming and Computer Science	
or 02-120 Programming for Scientists	

21-120	Differential and Integral Calculus	10
03-121	Modern Biology	9
or 03-231	Honors Biochemistry	
or 03-232	Biochemistry I	
21-122	Integration and Approximation	10
		60

Students are encouraged to complete these technical core requirements by the end of their fifth semester. AP credit may not be used to fulfill the core technical breadth requirements, though it can satisfy prerequisites for chemistry courses. If a student fulfills an entire category (e.g., physics or biology) solely through AP credit, they must take an approved upper-level course in that area to meet the core requirement.

Non-Technical General Education Requirements

All students in the Mellon College of Science (MCS) must complete a set of non-technical breadth requirements totaling a minimum of 75 units. These include communication, humanities and social sciences, global and cultural perspectives, and wellness:

Required Courses:

- 76-101 Interpretation and Argument (9 units)
- Arts, Humanities, and Social Sciences: Four courses totaling a minimum of 36 units
- Cultural/Global Understanding: One approved course (minimum 9 units)
- Science and Society: One approved course (minimum 6 units)
- Engage Sequence (5 total):
 - ENGAGE in Wellness
 - 38-230 ENGAGE in Wellness: Looking Inward (1 unit)
 - 38-330 ENGAGE in Wellness: Looking Outward (1 unit)
 - 38-430 ENGAGE in Wellness: Looking Forward (1 unit)
 - 38-110 ENGAGE in Service (1 unit)
 - 38-220 ENGAGE in the Arts (2 units)
- First-Year Seminars
 - 38-101 EUREKA!: Discovery and Its Impact (6 units)
 - 99-101 Core@CMU (3 units)

Important Notes:

- The Science and Society and ENGAGE requirements must be completed no later than the penultimate semester.
- Students may not double count courses across general education categories. For example, a course used to fulfill the Science and Society requirement may not also count toward the Cultural/Global Understanding category or the 36 units required in Arts, Humanities, and Social Sciences.

Overlap with Chemistry Electives:

Some chemistry courses approved for general education requirements may also count as chemistry electives. For example:

- Science and Society + Chemistry Elective:
 - 09-510 Chemistry and Sustainability (or graduate version, 09-710 Chemistry and Sustainability)
 - 09-381 Environmental Systems on a Changing Planet
 - 09-403 Hooked: The Chemical Basis of Drug Addiction

(Only one of these may count toward the 18 units of chemistry electives.)

- Cultural/Global Understanding + Chemistry Elective:
 - 09-227 The Culture of Color: Dyes, Chemistry, and Sustainability

A current list (<https://www.cmu.edu/mcs/undergrad/advising/hss-finearts/>) of approved courses in these categories is maintained by the MCS Dean's Office:

Sample Schedule by Year (First-Senior)

These schedules represent one possible path through the B.A. in Chemistry. Students should work closely with their academic advisor to develop an individualized plan that supports their goals, including study abroad, second majors, or research opportunities.

First Year

Fall	Units
09-105 Introduction to Modern Chemistry I	10
or 09-107 Honors Chemistry: Fundamentals, Concepts and Applications	
21-120 Differential and Integral Calculus	10
33-121 Physics I for Science Students	12
76-101 Interpretation and Argument	9
38-101 EUREKA!: Discovery and Its Impact	6
99-101 Core@CMU	3
	50

Planning Tip: Students interested in majoring in chemistry who have a strong chemistry background should enroll in 09-107 Honors Chemistry: Fundamentals, Concepts and Applications rather than 09-105 Introduction to Modern Chemistry I. Students who complete 09-107 with an A grade will be exempted from the requirement to take 09-106 Modern Chemistry II via a prerequisite waiver.

There are some elective laboratory courses offered for MCS students in the first year including 03-117 Frontiers, Analysis, and Discovery in Biological Sciences, 09-115 Introduction to Undergraduate Research in Chemistry or 09-101 Introduction to Experimental Chemistry. The maximum units allowed during the first semester is 54; therefore, students wishing to take a lab should take an alternate technical course to Physics I such as 15-110 Principles of Computing or 03-121 Modern Biology so that their unit total is lower.

Spring	Units
09-106 Modern Chemistry II	10
21-122 Integration and Approximation	10
33-121 Physics I for Science Students	12
or 03-121 Modern Biology	
or 15-110 Principles of Computing	
or 15-112 Fundamentals of Programming and Computer Science	
or 02-120 Programming for Scientists	
xx-xxx Arts, Humanities and Social Sciences Course 1	9
xx-xxx Free Elective	9
	50

Planning Tip: Chemistry majors who place out of 09-106 Modern Chemistry II can take 09-348 Inorganic Chemistry, 09-510 Chemistry and Sustainability or 09-381 Environmental Systems on a Changing Planet as a chemistry elective. 09-381 Environmental Systems on a Changing Planet is especially recommended for students pursuing the Environmental and Sustainability Studies minor. 09-510 Chemistry and Sustainability will serve as both a Chemistry elective as well as a MCS Science and Society requirement. Please note that 09-291 Environmental Systems on a Changing Planet does not count toward chemistry electives.

Sophomore Year

Fall	Units
09-201 Undergraduate Seminar I	1
09-219 Modern Organic Chemistry	10
09-221 Laboratory I: Introduction to Chemical Analysis	12
33-122 Physics II for Biological Sciences and Chemistry Students	9
Course is a prerequisite for 09-331, normally taken in the spring of the junior year	
xx-xxx Arts, Humanities and Social Sciences Course 2	9
	41

Spring	Units
09-202 Undergraduate Seminar II: Safety and Environmental Issues for Chemists	1
09-220 Modern Organic Chemistry II	10
09-222 Laboratory II: Organic Synthesis and Analysis	12
38-230 ENGAGE in Wellness: Looking Inward	1
xx-xxx Arts, Humanities and Social Sciences Course 3	9
xx-xxx Free Elective	9
	42

Planning Tip: Students pursuing careers in the health professions may wish to take 03-232 Biochemistry I in the Spring semester.

Junior Year

Fall	Units
09-301 Undergraduate Seminar III	1
09-321 Laboratory III: Molecular Design and Synthesis	12
or 09-323 Bioorganic Chemistry Laboratory	
38-330 ENGAGE in Wellness: Looking Outward	1
xx-xxx Free Elective	9
xx-xxx Arts, Humanities and Social Sciences Course 4	9
03-121 Modern Biology	9
or 15-110 Principles of Computing	
or 15-112 Fundamentals of Programming and Computer Science	
or 02-120 Programming for Scientists	
	41

Spring	Units
09-302 Undergraduate Seminar IV	1
09-331 Modern Analytical Instrumentation	9
09-348 Inorganic Chemistry	10
xx-xxx Cultural/Global Understanding Requirement	9
xx-xxx Approved Science and Society elective. This course can be scheduled at any point during your studies but prior to your final semester..	6-9
xx-xxx Free Elective	9
	44-47

Planning Tip:

Students pursuing careers in the health professions may wish to take 09-403 Hooked: The Chemical Basis of Drug Addiction in the Fall semester of their Junior year. It will fulfill both a Chemistry elective as well as a Science and Society elective.

Students may spread out junior-level courses across the junior and senior years to balance their academic load and research commitments. Work closely with your academic advisor to map out a schedule that fits your goals.

Senior Year

Fall	Units
09-401 Undergraduate Seminar V	1
09-xxx Chemistry Elective (see notes on electives)	9
38-110 ENGAGE in Service	1
38-220 ENGAGE in the Arts	2
38-430 ENGAGE in Wellness: Looking Forward	1
xx-xxx Free Electives	30
	44
Spring	Units
09-402 Undergraduate Seminar VI	3
09-xxx Chemistry Elective (see notes on electives)	9
xx-xxx Free Electives	38
	50

Planning Tip: The senior year is designed to provide maximum flexibility. Use this time to deepen your training through electives, conduct independent research, or prepare for graduate school, professional programs, or job applications. Be mindful of not overloading your final semester and aim to complete general education requirements, including all ENGAGE courses, before your last term.

Unit Summary and Graduation Requirements for the B.A. in Chemistry

Chemistry Requirements

A minimum of 121 units must come from chemistry-specific courses:

Required Chemistry Courses* Units	Units
09-105 Introduction to Modern Chemistry I	10
or 09-107 Honors Chemistry: Fundamentals, Concepts and Applications	
09-106 Modern Chemistry II	10
09-219 Modern Organic Chemistry	10
09-220 Modern Organic Chemistry II	10
09-331 Modern Analytical Instrumentation	9
09-348 Inorganic Chemistry	10

09-221	Laboratory I: Introduction to Chemical Analysis	12
09-222	Laboratory II: Organic Synthesis and Analysis	12
09-321	Laboratory III: Molecular Design and Synthesis	12
or 09-323	Bioorganic Chemistry Laboratory	
09-xxx	Chemistry Seminars	8
09-xxx	Chemistry Electives	18
		121

Lab Substitution Option

09-322 Laboratory IV: Molecular Spectroscopy and Dynamics may be taken in place of 09-321 Laboratory III: Molecular Design and Synthesis or 09-323 Bioorganic Chemistry Laboratory. However, students must complete the necessary prerequisites and corequisites: 09-231 Mathematical Methods for Chemists, 09-344 Physical Chemistry (Quantum): Microscopic Principles of Physical Chemistry, and 09-345 Physical Chemistry (Thermo): Macroscopic Principles of Physical Chemistry. In such cases, 09-344 Physical Chemistry (Quantum): Microscopic Principles of Physical Chemistry and 09-345 Physical Chemistry (Thermo): Macroscopic Principles of Physical Chemistry **will** count as chemistry electives toward the B.A. degree.

Residency Requirement for Chemistry Courses

All chemistry courses required for the B.A. that are numbered 09-2xx or higher must be taken at Carnegie Mellon University. Exceptions must be requested in advance and approved by the Director of Undergraduate Studies. Approval is typically granted only under unusual or extenuating circumstances.

Chemistry Electives (minimum 18 units required)

Chemistry electives are intended to enhance a student's technical knowledge in chemistry. These may include:

- 09-445 Undergraduate Research
- Most 09-3xx or higher chemistry courses (undergraduate or graduate)
- 03-231 Honors Biochemistry or 03-232 Biochemistry I

09-435 Independent Study Chemistry may only be used with permission of the Director of Undergraduate Studies.

Some interdisciplinary courses (e.g., 39-xxx) may count toward chemistry electives only if they have significant chemical content and are approved in advance by the Director of Undergraduate Studies.

In some cases, chemistry electives may also satisfy general education requirements such as Science and Society or Cultural/Global Understanding, but students should consult with an advisor to confirm eligibility and avoid double-counting within the same category.

Students should check with the chemistry department and the course-offering department each semester to confirm which courses are available and approved for elective credit.

Quick Guide: Choosing Chemistry Electives by Interest Area

Chemistry electives give you the flexibility to explore topics that align with your interests, deepen your technical training, or prepare you for specific career paths. Below are some common focus areas and electives that support them.

Interest Area	Suggested Chemistry Electives
Sustainability and Environmental Chemistry	09-510 Chemistry and Sustainability, 09-381 Environmental Systems on a Changing Planet, 09-529 Introduction to Sustainable Energy and Science
Biological and Health Applications	03-231 Biochemistry I or 03-232 Biochemistry I, 09-403 Hooked: The Chemical Basis of Drug Addiction, 09-737 Medicinal Chemistry and Drug development
Computational Chemistry and Modeling	09-563 Molecular Modeling and Computational Chemistry, 09-615 Computational Modeling. Statistical Analysis and Machine Learning in Science, 09-616 Neural Networks & Deep Learning in Science
Materials and Nanoscience	09-509 Physical Chemistry of Macromolecules, 09-507 Nanoparticles, 09-760 The Molecular Basis of Polymer Mechanics

Chemistry courses required for the B.S. (numbered 09-2xx or higher) must be taken at Carnegie Mellon. Exceptions are granted only under unusual or extenuating circumstances, with prior approval from the Director of Undergraduate Studies.

To plan your electives effectively, consult with your academic advisor and check semester availability with the chemistry department.

Other Required Courses and Electives

Other Requirements	Units
Biology (Modern Biology or Biochemistry)	9
Computer Science	10
Mathematics	20
Physics	21
Interpretation and Argument	9
Arts, Humanities and Social Sciences Courses	36
Cultural/Global Understanding	9
EUREKA! (First-year seminar)	6
Science and Society requirement	6
ENGAGE in Service	1
ENGAGE in Wellness Courses (three courses)	3
ENGAGE in the Arts	2
Core@CMU	3
Free Electives	104
Minimum number of units required for the degree:	360

Free Electives

Free electives include any Carnegie Mellon course, except those in science or engineering that are specifically intended for non-majors.

A maximum of 9 units total from the following categories may count toward the free elective requirement:

- Physical Education (P.E.)
- StuCo (Student College)
- ROTC

Students are encouraged to use free electives to pursue minors, deepen technical training, explore other disciplines, or prepare for future academic and career goals.

Additional Notes on Degree Requirements

Minimum Total Units

The B.A. curriculum typically requires students to take between 40 and 50 units per semester to meet the 360-unit graduation minimum. In practice, many students exceed this minimum as they explore electives in other disciplines or pursue additional majors. Students are strongly encouraged to take extra elective courses in whatever subjects they wish, to enrich their background and enhance their educational experience.

AP Credit and Unit Overlap

Some students may need to complete more than 360 units to graduate, especially if they repeat coursework for which they received AP credit. For example, a student who received AP credit for but takes 09-105 or 09-107 at CMU will only receive 10 units toward the requirement — not 20. The duplicate units will not count toward the degree total.

Transfer Students and Course Substitutions

Students who transfer into the department and have taken 09-217 Organic Chemistry I and/or 09-218 Organic Chemistry II must complete 09-435 Independent Study Chemistry (1 unit per course) under the supervision of the 09-219 Modern Organic Chemistry and/or 09-220 Modern Organic Chemistry II instructor(s) to cover missing content.

Students who have taken 09-207 Techniques in Quantitative Analysis and/or 09-208 Techniques for Organic Synthesis and Analysis must enroll in a 3-unit transition course:

- 09-215 Chemistry Tech I to Lab I Transition (for 09-207 Techniques in Quantitative Analysis)
- 09-216 - Chemistry Tech II to Lab II Transition (for 09-208 Techniques for Organic Synthesis and Analysis)