

Chemistry

UC Berkeley offers two bachelors' degrees in Chemistry: a Bachelor of Science (B.S.) through the College of Chemistry and a Bachelor of Arts (B.A.) through the College of Letters and Science. For specific information regarding degree requirements for each, please refer to the information below, and the appropriate Major Requirements and College Requirements tabs on this page.

B.S. in Chemistry, College of Chemistry

The B.S. in Chemistry degree provides a strong foundation in experimental processes, instrumentation, and quantitative analysis. Students will also acquire a strong foundation in math and physics, having taken the higher level sequences of these courses.

The B.S. in Chemistry is intended for students who are primarily interested in careers as professional chemists (e.g. in environmental, pharmaceutical, materials, and industrial chemistry), or wish to have a thorough grounding in chemistry in preparation for professional or graduate school in chemistry, a scientific career in government or industry, a teaching career, or related career tracks. Students in the B.S. program may also choose to pursue the Computational Chemistry or Materials Chemistry concentrations.

B.A. in Chemistry, College of Letters & Science

The B.A. in Chemistry includes a greater number of humanities and social science courses than the Bachelor of Science degree and is intended for those interested in careers in teaching, medicine, or other sciences in which a basic understanding of chemical processes is necessary.

Students who want to pursue the B.A. should apply for admission to the College of Letters & Science.

Minor Program

The College of Chemistry offers a minor in Chemistry. Chemical biology majors are not eligible to pursue this minor. Students must submit a notification of completion of the minor to the College of Chemistry Undergraduate Student Services Office.

In addition to the University, campus, and college requirements, listed on the College Requirements tab, students must fulfill the below requirements specific to their major program.

General Guidelines

1. A minimum grade point average (GPA) of 2.0 must be maintained in all courses undertaken at UC Berkeley, including those from UC Summer Sessions, UC Education Abroad Program, UC Berkeley in Washington Program, and XB courses from University Extension.
2. A minimum GPA of 2.0 in all courses taken in the college is required in order to advance and continue in upper division courses.
3. A minimum GPA of 2.0 in all upper division courses taken at the University is required to satisfy major requirements.
4. Chemistry majors who receive a grade of D+ or lower in a chemistry course for which a grade of C- or higher is required must repeat the course at UC Berkeley.

For information regarding grade requirements in specific courses, please see the notes sections below.

For information regarding residence requirements and unit requirements, please see the College Requirements tab.

Please note, the Academic Guide is updated once a year. For the most up to date requirements information, please take a look at the College of Chemistry website (<https://chemistry.berkeley.edu/ugrad/degrees/chem/>).

Lower Division Requirements

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|------------|---|---|
| CHEM 4A | General Chemistry and Quantitative Analysis | 5 |
| CHEM 4B | General Chemistry and Quantitative Analysis | 5 |
| CHEM 12A | Organic Chemistry | 5 |
| CHEM 12B | Organic Chemistry | 5 |
| MATH 1A | Calculus | 4 |
| MATH 1B | Calculus | 4 |
| MATH 53 | Multivariable Calculus | 4 |
| MATH 54 | Linear Algebra and Differential Equations | 4 |
| PHYSICS 7A | Physics for Scientists and Engineers | 4 |
| PHYSICS 7B | Physics for Scientists and Engineers | 4 |

Notes

1. Students should take CHEM 4A and CHEM 4B during their freshman year, and CHEM 12A and CHEM 12B during their sophomore year.
2. A grade of C- or better is required in CHEM 4A before taking CHEM 4B, in CHEM 4B before taking more advanced courses, and in CHEM 12A before taking CHEM 12B.
3. A grade of C- or better is recommended in CHEM 12A before taking BIOLOGY 1A.
4. Students who join the program after completing a general chemistry sequence that does not include quantitative analysis are required to take CHEM 4B or CHEM 105.
5. Students who join the program after completing CHEM 3A plus CHEM 3AL and CHEM 3B plus CHEM 3BL at Berkeley are allowed to substitute those courses for CHEM 12A and CHEM 12B. Students who join the program after completing only CHEM 3A plus CHEM 3AL at Berkeley are recommended to take CHEM 12B.
6. Students must take CHEM 96 during the fall term of their sophomore year at Berkeley.
7. Students should start MATH 1A in the first semester of their freshman year. MATH 10A and MATH 10B may be substituted for MATH 1A and MATH 1B.
8. Students should start PHYSICS 7A in the second semester of the freshman year. PHYSICS 5A and PHYSICS 5B plus PHYSICS 5BL may be substituted for PHYSICS 7A and PHYSICS 7B.
9. Students may substitute PHYSICS 89 for MATH 54.

Upper Division Requirements

For information regarding the upper division requirements for the Materials Chemistry concentration, see below.

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| CHEM 104A | Advanced Inorganic Chemistry | 3 |
| CHEM 104B | Advanced Inorganic Chemistry | 3 |
| CHEM 120A | Physical Chemistry | 3 |
| CHEM 120B | Physical Chemistry | 3 |

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| CHEM 125 | Physical Chemistry Laboratory | 3 |
| or CHEM C182 | Atmospheric Chemistry and Physics Laboratory | |
| Select one of the following: | | 4 |
| CHEM 105 | Instrumental Methods in Analytical Chemistry [4] | |
| CHEM 108 | Inorganic Synthesis and Reactions [4] | |
| CHEM 115 | Organic Chemistry--Advanced Laboratory Methods [4] | |
| Select 12 units of upper division chemistry and allied subjects courses (see below) ¹ | | 12 |
| One course must be an additional lecture course (or lab/lecture course) in Chemistry as approved by the student's staff adviser | | |

¹ Advanced Placement, Advanced Level, and International Baccalaureate credit cannot be applied to this requirement. No more than 4 units of research (e.g., CHEM H194 (<http://guide.berkeley.edu/archive/2021-22/search/?P=CHEM%20H194>) and CHEM 196 (<http://guide.berkeley.edu/archive/2021-22/search/?P=CHEM%20196>)) may be used to satisfy this requirement. If a course is used to satisfy another requirement, the course cannot also be used to satisfy the upper division Chemistry and Allied Subjects requirement.

Allied Subjects Courses

| | | |
|--------------|--|---|
| ASTRON C162 | Planetary Astrophysics | 4 |
| BIO ENG 100 | Ethics in Science and Engineering | 3 |
| BIO ENG 104 | Biological Transport Phenomena | 4 |
| BIO ENG 111 | Functional Biomaterials Development and Characterization | 4 |
| BIO ENG C112 | Molecular Biomechanics and Mechanobiology of the Cell | 4 |
| BIO ENG 115 | Tissue Engineering Lab | 4 |
| BIO ENG 116 | Cell and Tissue Engineering | 4 |
| BIO ENG C117 | Structural Aspects of Biomaterials | 4 |
| BIO ENG C118 | Biological Performance of Materials | 4 |
| BIO ENG C119 | Orthopedic Biomechanics | 4 |
| BIO ENG 121 | BioMEMS and Medical Devices | 4 |
| BIO ENG 131 | Introduction to Computational Molecular and Cell Biology | 4 |
| BIO ENG 132 | Genetic Devices | 4 |
| BIO ENG 143 | Computational Methods in Biology | 4 |
| BIO ENG 147 | Principles of Synthetic Biology | 4 |
| BIO ENG 150 | Introduction of Bionanoscience and Bionanotechnology | 4 |
| BIO ENG 151 | Micro/Nanofluidics for Bioengineering and Lab-On-A-Chip | 4 |
| BIO ENG 163 | Principles of Molecular and Cellular Biophotonics | 4 |
| BIO ENG C181 | The Berkeley Lectures on Energy: Energy from Biomass | 3 |
| CHM ENG 140 | Introduction to Chemical Process Analysis | 4 |
| CHM ENG 141 | Chemical Engineering Thermodynamics | 4 |
| CHM ENG 142 | Chemical Kinetics and Reaction Engineering | 4 |
| CHM ENG 150A | Transport Processes | 4 |
| CHM ENG 150B | Transport and Separation Processes | 4 |
| CHM ENG 154 | Chemical Engineering Laboratory | 4 |

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| CHM ENG 160 | Chemical Process Design | 4 |
| CHM ENG 162 | Dynamics and Control of Chemical Processes | 4 |
| CHM ENG 170A | Biochemical Engineering | 4 |
| CHM ENG 170B | Biochemical Engineering | 4 |
| CHM ENG C170L | Biochemical Engineering Laboratory | 3 |
| CHM ENG 171 | Transport Phenomena | 3 |
| CHM ENG 176 | Principles of Electrochemical Processes | 3 |
| CHM ENG C178 | Polymer Science and Technology | 3 |
| CHM ENG 179 | Process Technology of Solid-State Materials Devices | 3 |
| CHM ENG 180 | Chemical Engineering Economics | 3 |
| CHM ENG H194 | Research for Advanced Undergraduates | 2-4 |
| CHM ENG 195 | Special Topics | 2-4 |
| CHM ENG C195A | The Berkeley Lectures on Energy: Energy from Biomass | 3 |
| CHM ENG 196 | Special Laboratory Study | 2-4 |
| CHEM 100 | Communicating Chemistry (limited to 2 units) | 2 |
| CHEM 103 | Inorganic Chemistry in Living Systems (limited to 2 units) ¹ | 3 |
| CHEM 105 | Instrumental Methods in Analytical Chemistry | 4 |
| CHEM 108 | Inorganic Synthesis and Reactions | 4 |
| CHEM C110L | General Biochemistry and Molecular Biology Laboratory | 4 |
| CHEM 113 | Advanced Mechanistic Organic Chemistry | 3 |
| CHEM 114 | Advanced Synthetic Organic Chemistry | 3 |
| CHEM 115 | Organic Chemistry--Advanced Laboratory Methods | 4 |
| CHEM 122 | Quantum Mechanics and Spectroscopy | 3 |
| CHEM 125 | Physical Chemistry Laboratory | 3 |
| CHEM C130 | Biophysical Chemistry: Physical Principles and the Molecules of Life | 4 |
| CHEM 130B | Biophysical Chemistry (limited to unit 2 units) ¹ | 3 |
| CHEM 135 | Chemical Biology | 3 |
| CHEM C138 | The Berkeley Lectures on Energy: Energy from Biomass | 3 |
| CHEM 143 | Nuclear Chemistry | 2 |
| CHEM C150 | Introduction to Materials Chemistry | 3 |
| CHEM C170L | Biochemical Engineering Laboratory | 3 |
| CHEM C178 | Polymer Science and Technology | 3 |
| CHEM C182 | Atmospheric Chemistry and Physics Laboratory | 3 |
| CHEM C191 | Quantum Information Science and Technology | 3 |
| CHEM 192 | Individual Study for Advanced Undergraduates | 1-3 |
| CHEM H194 | Research for Advanced Undergraduates | 2-6 |
| CHEM 195 | Special Topics | 3 |
| CHEM 196 | Special Laboratory Study | 2-6 |
| CIV ENG C106 | Air Pollution | 3 |
| CIV ENG 111 | Environmental Engineering | 3 |
| CIV ENG 112 | Water & Wastewater Systems Design and Operation | 3 |
| CIV ENG 114 | Environmental Microbiology | 3 |
| CIV ENG 115 | Water Chemistry | 3 |
| CIV ENG C116 | Chemistry of Soils | 3 |
| CIV ENG C133 | Engineering Analysis Using the Finite Element Method | 3 |

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| CIV ENG 165 | Concrete Materials, Construction, and Sustainability | 3 | MAT SCI 151 | Polymeric Materials | 3 |
| COMPSCI 160 | User Interface Design and Development | 4 | MATH C103 | Introduction to Mathematical Economics | 4 |
| COMPSCI 162 | Operating Systems and System Programming | 4 | MATH 104 | Introduction to Analysis | 4 |
| COMPSCI 164 | Programming Languages and Compilers | 4 | MATH H104 | Honors Introduction to Analysis | 4 |
| COMPSCI 170 | Efficient Algorithms and Intractable Problems | 4 | MATH 105 | Second Course in Analysis | 4 |
| COMPSCI 174 | Combinatorics and Discrete Probability | 4 | MATH 110 | Linear Algebra | 4 |
| COMPSCI 184 | Foundations of Computer Graphics | 4 | MATH H110 | Honors Linear Algebra | 4 |
| COMPSCI C191 | Quantum Information Science and Technology | 3 | MATH 113 | Introduction to Abstract Algebra | 4 |
| EPS 103 | Introduction to Aquatic and Marine Geochemistry | 4 | MATH H113 | Honors Introduction to Abstract Algebra | 4 |
| EPS 111 | Course Not Available | | MATH 114 | Second Course in Abstract Algebra | 4 |
| EPS C129 | Biometeorology | 3 | MATH 115 | Introduction to Number Theory | 4 |
| EPS 131 | Geochemistry | 4 | MATH 121A | Mathematical Tools for the Physical Sciences | 4 |
| EPS C162 | Planetary Astrophysics | 4 | MATH 121B | Mathematical Tools for the Physical Sciences | 4 |
| EPS C180 | Air Pollution | 3 | MATH 123 | Ordinary Differential Equations | 4 |
| EPS C181 | Atmospheric Physics and Dynamics | 3 | MATH 125A | Mathematical Logic | 4 |
| EPS C182 | Atmospheric Chemistry and Physics Laboratory | 3 | MATH 126 | Introduction to Partial Differential Equations | 4 |
| EPS C183 | Carbon Cycle Dynamics | 3 | MATH 128A | Numerical Analysis | 4 |
| ECON C103 | Introduction to Mathematical Economics | 4 | MATH 128B | Numerical Analysis | 4 |
| EDUC 223B | Special Problems in Mathematics, Science and Technology Education (graduate-level; requires consent of instructor) | 2-6 | MATH 130 | Groups and Geometries | 4 |
| EDUC 224A | Mathematical Thinking and Problem Solving (graduate-level; requires consent of instructor) | 3 | MATH 135 | Introduction to the Theory of Sets | 4 |
| ENGIN 117 | Methods of Engineering Analysis | 3 | MATH 136 | Incompleteness and Undecidability | 4 |
| ENGIN 128 | Advanced Engineering Design Graphics | 3 | MATH 140 | Metric Differential Geometry | 4 |
| ESPM 119 | Chemical Ecology | 2 | MATH 142 | Elementary Algebraic Topology | 4 |
| ESPM 120 | Science of Soils | 3 | MATH 170 | Mathematical Methods for Optimization | 4 |
| ESPM C128 | Chemistry of Soils | 3 | MATH 185 | Introduction to Complex Analysis | 4 |
| ESPM C129 | Biometeorology | 3 | MATH H185 | Honors Introduction to Complex Analysis | 4 |
| ESPM C138 | Introduction to Comparative Virology | 4 | MATH 189 | Mathematical Methods in Classical and Quantum Mechanics | 4 |
| ESPM C148 | Pesticide Chemistry and Toxicology | 3 | MEC ENG C115 | Molecular Biomechanics and Mechanobiology of the Cell | 4 |
| ESPM 162 | Bioethics and Society | 4 | MEC ENG C117 | Structural Aspects of Biomaterials | 4 |
| ESPM 162A | Health, Medicine, Society and Environment | 4 | MEC ENG 118 | Introduction to Nanotechnology and Nanoscience | 3 |
| ESPM C180 | Air Pollution | 3 | MEC ENG C176 | Orthopedic Biomechanics | 4 |
| IND ENG 172 | Probability and Risk Analysis for Engineers | 4 | MEC ENG C180 | Engineering Analysis Using the Finite Element Method | 3 |
| INTEGBI 106A | Physical and Chemical Environment of the Ocean | 4 | MCELLBI C100A | Biophysical Chemistry: Physical Principles and the Molecules of Life | 4 |
| INTEGBI 115 | Introduction to Systems in Biology and Medicine | 4 | MCELLBI C103 | Bacterial Pathogenesis | 3 |
| MAT SCI 102 | Bonding, Crystallography, and Crystal Defects | 3 | MCELLBI 104 | Genetics, Genomics, and Cell Biology | 4 |
| MAT SCI 103 | Phase Transformations and Kinetics | 3 | MCELLBI 110 | Molecular Biology: Macromolecular Synthesis and Cellular Function | 4 |
| MAT SCI 104 | Materials Characterization | 3 | MCELLBI C110L | General Biochemistry and Molecular Biology Laboratory | 4 |
| MAT SCI 111 | Properties of Electronic Materials | 4 | MCELLBI C112 | General Microbiology | 4 |
| MAT SCI 112 | Corrosion (Chemical Properties) | 3 | MCELLBI C112L | General Microbiology Laboratory | 2 |
| MAT SCI 113 | Mechanical Behavior of Engineering Materials | 3 | MCELLBI C114 | Introduction to Comparative Virology | 4 |
| MAT SCI 117 | Properties of Dielectric and Magnetic Materials | 3 | MCELLBI C116 | Microbial Diversity | 3 |
| MAT SCI C118 | Biological Performance of Materials | 4 | MCELLBI 118 | Course Not Available | |
| MAT SCI 120 | Materials Production | 3 | MCELLBI 133L | Physiology and Cell Biology Laboratory | 4 |
| MAT SCI 121 | Metals Processing | 3 | MCELLBI 135A | Topics in Cell and Developmental Biology: Molecular Endocrinology | 3 |
| MAT SCI 122 | Ceramic Processing | 3 | MCELLBI 140 | General Genetics | 4 |
| MAT SCI 123 | ELECTRONIC MATERIALS PROCESSING | 4 | MCELLBI 140L | Genetics Laboratory | 4 |
| MAT SCI 125 | Thin-Film Materials Science | 3 | | | |
| MAT SCI 130 | Experimental Materials Science and Design | 3 | | | |
| MAT SCI 140 | Nanomaterials for Scientists and Engineers | 3 | | | |

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| MCELLBI 141 | Developmental Biology | 4 |
| MCELLBI 143 | Evolution of Genomes, Cells, and Development | 3 |
| MCELLBI C148 | Microbial Genomics and Genetics | 4 |
| MCELLBI 150 | Molecular Immunology | 4 |
| MCELLBI 150L | Immunology Laboratory | 4 |
| MCELLBI 160L | Neurobiology Laboratory | 4 |
| NUC ENG 101 | Nuclear Reactions and Radiation | 4 |
| NUC ENG 104 | Radiation Detection and Nuclear Instrumentation Laboratory | 4 |
| NUC ENG 107 | Introduction to Imaging | 3 |
| NUC ENG 120 | Nuclear Materials | 4 |
| NUC ENG 124 | Radioactive Waste Management | 3 |
| NUC ENG 130 | Analytical Methods for Non-proliferation | 3 |
| NUC ENG 150 | Introduction to Nuclear Reactor Theory | 4 |
| NUC ENG 161 | Nuclear Power Engineering | 4 |
| NUC ENG 162 | Radiation Biophysics and Dosimetry | 3 |
| NUC ENG 170A | Nuclear Design: Design in Nuclear Power Technology and Instrumentation | 3 |
| NUC ENG 170B | Nuclear Design: Design in Bionuclear, Nuclear Medicine, and Radiation Therapy | 3 |
| NUC ENG 180 | Introduction to Controlled Fusion | 3 |
| NUSCTX 103 | Nutrient Function and Metabolism | 4 |
| NUSCTX 108A | Introduction and Application of Food Science | 3 |
| NUSCTX 110 | Toxicology | 4 |
| NUSCTX 115 | Principles of Drug Action | 2 |
| NUSCTX 160 | Metabolic Bases of Human Health and Diseases | 4 |
| NUSCTX 171 | Nutrition and Toxicology Laboratory | 4 |
| PHYSICS 7C | Physics for Scientists and Engineers (must be completed with a grade of C- or better) | 4 |
| PHYSICS 105 | Analytic Mechanics | 4 |
| PHYSICS 110A | Electromagnetism and Optics | 4 |
| PHYSICS 110B | Electromagnetism and Optics | 4 |
| PHYSICS 112 | Introduction to Statistical and Thermal Physics | 4 |
| PHYSICS 130 | Quantum and Nonlinear Optics | 3 |
| PHYSICS 137B | Quantum Mechanics | 4 |
| PHYSICS 138 | Modern Atomic Physics | 3 |
| PHYSICS 141A | Solid State Physics | 4 |
| PHYSICS 141B | Solid State Physics | 3 |
| PHYSICS C191 | Quantum Information Science and Technology | 3 |
| PLANTBI C103 | Bacterial Pathogenesis | 3 |
| PLANTBI C112 | General Microbiology | 4 |
| PLANTBI C112L | General Microbiology Laboratory | 2 |
| PLANTBI C114 | Introduction to Comparative Virology | 4 |
| PLANTBI C116 | Microbial Diversity | 3 |
| PLANTBI 120 | Biology of Algae | 2 |
| PLANTBI 120L | Laboratory for Biology of Algae | 2 |
| PLANTBI 122 | Bioenergy | 2 |
| PLANTBI C124 | The Berkeley Lectures on Energy: Energy from Biomass | 3 |
| PLANTBI 135 | Physiology and Biochemistry of Plants | 3 |
| PLANTBI C148 | Microbial Genomics and Genetics | 4 |
| PLANTBI 150 | Plant Cell Biology | 3 |
| PLANTBI 160 | Plant Molecular Genetics | 3 |

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| PLANTBI 170 | Modern Applications of Plant Biotechnology | 2 |
| PLANTBI 180 | Environmental Plant Biology | 2 |
| PB HLTH 142 | Introduction to Probability and Statistics in Biology and Public Health | 4 |
| PB HLTH 162A | Public Health Microbiology | 4 |
| PB HLTH 162L | Course Not Available | |
| STAT 134 | Concepts of Probability | 4 |
| STAT 135 | Concepts of Statistics | 4 |

¹ For CHEM 103 and CHEM 130B, only 2 of the 3 units will count towards Allied Subject requirement since they have overlapping concepts with required major courses. However, students will receive the full 3 units of credit towards their GPA and the 120 unit graduation requirement.

Upper Division Requirements: Computational Chemistry Concentration

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| CHEM 121 | Introduction to Computational Chemistry | 3 |
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One course from each of the following areas:

1. Programming

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| ENGIN 7 | Introduction to Computer Programming for Scientists and Engineers [4] |
| COMPSCI 61A | The Structure and Interpretation of Computer Programs [4] |
| COMPSCI 88 | Course Not Available |
| MATH 124 | Programming for Mathematical Applications [4] |

2. Mathematical, computational, and statistical methods

| | |
|-------------|---|
| DATA C8 | Foundations of Data Science [4] |
| COMPSCI 61B | Data Structures [4] |
| COMPSCI 61C | Great Ideas of Computer Architecture (Machine Structures) [4] |
| COMPSCI 70 | Discrete Mathematics and Probability Theory [4] |
| COMPSCI 170 | Efficient Algorithms and Intractable Problems [4] |
| MATH 55 | Discrete Mathematics [4] |
| MATH 110 | Linear Algebra [4] |
| MATH 121A | Mathematical Tools for the Physical Sciences [4] |
| MATH 128A | Numerical Analysis [4] |
| PHYSICS 89 | Introduction to Mathematical Physics [4] |
| STAT 134 | Concepts of Probability [4] |
| STAT 150 | Stochastic Processes [3] |

3. Advanced methods and applications

| | |
|-------------|--|
| BIO ENG 143 | Computational Methods in Biology [4] |
| MAT SCI 215 | Computational Materials Science [3] |
| COMPSCI 176 | Algorithms for Computational Biology [4] |
| COMPSCI 189 | Introduction to Machine Learning [4] |
| DATA C100 | Principles & Techniques of Data Science [4] |
| MATH 121B | Mathematical Tools for the Physical Sciences [4] |
| CHEM C191 | Quantum Information Science and Technology [3] |

Upper Division Requirements: Materials Chemistry Concentration

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|-----------|------------------------------|---|
| CHEM 104A | Advanced Inorganic Chemistry | 3 |
| CHEM 104B | Advanced Inorganic Chemistry | 3 |
| CHEM 120A | Physical Chemistry | 3 |

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| CHEM 120B | Physical Chemistry | 3 |
| CHEM C150 | Introduction to Materials Chemistry | 3 |
| Select two laboratory courses from the following: | | |
| CHEM 105 | Instrumental Methods in Analytical Chemistry [4] | 5 |
| CHEM 125 | Physical Chemistry Laboratory | |
| CHEM C182 | Atmospheric Chemistry and Physics Laboratory | |
| CHEM 108 | Inorganic Synthesis and Reactions [4] | 5 |
| CHEM 11 | Organic Chemistry--Advanced Laboratory Methods | |
| Electives. Select 10 units of the following: | | 10 |
| BIO ENG C118 | Biological Performance of Materials [4] | 3 |
| CHEM C178 | Polymer Science and Technology [3] | |
| MAT SCI 104 | Materials Characterization [3] | 3 |
| MEC ENG 118 | Introduction to Nanotechnology and Nanoscience [3] | |
| PHYSICS 141A | Solid State Physics [4] | 3 |
| PHYSICS 141B | Solid State Physics [3] | |

In addition to the University, campus, and college requirements, listed on the College Requirements tab, students must fulfill the below requirements specific to their major program.

General Guidelines

1. All courses taken to fulfill the major requirements below must be taken for graded credit, other than courses listed which are offered on a *Pass/Fail* basis only. Other exceptions to this requirement are noted as applicable.
2. No more than one upper division course may be used to simultaneously fulfill requirements for a student's major and minor programs, with the exception of minors offered outside of the College of Letters & Science.
3. A minimum grade point average (GPA) of 2.0 must be maintained in both upper and lower division courses used to fulfill the major requirements.

For information regarding residence requirements and unit requirements, please see the College Requirements tab.

Please note, the Academic Guide is updated once a year. For the most up to date requirements information, please take a look at the College of Chemistry website (<https://chemistry.berkeley.edu/ugrad/degrees/chem/ba/>).

Lower Division Requirements

| | | |
|------------|---|---|
| CHEM 4A | General Chemistry and Quantitative Analysis ^{1, 2} | 5 |
| CHEM 4B | General Chemistry and Quantitative Analysis ^{1, 2} | 5 |
| CHEM 12A | Organic Chemistry ³ | 5 |
| CHEM 12B | Organic Chemistry | 5 |
| MATH 1A | Calculus | 4 |
| MATH 1B | Calculus | 4 |
| MATH 53 | Multivariable Calculus | 4 |
| MATH 54 | Linear Algebra and Differential Equations | 4 |
| PHYSICS 7A | Physics for Scientists and Engineers | 4 |
| PHYSICS 7B | Physics for Scientists and Engineers | 4 |

¹ A grade of C- or better is required in CHEM 4A before taking CHEM 4B, and in CHEM 4B before taking more advanced courses.

- ² Students who declare the major after completing a general chemistry sequence that does not include quantitative analysis are required to take CHEM 4B or CHEM 105.
- ³ A grade of C- or better in Chem 12A is required before taking Chem 12B.

Upper Division Requirements

| | | |
|------------------------------|--|---|
| CHEM 104A | Advanced Inorganic Chemistry ¹ | 3 |
| CHEM 104B | Advanced Inorganic Chemistry ¹ | 3 |
| CHEM 120A | Physical Chemistry ³ | 3 |
| CHEM 120B | Physical Chemistry ³ | 3 |
| Select one of the following: | | 4 |
| CHEM 105 | Instrumental Methods in Analytical Chemistry [4] | 4 |
| CHEM 108 | Inorganic Synthesis and Reactions [4] | |
| CHEM 115 | Organic Chemistry--Advanced Laboratory Methods [4] | 3 |
| CHEM 125 | Physical Chemistry Laboratory [3] ³ | |
| CHEM C170L | Biochemical Engineering Laboratory [3] | 3 |
| CHEM C182 | Atmospheric Chemistry and Physics Laboratory [3] | |

- ¹ CHEM 103 and CHEM 135 may be substituted for CHEM 104A and CHEM 104B.
- ² A grade of C- or higher is required in CHEM 120A and CHEM 120B if taken before CHEM 125.

Students who have a strong interest in an area of study outside their major often decide to complete a minor program. These programs have set requirements and are noted officially on the transcript in the memoranda section, but are not noted on diplomas.

General Guidelines

1. All minors must be declared no later than one semester before a student's Expected Graduation Term (EGT). If the semester before EGT is fall or spring, the deadline is the last day of RRR week. If the semester before EGT is summer, the deadline is the final Friday of Summer Sessions. To declare a minor, contact the department advisor for information on requirements, and the declaration process.
2. All courses taken to fulfill the minor requirements below must be taken for graded credit.
3. A minimum of three of the upper division courses taken to fulfill the minor requirements must be completed at UC Berkeley.
4. A minimum grade point average (GPA) of 2.0 is required for courses used to fulfill the minor requirements.
5. Students must consult with their college/school for information regarding overlap of courses between their majors and minors.

Requirements

1. Two semesters of organic chemistry (Chem 3A/L & 3B/L or Chem 12A & 12B)
2. Chem 120A, 120B, Chem C130, or Chem 130B (physical or biophysical chemistry)
3. Chem 103 or 104A (inorganic chemistry)
4. Two additional upper division Chemistry courses taken at Berkeley, excluding courses numbered 190-199; the two additional courses may be graduate level but will need to be the entire module ABC to satisfy the requirement.

Organic chemistry options: 10

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|------------------------------------|---|--|
| CHEM 3A & 3AL & CHEM 3B & CHEM 3BL | Chemical Structure and Reactivity and Organic Chemistry Laboratory and Chemical Structure and Reactivity and Organic Chemistry Laboratory | |
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CHEM 12A & CHEM 12B Organic Chemistry and Organic Chemistry

Physical or biophysical chemistry options (choose one):

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|-----------|--|---|
| CHEM 120A | Physical Chemistry | 3 |
| CHEM 120B | Physical Chemistry | 3 |
| CHEM C130 | Biophysical Chemistry: Physical Principles and the Molecules of Life | 4 |
| CHEM 130B | Biophysical Chemistry | 3 |

Inorganic chemistry options (choose one):

| | | |
|-----------|---------------------------------------|---|
| CHEM 103 | Inorganic Chemistry in Living Systems | 3 |
| CHEM 104A | Advanced Inorganic Chemistry | 3 |

All students in the College of Chemistry are required to complete the University requirements of American Cultures (<http://guide.berkeley.edu/archive/2021-22/undergraduate/colleges-schools/chemistry/american-cultures-requirement/>), American History and Institutions (<http://guide.berkeley.edu/archive/2021-22/undergraduate/colleges-schools/chemistry/american-history-institutions-requirements/>), and Entry-Level Writing (<http://guide.berkeley.edu/archive/2021-22/undergraduate/colleges-schools/chemistry/entry-level-writing-requirement/>). In addition, they must satisfy the following College requirements:

Reading and Composition (<http://guide.berkeley.edu/archive/2021-22/undergraduate/colleges-schools/chemistry/reading-composition-requirement/>)

In order to provide a solid foundation in reading, writing, and critical thinking the College requires lower division work in composition.

- Chemical Engineering majors: A-level Reading and Composition course (e.g., English R1A) by end of the first year
- Chemical Biology and Chemistry majors: A- and B-level courses by end of the second year (<http://guide.berkeley.edu/archive/2021-22/undergraduate/colleges-schools/chemistry/reading-composition-requirement/>)
- R&C courses must be taken for a letter grade
- English courses at other institutions may satisfy the requirement(s); check with your Undergraduate Adviser
- After admission to Berkeley, credit for English at another institution will not be granted if the Entry Level Writing requirement has not been satisfied

Humanities and Social Sciences Breadth Requirement: Chemistry & Chemical Biology majors

The College of Chemistry's humanities and social sciences breadth requirement promotes educational experiences that enrich and complement the technical requirements for each major.

- 15 units total; includes Reading & Composition and American Cultures courses

- Remaining units must come from the following L&S breadth areas, excluding courses which only teach a skill (such as drawing or playing an instrument):

Arts and Literature

Foreign Language (<http://guide.berkeley.edu/archive/2021-22/undergraduate/colleges-schools/chemistry/approved-foreign-language-courses/>)^{1,2}

Historical Studies

International Studies

Philosophy and Values

Social and Behavioral Sciences

To find course options for breadth, go to the Berkeley Academic Guide Class Schedule (<http://classes.berkeley.edu/>), select the term of interest, and use the 'Breadth Requirements' filter to select the breadth area(s) of interest.

- Breadth courses may be taken on a *Pass/No Pass* basis (excluding Reading and Composition)
- AP, IB, and GCE A-level exam credit (<http://chemistry.berkeley.edu/students/current-undergraduates/exam-credit-info/>) may be used to satisfy the breadth requirement

¹ Elementary-level courses may not be in the student's native language and may not be structured primarily to teach the reading of scientific literature.

² For Chemistry and Chemical Biology majors, elementary-level foreign language courses are not accepted toward the 15 unit breadth requirement if they are used (or are duplicates of high school courses used) to satisfy the Foreign Language requirement.

Foreign Language (Language Other Than English [LOTE]) Requirement

Applies to Chemistry and Chemical Biology majors only.

The LOTE requirement may be satisfied with one language other than English, in one of the following ways:

- By completing in high school the third year of one language other than English with minimum grades of C-.
- By completing at Berkeley the second semester of a sequence of courses in one language other than English, or the equivalent at another institution. Only LOTE courses that include reading and composition, as well as conversation, are accepted in satisfaction of this requirement. LOTE courses may be taken on a Pass/No Pass basis.
- By demonstrating equivalent knowledge of a language other than English through examination, including a College Entrance Examination Board (CEEB) Advanced Placement Examination with a score of 3 or higher (if taken before admission to college), an SAT II: Subject Test with a score of 590 or higher, or a proficiency examination offered by some departments at Berkeley or at another campus of the University of California.

Humanities and Social Sciences Breadth Requirement: Chemical Engineering major

- 22 units total; includes Reading and Composition and American Cultures courses
- Breadth Series requirement: As part of the 22 units, students must complete two courses, at least one being upper division, in the same or very closely allied humanities or social science department(s). AP credit may be used to satisfy the lower division aspect of the requirement.
- Breadth Series courses and all remaining units must come from the following lists of approved humanities and social science courses, excluding courses which only teach a skill (such as drawing or playing an instrument):

Arts and Literature

Foreign Language (<http://guide.berkeley.edu/archive/2021-22/undergraduate/colleges-schools/chemistry/approved-foreign-language-courses/>)^{1,2}

Historical Studies

International Studies

Philosophy and Values

To find course options for breadth, go to the Berkeley Academic Guide Class Schedule (<http://classes.berkeley.edu/>), select the term of interest, and use the 'Breadth Requirements' filter to select the breadth area(s) of interest.

- Breadth courses may be taken on a *Pass/No Pass* basis (excluding Reading and Composition)
- AP, IB, and GCE A-level exam (<http://chemistry.berkeley.edu/students/current-undergraduates/exam-credit-info/>) credit may be used to satisfy the breadth requirement

¹ Elementary-level courses may not be in the student's native language and may not be structured primarily to teach the reading of scientific literature.

² For chemical engineering majors, no more than six units of language other than English may be counted toward the 22 unit breadth requirement.

Class Schedule Requirements

- Minimum units per semester: 13
- Maximum units per semester: 19.5
- 12 units of course work each semester must satisfy degree requirements
- Chemical Engineering freshmen and Chemistry majors are required to enroll in a minimum of one chemistry course each semester
- After the freshman year, Chemical Engineering majors must enroll in a minimum of one chemical engineering course each semester

Semester Limit

- Students who entered as freshmen: 8 semesters
- Chemistry & Chemical Biology majors who entered as transfer students: 4 semesters
- Chemical Engineering and Joint majors who entered as transfer students: 5 semesters

Summer sessions are excluded when determining the limit on semesters. Students who wish to delay graduation to complete a minor, a double major, or simultaneous degrees must request approval for delay of graduation before what would normally be their final two semesters. The College of Chemistry does not have a rule regarding maximum units that a student can accumulate.

Senior Residence

After 90 units toward the bachelor's degree have been completed, at least 24 of the remaining units must be completed in residence in the College of Chemistry, in at least two semesters (the semester in which the 90 units are exceeded, plus at least one additional semester).

To count as a semester of residence for this requirement, a program must include at least 4 units of successfully completed courses. A summer session can be credited as a semester in residence if this minimum unit requirement is satisfied.

Juniors and seniors who participate in the UC Education Abroad Program (EAP) for a *full year* may meet a modified senior residence requirement. After 60 units toward the bachelor's degree have been completed, at least 24 (excluding EAP) of the remaining units must be completed in residence in the College of Chemistry, in at least two semesters. At least 12 of the 24 units must be completed after the student has already completed 90 units. Undergraduate Dean's approval for the modified senior residence requirement must be obtained before enrollment in the Education Abroad Program.

Minimum Total Units

A student must successfully complete at least 120 semester units in order to graduate.

Minimum Academic Requirements

A student must earn at least a C average (2.0 GPA) in all courses undertaken at UC, including those from UC Summer Sessions, UC Education Abroad Program, and UC Berkeley Washington Program, as well as XB courses from University Extension.

Minimum Course Grade Requirements

Students in the College of Chemistry who receive a grade of D+ or lower in a chemical engineering or chemistry course for which a grade of C- or higher is required must repeat the course at Berkeley.

Students in the College of Chemistry must achieve:

- C- or higher in CHEM 4A before taking CHEM 4B
- C- or higher in CHEM 4B before taking more advanced courses
- C- or higher in CHEM 12A before taking CHEM 12B
- GPA of at least 2.0 in all courses taken in the college in order to advance to and continue in the upper division

Chemistry or chemical biology majors must also achieve:

- C- or higher in CHEM 120A and CHEM 120B if taken before CHEM 125 or CHEM C182
- 2.0 GPA in all upper division courses taken at the University to satisfy major requirements

Chemical engineering students must also achieve:

- C- or higher in CHM ENG 140 before taking any other CBE courses
- C- or higher in CHM ENG 150A to be eligible to take any other course in the 150 series
- 2.0 GPA in all upper division courses taken at the University to satisfy major requirements

Chemical engineering students who do not achieve a grade of C- or higher in CHM ENG 140 on their first attempt are advised to change to another major. If the course is not passed with a grade of C- or higher on the second attempt, continuation in the Chemical Engineering program is normally not allowed.

CoC Grading Policy for Fall 2020, Spring 2021, and summer 2021

After carefully considering advice from the campus Faculty Senate and the ASUC Office of Academic Affairs, the College of Chemistry has decided to accept P grades in satisfaction of college, major, and minor requirements for Fall 2020, Spring 2021, and Summer 2021. (This does not apply to the UC-wide Entry Level Writing requirement: College Writing R1A must be taken for a letter grade and completed with a C or better to satisfy the requirement.)

How P/NP grades impact academic progress

- The issuing of a P grade signifies that the student has passed the class at minimum C- level work. Bear in mind that the D grade ("barely passing") is, in some cases, sufficient to fulfill a requirement; however, under P/NP it will result in a NP, which is not sufficient to fulfill any requirements.
- P grades may comprise no more than one third of the total required units completed at UC Berkeley toward the 120 overall minimum unit requirement.
- Prerequisites for entry into all CoC majors and minors may be met by courses taken for P/NP during the Fall 2020 and Spring 2021 semesters.
- Regulations on course repetition will not be modified for Fall 2020 and Spring 2021.

Financial Aid

Courses taken for P/NP are factored into Satisfactory Academic Progress rules. A "P" is considered to be attempted and completed, while an "NP" is considered to be attempted but NOT completed when determining completion rate %.

More information about how P/NP grades impact Satisfactory Academic Progress is available on the Financial Aid website (<https://financialaid.berkeley.edu/satisfactory-academic-progress/>).

Academic probation

- CoC students will not be placed automatically on academic probation for taking all courses for P/NP during Fall 2020 or Spring 2021.
- Students who choose to take all courses for P/NP, and who receive greater than 50% NPs, will be placed on probation.

- Students who are currently on academic probation or who are subject to dismissal may not take classes for P/NP, unless the course is offered only for P/NP. This rule was waived by the Academic Senate in Spring 2020, but not for Fall 2020, Spring 2021, or Summer 2021.

These policy modifications are only applicable for Fall 2020, Spring 2021, and Summer 2021 and may not be applied to other semesters.

Minimum Progress

To make normal progress toward a degree, undergraduates must successfully complete 30 units of coursework each year. The continued enrollment of students who do not maintain normal progress will be subject to the approval of the Undergraduate Dean. To achieve minimum academic progress, the student must meet two criteria:

1. Completed no fewer units than 15 multiplied by the number of semesters, less one, in which the student has been enrolled at Berkeley. Summer sessions do not count as semesters for this purpose.
2. A student's class schedule must contain at least 13 units in any term, unless otherwise authorized by the staff adviser or the Undergraduate Dean.

Undergraduate students must fulfill the following requirements in addition to those required by their major program.

For detailed lists of courses that fulfill college requirements, please review the College of Letters & Sciences (<http://guide.berkeley.edu/archive/2021-22/undergraduate/colleges-schools/letters-science/>) page in this Guide. For College advising appointments, please visit the L&S Advising (<https://lsadvising.berkeley.edu/home/>) Pages.

University of California Requirements

Entry Level Writing (<http://writing.berkeley.edu/node/78/>)

All students who will enter the University of California as freshmen must demonstrate their command of the English language by fulfilling the Entry Level Writing requirement. Fulfillment of this requirement is also a prerequisite to enrollment in all reading and composition courses at UC Berkeley.

American History and American Institutions (<http://guide.berkeley.edu/archive/2021-22/undergraduate/colleges-schools/letters-science/american-history-institutions-requirement/>)

The American History and Institutions requirements are based on the principle that a US resident graduated from an American university, should have an understanding of the history and governmental institutions of the United States.

Berkeley Campus Requirement

American Cultures (<http://americancultures.berkeley.edu/students/courses/>)

All undergraduate students at Cal need to take and pass this course in order to graduate. The requirement offers an exciting intellectual environment centered on the study of race, ethnicity and culture of the United States. AC courses offer students opportunities to be part of research-led, highly accomplished teaching environments, grappling with the complexity of American Culture.

College of Letters & Science Essential Skills Requirements

Quantitative Reasoning (<http://guide.berkeley.edu/archive/2021-22/undergraduate/colleges-schools/letters-science/quantitative-reasoning-requirement/>)

The Quantitative Reasoning requirement is designed to ensure that students graduate with basic understanding and competency in math, statistics, or computer science. The requirement may be satisfied by exam or by taking an approved course.

Foreign Language (<http://guide.berkeley.edu/archive/2021-22/undergraduate/colleges-schools/letters-science/foreign-language-requirement/>)

The Foreign Language requirement may be satisfied by demonstrating proficiency in reading comprehension, writing, and conversation in a foreign language equivalent to the second semester college level, either by passing an exam or by completing approved course work.

Reading and Composition (<http://guide.berkeley.edu/archive/2021-22/undergraduate/colleges-schools/letters-science/reading-composition-requirement/>)

In order to provide a solid foundation in reading, writing, and critical thinking the College requires two semesters of lower division work in composition in sequence. Students must complete parts A & B reading and composition courses by the end of their second semester and a second-level course by the end of their fourth semester.

College of Letters & Science 7 Course Breadth Requirements

Breadth Requirements (<http://guide.berkeley.edu/archive/2021-22/undergraduate/colleges-schools/letters-science/#breadthrequirementstext>)

The undergraduate breadth requirements provide Berkeley students with a rich and varied educational experience outside of their major program. As the foundation of a liberal arts education, breadth courses give students a view into the intellectual life of the University while introducing them to a multitude of perspectives and approaches to research and scholarship. Engaging students in new disciplines and with peers from other majors, the breadth experience strengthens interdisciplinary connections and context that prepares Berkeley graduates to understand and solve the complex issues of their day.

Unit Requirements

- 120 total units
- Of the 120 units, 36 must be upper division units
- Of the 36 upper division units, 6 must be taken in courses offered outside your major department

Residence Requirements

For units to be considered in "residence," you must be registered in courses on the Berkeley campus as a student in the College of Letters & Science. Most students automatically fulfill the residence requirement by attending classes here for four years. In general, there is no need to be concerned about this requirement, unless you go abroad for a semester or year or want to take courses at another institution or through UC Extension during your senior year. In these cases, you should make

an appointment to meet an adviser to determine how you can meet the Senior Residence Requirement.

Note: Courses taken through UC Extension do not count toward residence.

Senior Residence Requirement

After you become a senior (with 90 semester units earned toward your BA degree), you must complete at least 24 of the remaining 30 units in residence in at least two semesters. To count as residence, a semester must consist of at least 6 passed units. Intercampus Visitor, EAP, and UC Berkeley-Washington Program (UCDC) units are excluded.

You may use a Berkeley Summer Session to satisfy one semester of the Senior Residence requirement, provided that you successfully complete 6 units of course work in the Summer Session and that you have been enrolled previously in the college.

Modified Senior Residence Requirement

Participants in the UC Education Abroad Program (EAP), Berkeley Summer Abroad, or the UC Berkeley Washington Program (UCDC) may meet a Modified Senior Residence requirement by completing 24 (excluding EAP) of their final 60 semester units in residence. At least 12 of these 24 units must be completed after you have completed 90 units.

Upper Division Residence Requirement

You must complete in residence a minimum of 18 units of upper division courses (excluding UCEAP units), 12 of which must satisfy the requirements for your major.

Mission

The Chemistry major provides training for students planning careers in the chemical sciences and also for those whose interests lie in biology, medicine, earth sciences, secondary education, business, and law. More than half of the total Berkeley undergraduate population will, at some stage of their degree program, take a course from the Department of Chemistry. The curriculum of the department is designed to satisfy the diverse needs of all these students.

Each Chemistry graduate will have completed an integrated, rigorous program which includes foundational course work in chemistry and in-depth course work in chemistry or chemistry-related fields. The ACS-certified degree further emphasizes laboratory experience and the development of professional skills. Advanced coursework and educational activities outside the traditional classroom, such as independent research, provide students the opportunity to conduct individual research projects or participate as a member of a research team. Many undergraduate students also benefit from taking our graduate courses in synthetic and physical chemistry.

At graduation, Chemistry majors will have a set of fundamental competencies that are knowledge-based, performance/skills-based, and effective.

Learning Goals of the Major

Graduates will be able to:

1. Master a broad set of chemical knowledge concerning the fundamentals in the basic areas of the discipline (organic, inorganic, analytical, physical, and biological chemistry).
2. Solve problems competently by identifying the essential parts of a problem and formulating a strategy for solving the problem. They

will be able to rationally estimate the solution to a problem, apply appropriate techniques to arrive at a solution, test the correctness of the solution, and interpret their results.

3. Use computers in data acquisition and processing and use available software as a tool in data analysis.
4. Employ modern library search tools to locate and retrieve scientific information about a topic, chemical, chemical technique, or an issue relating to chemistry.

Skills

Graduates will demonstrate the ability to:

1. Understand the objective of their chemical experiments, properly carry out the experiments, and appropriately record and analyze the results.
2. Use standard laboratory equipment, modern instrumentation, and classical techniques to carry out experiments.
3. Know and follow the proper procedures and regulations for safe handling and use of chemicals.
4. Communicate the concepts and results of their laboratory experiments through effective writing and oral communication skills.

Effective

Graduates will be able to:

1. Successfully pursue their career objectives in advanced education in professional and/or graduate schools, in a scientific career in government or industry, in a teaching career in the school systems, or in a related career following graduation.
The relationship between the major's core curriculum and student learning outcomes can be seen in the Appendix in Table I.

Major Maps help undergraduate students discover academic, co-curricular, and discovery opportunities at UC Berkeley based on intended major or field of interest. Developed by the Division of Undergraduate Education in collaboration with academic departments, these experience maps will help you:

- **Explore** your major and gain a better understanding of your field of study
- **Connect** with people and programs that inspire and sustain your creativity, drive, curiosity and success
- **Discover** opportunities for independent inquiry, enterprise, and creative expression
- **Engage** locally and globally to broaden your perspectives and change the world
- **Reflect** on your academic career and prepare for life after Berkeley

Use the major map below as a guide to planning your undergraduate journey and designing your own unique Berkeley experience.

View the Chemistry Major Map PDF. (https://vcue.berkeley.edu/sites/default/files/chemistry_-_chemical_biology.pdf)

Chemistry

Expand all course descriptions [+] Collapse all course descriptions [-]

CHEM 1A General Chemistry 3 Units

Terms offered: Fall 2022, Summer 2022 8 Week Session, Spring 2022
Stoichiometry of chemical reactions, quantum mechanical description of atoms, the elements and periodic table, chemical bonding, real and ideal gases, thermochemistry, introduction to thermodynamics and equilibrium, acid-base and solubility equilibria, introduction to oxidation-reduction reactions, introduction to chemical kinetics.

General Chemistry: Read More [+]

Rules & Requirements

Prerequisites: High school chemistry recommended

Credit Restrictions: Students will receive no credit for CHEM 1A after completing CHEM 1AD or CHEM 4A. A deficient grade in CHEM 1A may be removed by taking CHEM 1AD.

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of lecture, 1-1 hours of discussion, and 0-2 hours of voluntary per week

Summer: 8 weeks - 6-6 hours of lecture, 2-2 hours of discussion, and 0-2 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

General Chemistry: Read Less [-]

CHEM 1AD General Chemistry (Digital) 3 Units

Terms offered: Spring 2016

An interactive general chemistry course that uses modern digital technology, offered in a smaller classroom setting to facilitate student participation and foster an engaging learning environment. Topics cover the Chemistry 1A curriculum, ranging from quantum mechanics and interactions of atoms and molecules to properties and equilibria of bulk materials. The course involves a blend of classroom lectures and peer learning with substantial web-based assignments and resources including web access to lecture videos. Lecture time is also devoted to ChemQuiz peer discussions and live demos of chemical properties and processes, which students generally find to be illuminating and valuable learning experiences.

General Chemistry (Digital): Read More [+]

Rules & Requirements

Prerequisites: High school chemistry recommended

Credit Restrictions: Students will receive no credit for Chemistry 1AD after completing Chemistry 1A or 4A. A deficient grade in Chemistry 1A may be removed by taking Chemistry 1AD.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Pines, Slack

General Chemistry (Digital): Read Less [-]

CHEM 1AL General Chemistry Laboratory 2 Units

Terms offered: Fall 2022, Summer 2022 8 Week Session, Spring 2022

An experimental approach to chemical sciences with emphasis on developing fundamental, reproducible laboratory technique and a goal of understanding and achieving precision and accuracy in laboratory experiments. Proper use of laboratory equipment and standard wet chemical methods are practiced. Areas of investigations include chemical equilibria, spectroscopy, nanotechnology, green chemistry, and thermochemistry. Completion of, or concurrent enrollment in 1A is required.

General Chemistry Laboratory: Read More [+]

Rules & Requirements

Prerequisites: CHEM 1A, with min grade of C-; or co-enrollment in CHEM 1A; or AP CHEM with min score of 4; or CHEM HL IB with min score of 5; or GCE A-Level CHEM with min grade of C

Credit Restrictions: Students will receive no credit for 1AL after taking 4A.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture, 3 hours of laboratory, and 0 hours of voluntary per week

Summer: 8 weeks - 2 hours of lecture, 6 hours of laboratory, and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

General Chemistry Laboratory: Read Less [-]

CHEM 1B General Chemistry 4 Units

Terms offered: Spring 2022, Spring 2021, Spring 2020

Introduction to chemical kinetics, electrochemistry, properties of the states of matter, binary mixtures, thermodynamic efficiency and the direction of chemical change, quantum mechanical description of bonding introduction to spectroscopy. Special topics: Research topics in modern chemistry and biochemistry, chemical engineering.

General Chemistry: Read More [+]

Rules & Requirements

Prerequisites: CHEM 1A and CHEM 1AL with min grades of C-; or CHEM 4A with min grade of C-; or AP CHEM with min score of 4; or CHEM HL IB with min score of 5; or GCE A-Level CHEM with min grade of C

Credit Restrictions: Students will receive no credit for Chemistry 1B after completing Chemistry 4B.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture, 4 hours of laboratory, and 0 hours of voluntary per week

Summer: 8 weeks - 6 hours of lecture, 8 hours of laboratory, and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

General Chemistry: Read Less [-]

CHEM W1A General Chemistry 3 Units

Terms offered: Summer 2013 10 Week Session, Summer 2013 8 Week Session, Summer 2012 8 Week Session

Stoichiometry of chemical reactions, quantum mechanical description of atoms, the elements and periodic table, chemical bonding, real and ideal gases, thermochemistry, introduction to thermodynamics and equilibrium, acid-base and solubility equilibria, introduction to oxidation-reduction reactions, introduction to chemical kinetics. This course is web-based.

General Chemistry: Read More [+]

Rules & Requirements

Prerequisites: High school chemistry is recommended

Credit Restrictions: Students will receive no credit for CHEM W1A after passing CHEM 1A or CHEM 4A. A deficiency in CHEM 1A may be removed by taking CHEM W1A.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of web-based lecture and 1 hour of web-based discussion per week

Summer: 8 weeks - 6 hours of web-based lecture and 2 hours of web-based discussion per week

Online: This is an online course.

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

General Chemistry: Read Less [-]

CHEM 3A Chemical Structure and Reactivity 3 Units

Terms offered: Fall 2022, Summer 2022 8 Week Session, Spring 2022

Introduction to organic chemical structures, bonding, and chemical reactivity. The organic chemistry of alkanes, alkyl halides, alcohols, alkenes, alkynes, and organometallics.

Chemical Structure and Reactivity: Read More [+]

Rules & Requirements

Prerequisites: CHEM 1A with min grade of C-; or AP Chem with min score of 4; or Chem HL IB with min score of 5; or GCE A-Level Chem with min grade of C

Credit Restrictions: Students will receive no credit for CHEM 3A after completing CHEM 12A; a deficient grade in CHEM 12A may be removed by taking CHEM 3A- will restrict credit if completed before Chemistry 3A.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, and 0 hours of voluntary per week

Summer: 8 weeks - 6 hours of lecture, 2 hours of discussion, and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Chemical Structure and Reactivity: Read Less [-]

CHEM 3AL Organic Chemistry Laboratory 2 Units

Terms offered: Fall 2022, Summer 2022 8 Week Session, Spring 2022

Introduction to the theory and practice of methods used in the organic chemistry laboratory. An emphasis is placed on the separation and purification of organic compounds. Techniques covered will include extraction, distillation, sublimation, recrystallization, and chromatography. Detailed discussions and applications of infrared and nuclear magnetic resonance spectroscopy will be included.

Organic Chemistry Laboratory: Read More [+]

Rules & Requirements

Prerequisites: CHEM 1A and CHEM 1AL with min grades of C-; or CHEM 4A with min grade of C-; or AP CHEM with min score of 4; or CHEM HL IB with min score of 5; or GCE A-Level CHEM with min grade of C. Corequisite: CHEM 3A with min grade of C- or coenrollment in CHEM 3A

Credit Restrictions: Students will receive no credit for CHEM 3AL after taking CHEM 12A.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 4 hours of laboratory per week

Summer: 8 weeks - 2 hours of lecture and 8 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Organic Chemistry Laboratory: Read Less [-]

CHEM 3B Chemical Structure and Reactivity 3 Units

Terms offered: Fall 2022, Summer 2022 8 Week Session, Spring 2022
Conjugation, aromatic chemistry, carbonyl compounds, carbohydrates, amines, carboxylic acids, amino acids, peptides, proteins, and nucleic acid chemistry. Ultraviolet spectroscopy and mass spectrometry will be introduced.

Chemical Structure and Reactivity: Read More [+]

Rules & Requirements

Prerequisites: CHEM 3A with min grade of C-

Credit Restrictions: Students will receive no credit for 3B after taking 12B.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, and 0 hours of voluntary per week

Summer: 8 weeks - 6 hours of lecture, 2 hours of discussion, and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Chemical Structure and Reactivity: Read Less [-]

CHEM 3BL Organic Chemistry Laboratory 2 Units

Terms offered: Fall 2022, Summer 2022 8 Week Session, Spring 2022
The synthesis and purification of organic compounds will be explored. Natural product chemistry will be introduced. Advanced spectroscopic methods including infrared, ultraviolet, and nuclear magnetic resonance spectroscopy and mass spectrometry will be used to analyze products prepared and/or isolated. Qualitative analysis of organic compounds will be covered.

Organic Chemistry Laboratory: Read More [+]

Rules & Requirements

Prerequisites: CHEM 3AL with min grade of C-. Co-requisite: CHEM 3B with min grade of C- or co-enrollment in CHEM 3B

Credit Restrictions: Students will receive no credit for CHEM 3BL after taking CHEM 12B.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 4 hours of laboratory per week

Summer: 8 weeks - 2 hours of lecture and 8 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Organic Chemistry Laboratory: Read Less [-]

CHEM N3AL Organic Chemistry Laboratory 2 Units

Terms offered: Summer 2018 8 Week Session, Summer 2017 8 Week Session, Summer 2015 8 Week Session

Introduction to the theory and practice of methods used in the organic chemistry laboratory. An emphasis is placed on the separation and purification of organic compounds. Techniques covered will include extraction, distillation, sublimation, recrystallization, and chromatography. Detailed discussions and applications of infrared and nuclear magnetic resonance spectroscopy will be included.

Organic Chemistry Laboratory: Read More [+]

Rules & Requirements

Prerequisites: CHEM 1A and CHEM 1AL with min grades of C-; or CHEM 4A with min grade of C-; or AP CHEM with min score of 4; or CHEM HL IB with min score of 5; or GCE A-Level CHEM with min grade of C. Co-requisite: CHEM 3A with min grade of C- or co-enrollment in CHEM 3A. CHEM 4A with approval of instructor

Credit Restrictions: Students will receive no credit for CHEM N3AL after taking CHEM 12A.

Hours & Format

Summer: 8 weeks - 2 hours of web-based lecture and 8 hours of laboratory per week

Online: This is an online course.

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructor: Pedersen

Organic Chemistry Laboratory: Read Less [-]

CHEM 4A General Chemistry and Quantitative Analysis 5 Units

Terms offered: Fall 2022, Fall 2021, Fall 2020

Series is intended for majors in physical, biological sciences, and engineering. It presents the foundation principles of chemistry, including stoichiometry, ideal and real gases, acid-base and solubility equilibria, oxidation-reduction reactions, thermochemistry, entropy, nuclear chemistry and radioactivity, the atoms and elements, the periodic table, quantum theory, chemical bonding, molecular structure, chemical kinetics, and descriptive chemistry. Examples and applications will be drawn from diverse areas of interest such as atmospheric, environmental, materials, polymer and computational chemistry, and biochemistry. Laboratory emphasizes quantitative work. Equivalent to 1A-1B plus 15 as prerequisite for further courses in chemistry.

General Chemistry and Quantitative Analysis: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: High school chemistry; calculus (may be taken concurrently); high school physics is recommended

Credit Restrictions: Students will receive no credit for 4A after taking 1A. Deficiency in 4A may be removed by successfully completing 1A and 1AL together in the same semester.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 4 hours of laboratory, and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

General Chemistry and Quantitative Analysis: Read Less [\[-\]](#)

CHEM 4B General Chemistry and Quantitative Analysis 5 Units

Terms offered: Spring 2022, Spring 2021, Spring 2020

Series is intended for majors in physical, biological sciences, and engineering. It presents the foundation principles of chemistry, including stoichiometry, ideal and real gases, acid-base and solubility equilibria, oxidation-reduction reactions, thermochemistry, entropy, nuclear chemistry and radioactivity, the atoms and elements, the periodic table, quantum theory, chemical bonding, molecular structure, chemical kinetics, and descriptive chemistry. Examples and applications will be drawn from diverse areas of interest such as atmospheric, environmental, materials, polymer and computational chemistry, and biochemistry. Laboratory emphasizes quantitative work. Equivalent to 1A-1B plus 15 as prerequisite for further courses in chemistry.

General Chemistry and Quantitative Analysis: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: High school chemistry; calculus (may be taken concurrently); high school physics is recommended

Credit Restrictions: Deficiency in 4B may be removed by successfully completing 15.

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of lecture, 4-4 hours of laboratory, and 0-2 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

General Chemistry and Quantitative Analysis: Read Less [\[-\]](#)

CHEM 12A Organic Chemistry 5 Units

Terms offered: Fall 2022, Fall 2021, Fall 2020

A study of all aspects of fundamental organic chemistry, including nomenclature, chemical and physical properties, reactions and syntheses of the major classes of organic compounds. The study includes theoretical aspects, reaction mechanisms, multistep syntheses, and the chemistry of polycyclic and heterocyclic compounds. This course is more extensive and intensive than 3A-3B and includes a greater emphasis on reaction mechanisms and multistep syntheses. 12A (F); 12B (SP)
Organic Chemistry: Read More [+]

Rules & Requirements

Prerequisites: 12A: 1B or 4B with grade of C- or higher; 12B: 12A with grade of C- or higher. For students majoring in chemistry or a closely related field such as chemical engineering or molecular and cell biology

Credit Restrictions: Students will receive no credit for 12A after taking both 3A and 3AL. Deficiency in 12A may be removed by successfully completing 3A and 3AL in the same semester. Students will receive no credit for 12A after taking 112A. Chem 12A is formerly known as Chem 112A.

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of lecture, 1-1 hours of discussion, 5-5 hours of laboratory, and 0-2 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Formerly known as: Chemistry 112A

Organic Chemistry: Read Less [-]

CHEM 12B Organic Chemistry 5 Units

Terms offered: Spring 2022, Spring 2021, Spring 2020

A study of all aspects of fundamental organic chemistry, including nomenclature, chemical and physical properties, reactions and syntheses of the major classes of organic compounds. The study includes theoretical aspects, reaction mechanisms, multistep syntheses, and the chemistry of polycyclic and heterocyclic compounds. This course is more extensive and intensive than 3A-3B and includes a greater emphasis on reaction mechanisms and multistep syntheses. 12A (F); 12B (SP)
Organic Chemistry: Read More [+]

Rules & Requirements

Prerequisites: 12A: 1B or 4B with grade of C- or higher. 12B: 12A with grade of C- or higher. For students majoring in chemistry or a closely related field such as chemical engineering or molecular and cell biology

Credit Restrictions: Students will receive no credit for 12B after taking both 3B and 3BL. Deficiency in 12B may be removed by successfully completing 3B and 3BL in the same semester. Students will receive no credit for 12B after taking 112B. Chem 12B is formerly known as Chem 112B.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, 5 hours of laboratory, and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Formerly known as: Chemistry 112B

Organic Chemistry: Read Less [-]

CHEM 15 Analytical and Bioanalytical Chemistry 3 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016

An introduction to analytical and bioanalytical chemistry including background in statistical analysis of data, acid-base equilibria, electrochemical, spectrometric, and chromatographic methods of analysis and some advanced topics in bioanalytical chemistry such as microfluidics, bioassay techniques, and enzymatic biosensors.
Analytical and Bioanalytical Chemistry: Read More [+]

Rules & Requirements

Prerequisites: 1A and 1AL or equivalent

Credit Restrictions: Deficiency in 15 may be removed by successfully completing 4B.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Analytical and Bioanalytical Chemistry: Read Less [-]

CHEM 24 Freshman Seminar 1 Unit

Terms offered: Fall 2021, Spring 2017, Spring 2016

The Freshman Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small seminar setting. Freshman seminars are offered in all campus departments, and topics may vary from department to department and semester to semester. Enrollment limited to 15 freshmen. Freshman Seminar: Read More [+]

Rules & Requirements

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of seminar per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final Exam To be decided by the instructor when the class is offered.

Freshman Seminar: Read Less [-]

CHEM 32 Preparation for General Chemistry 2 Units

Terms offered: Fall 2022, Fall 2021, Fall 2020

Foundation and preparation for General Chemistry. Topics and concepts include elements, atoms, molecules, chemical reactions, chemical calculations, properties of gases and gas laws; thermodynamics, acid/base chemical equilibrium, and periodic trends. In addition, by practicing learning as a process, students will cultivate the habits, strategies, and mindset necessary to succeed in the sciences. Through rigorous practice and guided reflection, students will grow in their ability to master the subject matter and hone their disposition toward scientific learning.

Preparation for General Chemistry: Read More [+]

Rules & Requirements

Credit Restrictions: Students will receive no credit for CHEM 32 after taking and passing any other Chemistry course.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week

Summer:

6 weeks - 5 hours of lecture and 2 hours of discussion per week
10 weeks - 3 hours of lecture and 3 hours of discussion per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam required, with common exam group.

Preparation for General Chemistry: Read Less [-]

CHEM 32L Preparation for General Chemistry Laboratory 1 Unit

Terms offered: Prior to 2007

An introduction to the experimental nature of chemistry. An emphasis is placed on gaining familiarity with equipment and experience with the rigorous approaches used in Chemistry laboratory courses. Areas of investigation include scientific calculations and statistical analysis, analytical measurements, acid-base chemistry, titration, equilibrium, solubility, and green chemistry.

Preparation for General Chemistry Laboratory: Read More [-]

Rules & Requirements

Prerequisites: Must be concurrently enrolled in Chem 32

Credit Restrictions: Students will receive no credit for CHEM 32L after completing CHEM 1AL. A deficient grade in CHEM 32L may be removed by taking CHEM 1AL.

Hours & Format

Summer: 6 weeks - 6 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Preparation for General Chemistry Laboratory: Read Less [-]

CHEM 34 Preparation for General Chemistry for CoC Majors 4 Units

Terms offered: Summer 2022 Second 6 Week Session

This course is designed to help develop fundamental laboratory techniques, study habits, chemical vocabulary, and knowledge of chemistry concepts needed to succeed in CHEM 4A. Students in the course will also come to know and belong to the larger College of Chemistry community, through panel discussions with CoC faculty, students, and staff, and immersion in current research via weekly lab tours and research talks from professors and graduate students. After completing the course, you will understand essential chemistry concepts relevant to CHEM 4A, including chemical calculations, statistics, quantitative analysis, models of atoms, the periodic table, molecules and chemical bonds, acid-base chemistry, thermochemistry, and equilibrium. Preparation for General Chemistry for CoC Majors: Read More [+]

Rules & Requirements

Prerequisites: Students must be enrolled in a College of Chemistry major (Chemistry, Chemical Biology, or Chemical Engineering) to take CHEM 34. Nonmajors should enroll in CHEM 32

Hours & Format

Summer: 6 weeks - 8 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Preparation for General Chemistry for CoC Majors: Read Less [-]

CHEM 49 Supplementary Work in Lower Division Chemistry 1 - 4 Units

Terms offered: Fall 2017, Fall 2016, Spring 2016

Students with partial credit in lower division chemistry courses may, with consent of instructor, complete the credit under this heading.

Supplementary Work in Lower Division Chemistry: Read More [\[+\]](#)

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Summer:

6 weeks - 1-6 hours of independent study per week

8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Supplementary Work in Lower Division Chemistry: Read Less [\[-\]](#)

CHEM 96 Introduction to Research and Study in the College of Chemistry 1 Unit

Terms offered: Fall 2022, Fall 2021, Fall 2020

Introduces sophomores and new transfer students to research activities and programs of study in the College of Chemistry. Includes lectures by faculty, an introduction to college library and computer facilities, the opportunity to meet alumni and advanced undergraduates in an informal atmosphere, and discussion of college and campus resources.

Introduction to Research and Study in the College of Chemistry: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Sophomore or junior standing in the College of Chemistry, or consent of instructor

Credit Restrictions: Students will receive no credit for CHEM 96 after completing CHEM C96.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of seminar per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam required.

Introduction to Research and Study in the College of Chemistry: Read Less [\[-\]](#)

CHEM 98 Supervised Group Study 1 - 4 Units

Terms offered: Spring 2022, Fall 2021, Spring 2021

Group study of selected topics.

Supervised Group Study: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Consent of instructor

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Supervised Group Study: Read Less [\[-\]](#)

CHEM 98W Directed Group Study 1 Unit

Terms offered: Fall 2020, Fall 2019, Fall 2018

Topics vary with instructor. Enrollment restrictions apply.

Directed Group Study: Read More [\[+\]](#)

Rules & Requirements

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of directed group study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Directed Group Study: Read Less [\[-\]](#)

CHEM 100 Communicating Chemistry 2 Units

Terms offered: Spring 2011, Spring 2010, Spring 2009

For undergraduate and graduate students interested in improving their ability to communicate their scientific knowledge by teaching chemistry in elementary schools. The course will combine instruction in inquiry-based chemistry teaching methods and learning pedagogy with 10 weeks of supervised teaching experience in a local school classroom. Thus, students will practice communicating scientific knowledge and receive mentoring on how to improve their presentations. Approximately three hours per week, including time spent in school classrooms.

Communicating Chemistry: Read More [+]

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of fieldwork per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Formerly known as: 20

Communicating Chemistry: Read Less [-]

CHEM 101 Greener Solutions: A Safer Design Partnership 3 Units

Terms offered: Not yet offered

Green chemistry seeks to promote the design and adoption of safer chemicals and materials. Their development and adoption depends on solving a number of design and selection challenges. The Greener Solutions course guides interdisciplinary teams undergraduate students to solve these challenges in a specific application

Greener Solutions: A Safer Design Partnership: Read More [+]

Objectives & Outcomes

Course Objectives: 1. Understand the principles of green chemistry and bio-inspired design and be able to apply them in developing safer alternatives to a hazardous chemical or material in a specific application;

2. Understand principles of chemical exposure, hazard and risk and be able to apply them in the process of evaluating alternatives to a chemical of concern;

3. Effectively access information and use tools to evaluate and compare the hazard profiles of chemicals and materials;

4. Frame research questions and propose solutions, working in the applied setting of a partner company's challenge; and

5. Communicate complex technical ideas clearly and effectively in written and oral form.

This 4-unit interdisciplinary, project-based course is intended for undergraduate students in public health, chemical engineering, chemistry, environmental studies, and engineering. The course draws on students' disciplinary expertise and teaches new skills to identify safer alternatives to hazardous chemicals currently used in a product or manufacturing process

Student Learning Outcomes: Student teams complete interim assignments during the six-week, session-long research project, which culminates in a final report and presentation. While class lectures, discussion and assignments support the technical aspects of the project, significant emphasis is also placed on developing the requisite processoriented skills: gathering information, working in teams, and communicating effectively in both written and oral forms.

Rules & Requirements

Prerequisites: Advanced undergraduate; general chemistry or equivalent knowledge. Recommended: General Chemistry (CHEM 1A, 1B, 4A, 4B)

Repeat rules: Course may be repeated for credit with instructor consent.

Hours & Format

Summer: 6 weeks - 3 hours of lecture, 3 hours of demonstration, and 3 hours of directed group study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Greener Solutions: A Safer Design Partnership: Read Less [-]

CHEM 102 Foundations of Discovery Learning for College of Chemistry Transfer Students 1 Unit

Terms offered: Not yet offered

This course is offered to incoming junior transfer students majoring in chemistry, chemical biology, or chemical and biomolecular engineering within the College of Chemistry (CoC) at UC Berkeley. The course is designed to assist transfer students with their transition into the CoC through: 1) discussions around best learning practices, stress management, CoC coursework, and careers, 2) interactions with the CoC community, including personalized mentorship from graduate students and faculty, and 3) rigorous preparation for creating and participating in discovery learning experiences, such as research or industrial internships. Students in the course will complete assignments relating to professional development and discovery learning. Foundations of Discovery Learning for College of Chemistry Transfer Students: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Students must be junior transfers enrolled in a College of Chemistry major (Chemistry, Chemical Biology, or Chemical Engineering)

Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Foundations of Discovery Learning for College of Chemistry Transfer Students: Read Less [\[-\]](#)

CHEM 103 Inorganic Chemistry in Living Systems 3 Units

Terms offered: Fall 2022, Fall 2021, Fall 2020

The basic principles of metal ions and coordination chemistry applied to the study of biological systems.

Inorganic Chemistry in Living Systems: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Chemistry 3A or 112A. Chemistry majors can only count 2 of the 3 units towards their Allied Subject requirement

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Inorganic Chemistry in Living Systems: Read Less [\[-\]](#)

CHEM 104A Advanced Inorganic Chemistry 3 Units

Terms offered: Fall 2022, Fall 2021, Fall 2020

The chemistry of metals and nonmetals including the application of physical chemical principles.

Advanced Inorganic Chemistry: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 1B, 4B, or 3A; 104A is prerequisite to 104B

Credit Restrictions: 104A: No restrictions; 104B: Chemical Biology majors can only count 2 of the 3 units towards their Allied Subject requirement for 104B after taking 103.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 0 hours of voluntary per week

Summer: 8 weeks - 6 hours of lecture and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Advanced Inorganic Chemistry: Read Less [\[-\]](#)

CHEM 104B Advanced Inorganic Chemistry 3 Units

Terms offered: Spring 2022, Spring 2021, Spring 2020

The chemistry of metals and nonmetals including the application of physical chemical principles.

Advanced Inorganic Chemistry: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 104A or consent of instructor. Chemical Biology majors can only count 2 of the 3 units towards their Allied Subject requirement for 104B after taking 103

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Summer: 8 weeks - 6 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Advanced Inorganic Chemistry: Read Less [\[-\]](#)

CHEM 105 Instrumental Methods in Analytical Chemistry 4 Units

Terms offered: Fall 2022, Spring 2022, Fall 2021

Principles, instrumentation and analytical applications of atomic spectroscopies, mass spectrometry, separations, electrochemistry and micro-characterization. Discussion of instrument design and capabilities as well as real-world problem solving with an emphasis on bioanalytical, environmental, and forensic applications. Hands-on laboratory work using modern instrumentation, emphasizing independent projects involving real-life samples and problem solving.

Instrumental Methods in Analytical Chemistry: Read More [+]

Rules & Requirements

Prerequisites: 4B; or 1B and 15; or 1B and a UC GPA of 3.3 or higher

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 8 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instrumental Methods in Analytical Chemistry: Read Less [-]

CHEM 108 Inorganic Synthesis and Reactions 4 Units

Terms offered: Fall 2022, Spring 2022, Fall 2019

The preparation of inorganic compounds using vacuum line, air- and moisture-exclusion, electrochemical, high-pressure, and other synthetic techniques. Kinetic and mechanistic studies of inorganic compounds.

Inorganic Synthesis and Reactions: Read More [+]

Rules & Requirements

Prerequisites: 4B or 15; 104B with grade of C- or higher, or 103

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 8 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Inorganic Synthesis and Reactions: Read Less [-]

CHEM C110L General Biochemistry and Molecular Biology Laboratory 4 Units

Terms offered: Fall 2022, Spring 2022, Fall 2021

Experimental techniques of biochemistry and molecular biology, designed to accompany the lectures in Molecular and Cell Biology 100B and 110.

General Biochemistry and Molecular Biology Laboratory: Read More [+]

Rules & Requirements

Prerequisites: 110 (may be taken concurrently)

Hours & Format

Fall and/or spring: 15 weeks - 2-2 hours of lecture and 6-8 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Also listed as: MCELLBI C110L

General Biochemistry and Molecular Biology Laboratory: Read Less [-]

CHEM 113 Advanced Mechanistic Organic Chemistry 3 Units

Terms offered: Fall 2022, Fall 2020, Fall 2018

Advanced topics in mechanistic and physical organic chemistry typically including kinetics, reactive intermediates, substitution reactions, linear free energy relationships, orbital interactions and orbital symmetry control of reactions, isotope effects, and photochemistry.

Advanced Mechanistic Organic Chemistry: Read More [+]

Rules & Requirements

Prerequisites: 3B or 112B with a minimum grade of B- or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Advanced Mechanistic Organic Chemistry: Read Less [-]

CHEM 114 Advanced Synthetic Organic Chemistry 3 Units

Terms offered: Spring 2022, Spring 2020, Spring 2018

Advanced topics in synthetic organic chemistry with a focus on selectivity. Topics include reductions, oxidations, enolate chemistry and the aldol reaction, reactions of non-stabilized anions, olefination reactions, pericyclic reactions and application to the synthesis of complex structures.

Advanced Synthetic Organic Chemistry: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 3B or 112B with a minimum grade of B- or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Advanced Synthetic Organic Chemistry: Read Less [\[-\]](#)

CHEM 115 Organic Chemistry--Advanced Laboratory Methods 4 Units

Terms offered: Fall 2022, Summer 2022 First 6 Week Session, Spring 2022

Advanced synthetic methods, chemical and spectroscopic structural methods, designed as a preparation for experimental research.

Organic Chemistry--Advanced Laboratory Methods: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 112B with a grade of C- or higher

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 11 hours of laboratory per week

Summer:

6 weeks - 2.5 hours of lecture and 27.5 hours of laboratory per week

8 weeks - 2 hours of lecture and 20.5 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Organic Chemistry--Advanced Laboratory Methods: Read Less [\[-\]](#)

CHEM 120A Physical Chemistry 3 Units

Terms offered: Fall 2022, Spring 2022, Fall 2021

Kinetic, potential, and total energy of particles and forces between them; principles of quantum theory, including one-electron and many-electron atoms and its applications to chemical bonding, intermolecular interactions, and elementary spectroscopy.

Physical Chemistry: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 4B or equivalent; Physics 7B or 8B; Mathematics 53; Mathematics 54 or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Physical Chemistry: Read Less [\[-\]](#)

CHEM 120B Physical Chemistry 3 Units

Terms offered: Fall 2022, Spring 2022, Fall 2021

Statistical mechanics, thermodynamics, equilibrium and applications to chemical systems: states of matter, solutions and solvation, chemical kinetics, molecular dynamics, and molecular transport.

Physical Chemistry: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 120A (or may be taken concurrently); 4B or equivalent; Mathematics 53; Mathematics 54 (may be taken concurrently); Physics 7B or 8B

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Physical Chemistry: Read Less [\[-\]](#)

CHEM 121 Introduction to Computational Chemistry 3 Units

Terms offered: Fall 2021, Fall 2020

This course demonstrates how computers are used to solve modern problems in physical chemistry. It focuses first on methods of electronic structure theory that reveal details of molecular structure and energetics, and secondly on simulation methods that explore fluctuations and dynamics of complex systems comprising many molecules. Students will use MATLAB to implement these numerical approaches for illustrative problems. No prior programming experience is required.

Introduction to Computational Chemistry: Read More [+]

Rules & Requirements

Prerequisites: Chem 120A and Chem 120B are very strongly recommended as prerequisites, or co-requisites

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of lecture and 1-2 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Introduction to Computational Chemistry: Read Less [-]

CHEM 122 Quantum Mechanics and Spectroscopy 3 Units

Terms offered: Fall 2022, Fall 2021, Fall 2020

Postulates and methods of quantum mechanics and group theory applied to molecular structure and spectra.

Quantum Mechanics and Spectroscopy: Read More [+]

Rules & Requirements

Prerequisites: 120A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Quantum Mechanics and Spectroscopy: Read Less [-]

CHEM 125 Physical Chemistry Laboratory 3 Units

Terms offered: Fall 2022, Spring 2022, Fall 2021

Experiments in thermodynamics, kinetics, molecular structure, and general physical chemistry.

Physical Chemistry Laboratory: Read More [+]

Rules & Requirements

Prerequisites: Two of the following: 120A, 120B, C130, or 130B with grades of C- or higher (one of which may be taken concurrently)

Credit Restrictions: Deficiency in 125 may be removed by successfully completing C182. Consent of instructor is required to enroll in 125 after completing C182 or EPS C182.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 5 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Physical Chemistry Laboratory: Read Less [-]

CHEM 130B Biophysical Chemistry 3 Units

Terms offered: Spring 2022, Spring 2021, Spring 2020

The weekly one-hour discussion is for problem solving and the application of calculus in physical chemistry. Molecular structure, intermolecular forces and interactions, biomolecular spectroscopy, high-resolution structure determinations.

Biophysical Chemistry: Read More [+]

Rules & Requirements

Prerequisites: Chemistry C130 or Molecular and Cell Biology C100A, or consent of instructor. Chemistry and Chemical Biology majors can only count 2 of the 3 units towards their Allied Subject requirement

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Biophysical Chemistry: Read Less [-]

CHEM C130 Biophysical Chemistry: Physical Principles and the Molecules of Life 4 Units

Terms offered: Fall 2022, Spring 2022, Fall 2021

Thermodynamic and kinetic concepts applied to understanding the chemistry and structure of biomolecules (proteins, DNA, and RNA). Molecular distributions, reaction kinetics, enzyme kinetics. Bioenergetics, energy transduction, and motor proteins. Electrochemical potential, membranes, and ion channels.

Biophysical Chemistry: Physical Principles and the Molecules of Life:

Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Chemistry 3A or 112A, Mathematics 1A, Biology 1A and 1AL; Chemistry 3B or 112B recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Summer: 8 weeks - 5.5 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Also listed as: MCELLBI C100A

Biophysical Chemistry: Physical Principles and the Molecules of Life:

Read Less [\[-\]](#)

CHEM 135 Chemical Biology 3 Units

Terms offered: Fall 2022, Fall 2021, Fall 2020

One-semester introduction to biochemistry, aimed toward chemistry and chemical biology majors.

Chemical Biology: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 3B or 112B; Biology 1A; or consent of instructor

Credit Restrictions: Students will receive no credit for 135 after taking Molecular and Cell Biology 100B or 102.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Chemical Biology: Read Less [\[-\]](#)

CHEM C138 The Berkeley Lectures on Energy: Energy from Biomass 3 Units

Terms offered: Fall 2015, Fall 2014, Fall 2013

After an introduction to the different aspects of our global energy consumption, the course will focus on the role of biomass. The course will illustrate how the global scale of energy guides the biomass research. Emphasis will be placed on the integration of the biological aspects (crop selection, harvesting, storage and distribution, and chemical composition of biomass) with the chemical aspects to convert biomass to energy. The course aims to engage students in state-of-the-art research.

The Berkeley Lectures on Energy: Energy from Biomass: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Chemistry 1B or Chemistry 4B, Mathematics 1B, Biology 1A

Repeat rules: Course may be repeated for credit under special circumstances: Repeatable when topic changes with consent of instructor.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Bell, Blanch, Clark, Smit, C. Somerville

Also listed as: BIO ENG C181/CHM ENG C195A/PLANTBI C124

The Berkeley Lectures on Energy: Energy from Biomass: Read Less [\[-\]](#)

CHEM C142 Machine Learning, Statistical Models, and Optimization for Molecular Problems 4 Units

Terms offered: Not yet offered

An introduction to mathematical optimization, statistical models, and advances in machine learning for the physical sciences. Machine learning prerequisites are introduced including local and global optimization, various statistical and clustering models, and early meta-heuristic methods such as genetic algorithms and artificial neural networks. Building on this foundation, current machine learning techniques are covered including deep learning artificial neural networks, Convolutional neural networks, Recurrent and long short term memory (LSTM) networks, graph neural networks, decision trees.

Machine Learning, Statistical Models, and Optimization for Molecular Problems: Read More [+]

Objectives & Outcomes

Course Objectives: To build on optimization and statistical modeling to the field of machine learning techniques

To introduce the basics of optimization and statistical modeling techniques relevant to chemistry students

To utilize these concepts on problems relevant to the chemical sciences.

Student Learning Outcomes: Students will be able to understand the landscape and connections between numerical optimization, stand-alone statistical models, and machine learning techniques, and its relevance for chemical problems

Rules & Requirements

Prerequisites: MATH 53 and MATH 54; CHEM 120A or CHEM 120B or BIO ENG 103

Credit Restrictions: Students will receive no credit for BIO ENG C142 after completing BIO ENG 142. A deficient grade in BIO ENG C142 may be removed by taking BIO ENG 142.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

Instructor: Teresa Head-Gordon

Formerly known as: Bioengineering C142/Chemistry C142

Also listed as: BIO ENG C142

Machine Learning, Statistical Models, and Optimization for Molecular Problems: Read Less [-]

CHEM 143 Nuclear Chemistry 2 Units

Terms offered: Fall 2019, Fall 2018, Fall 2017

Radioactivity, fission, nuclear models and reactions, nuclear processes in nature. Computer methods will be introduced.

Nuclear Chemistry: Read More [+]

Rules & Requirements

Prerequisites: Physics 7B or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Nuclear Chemistry: Read Less [-]

CHEM C146 Radiochemical Methods in Nuclear Technology and Forensics 3 Units

Terms offered: Spring 2022, Spring 2021

Experimental illustrations of the interrelation between chemical and nuclear science and technology and nuclear forensics; radioactive decay and counting techniques; nuclear spectroscopy; fundamental radiochemical techniques; radiochemical separations techniques; tracers; activation analysis; forensic applications of radiochemistry; fusion, fission and nuclear reactors.

Radiochemical Methods in Nuclear Technology and Forensics: Read More [+]

Objectives & Outcomes

Course Objectives: Familiarize students with principles of nuclear and radiochemistry and its many important applications in our daily lives; provide hands-on training.

Student Learning Outcomes: A solid understanding of nuclear and radiochemistry; proficiency in safe handling of radioactive materials in the laboratory, and appreciation for the wide application of radiochemical techniques in chemistry, nuclear technology, and nuclear forensics.

Rules & Requirements

Prerequisites: CHEM 4B or CHEM 15; and CHEM 143 is recommended

Credit Restrictions: Students will receive no credit for CHEM 146 after completing CHEM 144, or CHEM C144.

Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of lecture and 4.5 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Formerly known as: Chemistry 146

Also listed as: NUC ENG C146

Radiochemical Methods in Nuclear Technology and Forensics: Read Less [-]

CHEM 149 Supplementary Work in Upper Division Chemistry 1 - 4 Units

Terms offered: Spring 2016, Spring 2015, Spring 2014

Students with partial credit in upper division chemistry courses may, with consent of instructor, complete the credit under this heading.

Supplementary Work in Upper Division Chemistry: Read More [+]

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study per week

Summer:

6 weeks - 2.5-10 hours of independent study per week

8 weeks - 1.5-7.5 hours of independent study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Supplementary Work in Upper Division Chemistry: Read Less [-]

CHEM C150 Introduction to Materials Chemistry 3 Units

Terms offered: Fall 2022, Fall 2021, Spring 2021, Spring 2020

The application of basic chemical principles to problems in materials discovery, design, and characterization will be discussed. Topics covered will include inorganic solids, nanoscale materials, polymers, and biological materials, with specific focus on the ways in which atomic-level interactions dictate the bulk properties of matter.

Introduction to Materials Chemistry: Read More [+]

Rules & Requirements

Prerequisites: CHEM 104A. CHEM 104B recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Also listed as: MAT SCI C150

Introduction to Materials Chemistry: Read Less [-]

CHEM C170L Biochemical Engineering Laboratory 3 Units

Terms offered: Fall 2022, Spring 2022, Fall 2021, Fall 2018, Spring 2014, Spring 2013

Laboratory techniques for the cultivation of microorganisms in batch and continuous reactions. Enzymatic conversion processes. Recovery of biological products.

Biochemical Engineering Laboratory: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Chemical Engineering 170A (may be taken concurrently) or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 7 hours of laboratory and 1 hour of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Also listed as: CHM ENG C170L

Biochemical Engineering Laboratory: Read Less [\[-\]](#)

CHEM C178 Polymer Science and Technology 3 Units

Terms offered: Fall 2021, Fall 2020, Spring 2020, Fall 2016, Spring 2016, Spring 2015

An interdisciplinary course on the synthesis, characterization, and properties of polymer materials. Emphasis on the molecular origin of properties of polymeric materials and technological applications. Topics include single molecule properties, polymer mixtures and solutions, melts, glasses, elastomers, and crystals. Experiments in polymer synthesis, characterization, and physical properties.

Polymer Science and Technology: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Junior standing

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Also listed as: CHM ENG C178

Polymer Science and Technology: Read Less [\[-\]](#)

CHEM C182 Atmospheric Chemistry and Physics Laboratory 3 Units

Terms offered: Spring 2022, Spring 2021, Spring 2020

Fluid dynamics, radiative transfer, and the kinetics, spectroscopy, and measurement of atmospherically relevant species are explored through laboratory experiments, numerical simulations, and field observations. Atmospheric Chemistry and Physics Laboratory: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Earth and Planetary Science 50 and 102 with grades of C- or higher (one of which may be taken concurrently) or two of the following: Chemistry 120A, 120B, C130, or 130B with grades of C- or higher (one of which may be taken concurrently)

Credit Restrictions: Deficiency in C182 may be removed by successfully completing 125. Consent of instructor is required to enroll in C182 after completing 125.

Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of lecture and 5 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Formerly known as: Chemistry C182/Earth and Planetary Science C182

Also listed as: EPS C182

Atmospheric Chemistry and Physics Laboratory: Read Less [\[-\]](#)

CHEM C191 Quantum Information Science and Technology 3 Units

Terms offered: Fall 2021, Fall 2020, Spring 2020

This multidisciplinary course provides an introduction to fundamental conceptual aspects of quantum mechanics from a computational and informational theoretic perspective, as well as physical implementations and technological applications of quantum information science. Basic sections of quantum algorithms, complexity, and cryptography, will be touched upon, as well as pertinent physical realizations from nanoscale science and engineering.

Quantum Information Science and Technology: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Linear Algebra (EECS 16A or PHYSICS 89 or MATH 54) AND either discrete mathematics (COMPSCI 70 or MATH 55), or quantum mechanics (PHYSICS 7C or PHYSICS 137A or CHEM 120A)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Also listed as: COMPSCI C191/PHYSICS C191

Quantum Information Science and Technology: Read Less [\[-\]](#)

CHEM 192 Individual Study for Advanced Undergraduates 1 - 3 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015

All properly qualified students who wish to pursue a problem of their own choice, through reading or nonlaboratory study, may do so if their proposed project is acceptable to the member of the staff with whom they wish to work.

Individual Study for Advanced Undergraduates: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Consent of instructor and adviser

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Summer:

6 weeks - 1-5 hours of independent study per week

8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Individual Study for Advanced Undergraduates: Read Less [\[-\]](#)

CHEM H193 Senior Honors Thesis 3 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015

A senior honors thesis is written in consultation with the student's faculty research advisor. This is a required course for students wishing to graduate with honors in Chemistry or Chemical Biology.

Senior Honors Thesis: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Senior standing, approval of faculty research advisor, overall GPA of 3.4 or higher at Berkeley

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 9-0 hours of independent study per week

Summer: 8 weeks - 16.5 hours of independent study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Senior Honors Thesis: Read Less [\[-\]](#)

CHEM H194 Research for Advanced Undergraduates 2 - 6 Units

Terms offered: Fall 2022, Summer 2022 Second 6 Week Session, Spring 2022

Students may pursue original research under the direction of one of the members of the staff.

Research for Advanced Undergraduates: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Minimum GPA of 3.4 overall at Berkeley and consent of instructor and adviser

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 0-6 hours of independent study and 0-6 hours of laboratory per week

Summer:

6 weeks - 0-15 hours of independent study and 0-15 hours of laboratory per week

8 weeks - 0-11.5 hours of independent study and 0-11.5 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Research for Advanced Undergraduates: Read Less [\[-\]](#)

CHEM 195 Special Topics 3 Units

Terms offered: Spring 2022, Spring 2021, Fall 2020

Special topics will be offered from time to time. Examples are: photochemical air pollution, computers in chemistry.

Special Topics: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Summer: 10 weeks - 4.5 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Special Topics: Read Less [\[-\]](#)

CHEM 196 Special Laboratory Study 2 - 6 Units

Terms offered: Fall 2022, Spring 2021, Spring 2020
Special laboratory work for advanced undergraduates.
Special Laboratory Study: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Consent of instructor and adviser

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study and 0-1 hours of laboratory per week

Summer:

6 weeks - 2.5-10 hours of independent study and 0-2.5 hours of laboratory per week
8 weeks - 2-7.5 hours of independent study and 0-2 hours of laboratory per week
10 weeks - 1.5-6 hours of independent study and 0-1.5 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Special Laboratory Study: Read Less [\[-\]](#)

CHEM 197 Field Study in Chemistry 1 - 4 Units

Terms offered: Spring 2021, Spring 2020, Summer 2016 8 Week Session
Supervised experience in off-campus organizations relevant to specific aspects and applications of chemistry. Written report required at the end of the term. Course does not satisfy unit or residence requirements for the bachelor's degree.

Field Study in Chemistry: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Upper division standing and consent of instructor

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of fieldwork per week

Summer: 8 weeks - 6 hours of fieldwork per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Field Study in Chemistry: Read Less [\[-\]](#)

CHEM 198 Directed Group Study 1 - 4 Units

Terms offered: Fall 2022, Spring 2022, Fall 2021

Group study of selected topics.

Directed Group Study: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Completion of 60 units of undergraduate study and in good standing

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Directed Group Study: Read Less [\[-\]](#)

CHEM 199 Supervised Independent Study and Research 1 - 4 Units

Terms offered: Fall 2022, Fall 2021, Fall 2020

Enrollment is restricted by regulations listed in the .

Supervised Independent Study and Research: Read More [\[+\]](#)

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Summer:

6 weeks - 1-5 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Supervised Independent Study and Research: Read Less [\[-\]](#)