Fall 2020 Course Descriptions as of 04/05/2020 08:10 PM

Information in Browse Course Catalog is subject to change. Information is term specific. Please refer to the appropriate term when searching for course content. Key to Course Descriptions may be found at: **http://rcs.registrar.arizona.edu/course_descriptions_key**.

Chemistry (CHEM)

CHEM 100: Preparatory Chemistry (4 units)
Description: This course is designed for science and engineering majors who need to strengthen their fundamental chemical and mathematical knowledge. Through active involvement with the course content, students are expected to develop a basic understanding of core models used in chemistry to describe, explain, and predict the properties of matter in qualitative and quantitative manners. This course serves to prepare students for CHEM 151.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Discussion Required
Lecture Required
Course typically offered:
Main Campus: Fall

CHEM 101A: Lectures in General Chemistry (3 units)
Description: An introduction to chemical principles designed for students with a minimal background in science and mathematics. This course is designed for nontechnical students and is not a prerequisite for higher level chemistry courses.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Algebra recommended.

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CHEM 101B: Lectures in General Chemistry (3 units)
Description: Application of chemical principles presented in CHEM 101A to problems of interest to prenursing and allied health majors, with an emphasis on organic and biochemical principles. This course is designed for nontechnical students and is not a prerequisite for higher level chemistry courses.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Credit allowed for only one of the following: CHEM 101B or CHEM 241A, or 242A or 246A.
Enrollment requirement: CHEM 101A or CHEM 151 or CHEM 161 or CHEM 141.

CHEM 102: Laboratory in General Chemistry (1 unit)
Description: An introduction to the chemical laboratory with emphasis on problems of interest to the pre-nursing and allied health majors. This course is designed for non-technical students and is not a pre-requisite for higher chemistry courses.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Flat Fee: $100
Course Components: Laboratory Required
Lecture May Be Offered
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CHEM 101A. Concurrent registration, CHEM 101B. Credit allowed for only one of these lecture/lab combinations: CHEM 101A - 102A , or CHEM 103A - 104A, or CHEM 105A - 106A, or CHEM 151.
Enrollment requirement: [CHEM 101A OR CHEM 151 OR (CHEM 105A AND 106A) OR (CHEM 103A AND 104A)] AND pre-requisite or concurrent enrollment in CHEM 101B.

CHEM 141: General Chemistry Lecture I: Quantitative (3 units)
Description: CHEM 141 is the first part of a two-semester lecture series introducing students to the central principles of modern chemistry using a quantitative atoms-first approach. The course is intended for students who require a strong foundation in general chemistry, rooted in a technical (mathematical) approach to the discipline. It specifically targets science and engineering majors and other students interested in a systematic development of modern chemistry.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Credit is allowed for only one of these lecture/lab combinations: CHEM 105A-106A, or CHEM 141-143, or CHEM 151, or CHEM 161-163.
Enrollment requirement: PPL 50+ or SAT I MSS 590+ or ACT MATH 24+ or one course from MATH 108, 112, 113, 119A, 120R, 122B, 125, 129, or 223. Must not have taken CHEM 105A/106A, CHEM 151, or CHEM 161/163.

CHEM 142: General Chemistry Lecture II: Quantitative Approach (3 units)
Description: CHEM 142 is the second part of a two-semester lecture series introducing students to the central principles of modern chemistry using a quantitative atoms-first approach. The course is intended for students who require a strong foundation in general chemistry, rooted in a technical (mathematical) approach to the discipline. It specifically targets science and engineering majors and other students interested in a systematic development of modern chemistry.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Credit allowed for only one of these lecture/lab combinations: CHEM 105B/106B, or CHEM 142/144, or CHEM 162/164, or CHEM 152. Must not have taken CHEM 105B, CHEM 152, CHEM 162.
Enrollment requirement: CHEM 151 or 141/143 or 161/163 and 1 of the following: Concurrent enrollment in UA Math 112 or PPL 50+ or SAT I MSS 590+ or ACT MATH 24+ or 1 course from MATH 112,113,120R,122B,125,129, or 223. Test scores expire after 2 years.

CHEM 143: General Chemistry Lab 1: Quantitative (1 unit)
Description: CHEM 143 is the first semester of a two-semester laboratory sequence designed to provide an introduction to the central principles and practices of modern quantitative chemical analysis.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $100
Course Components: Laboratory Required
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Credit is allowed for only one of these lecture/lab combinations: CHEM 105A-106A, or CHEM 141-143, or CHEM 151, or CHEM 161-163.
Enrollment requirement: PPL 50+ or SAT I MSS 590+ or ACT MATH 24+ or one course from MATH 108, 112, 113, 119A, 120R, 122B, 125, 129, or 223. Must not have taken CHEM 105A/106A, CHEM 151, or CHEM 161/163.

CHEM 144: General Chemistry Lab II: Quantitative (1 unit)
Description: CHEM 144 is the second semester of a two-semester laboratory sequence designed to provide an introduction to the central principles and practices of modern quantitative chemical analysis.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $100
Course Components: Laboratory Required
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Credit allowed for only one of these lecture/lab combinations: CHEM 105B/106B or CHEM 142/144 or CHEM 162/164, or CHEM 152.
Enrollment requirement: CHEM 151 or 141/143 or 161/163. Concurrent enrollment or completion of CHEM 142 and 1 of the following: PPL 50+ or SAT I MSS 590+ or ACT MATH 24+ or 1 course from MATH 112,113,120R,122B,125,129, or 223. Test scores expire after 2 years.

CHEM 151: General Chemistry I (4 units)
Description: Integrated lecture-lab course designed to develop a basic understanding of the central principles of chemistry that are useful to explain and predict the properties of chemical substances based on their atomic and molecular structure. Additionally, students will be introduced to modern laboratory techniques and participate in experimental activities that promote the development of basic and advanced science-process skills. The course is designed for students who require a strong foundation in general chemistry, such as science and engineering majors, pre-medical and pre-pharmacy students.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Flat Fee: $100

Course Components:	Laboratory	Required
	Lecture	Required

Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: Credit is allowed for only one of these lecture/lab combinations: CHEM 105/106A, CHEM 141/143, CHEM 151 or CHEM 161/163.
Enrollment requirement: PPL 50+ or SAT I MSS 590+ or ACT MATH 24+ or one course from MATH 108, 112, 113, 119A, 120R, 122B, 125, 129, or 223. Test scores expire after 2 years. Must not have taken CHEM 105A/106A, CHEM 151, or CHEM 161/163.
Shared Unique Number: SUN# CHM 1151

CHEM 152: General Chemistry II (4 units)
Description: Continuation of CHEM 151. Integrated lecture-lab course designed to develop a basic understanding of the central principles of chemistry that are useful to explain and predict the properties of chemical substances based on their atomic and molecular structure. Additionally, students will be introduced to modern laboratory techniques and participate in experimental activities that promote the development of basic and advanced science-process skills. The course is designed for students who require a strong foundation in general chemistry, such as science and engineering majors, pre-medical and pre-pharmacy students.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Flat Fee: $100

Course Components:	Laboratory	Required
	Lecture	Required

Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: Credit allowed for only one of the these lecture/lab combinations: CHEM 105B/106B, CHEM 142/144, CHEM 162/164, or CHEM 152.
Enrollment requirement: CHEM 151 or CHEM 141/143 or CHEM 161/163 and one of the following: Concurrent enrollment in UA Math 112 or PPL 50+ or SAT I MSS 590+ or ACT MATH 24+ or one courses from MATH 112, 113, 120R, 122B, 125, 129, or 223. Test scores expire after 2 years.
Shared Unique Number: SUN# CHM 1152

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May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CHEM 161: Honors Fundamentals of Chemistry (3 units)
Description: Fundamental concepts of modern chemistry, with emphasis on theoretical and physical principles; atomic and molecular structure and quantum theory; chemical bonding; properties of gases, liquids and solids; solutions; thermochemistry.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: Credit is allowed for only one of these lecture/lab combinations: CHEM 105A - 106A, CHEM 141-143, CHEM 151 or CHEM 161-163.
Enrollment requirement: PPL 90+ or SAT I MSS 700+ or ACT MATH 31+. Test scores expire after 2 years. Honors Active. Must not have taken CHEM 141/143 or CHEM 151.
Honors Course: Honors Course
Honors Course: Honors Course

CHEM 162: Honors Fundamentals of Chemistry (3 units)
Description: Fundamental concepts of modern chemistry, with emphasis on theoretical and physical principles; thermodynamics and equilibria, acid-base chemistry; electochemistry; kinetics; spectroscopy; nuclear chemistry; materials.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: Credit allowed for only one of these lecture/lab combinations: CHEM 105B/106B, CHEM 142/144, CHEM 152, or CHEM 162/164.
Enrollment requirement: CHEM 161 or department consent. Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course

CHEM 163: Honors Fundamental Techniques of Chemistry (1 unit)
Description: Advanced techniques in college chemistry; measurements, separations; identification; purification and analysis of organic and inorganic substances.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $100
Course Components: Laboratory Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: Credit is allowed for only one of these lecture/lab combinations: CHEM 105A-106A, CHEM 141-143, CHEM 151, or CHEM 161-163.
Enrollment requirement: Concurrent enrollment or completion of CHEM 161. Must not have taken CHEM 141/143 or CHEM 151. Honors active.
Honors Course: Honors Course
Honors Course: Honors Course

CHEM 164: Honors Fundamental Techniques of Chemistry (1 unit)
Description: Advanced techniques in college chemistry; measurements, separations; identification; purification and analysis of organic and inorganic substances. Lab stresses individual studies and library research.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $100
Course Components: Laboratory Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: Credit allowed for only one of these lecture/lab combinations: CHEM 103B/104B, or CHEM 105B/106B, or CHEM 142/144, or CHEM 162/164, or CHEM 152.
Enrollment requirement: CHEM 161 and CHEM 163 or department consent. Concurrent enrollment or completion CHEM 162. Honors active.
Honors Course: Honors Course
Honors Course: Honors Course

CHEM 197A: Med-Start Chemistry Lab (1 unit)
Description: A university level chemistry laboratory experience for Med-Start program students
Grading basis: Pass/Fail
Career: Undergraduate
Course Components: Laboratory Required
Course typically offered:
Main Campus: Summer

Recommendations and additional information: Students must be enrolled in the Med-Start Summer Program.

CHEM 197B: General Chemistry Chemical Thinking Supplemental Instruction (1 - 2 units)
Description: This course is designed to complement CHEM 151. Students enrolled in the course will participate in weekly problem sessions pertaining to material covered in CHEM 151.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Workshop Required
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: This course is supplemental instruction for General Chemistry Chemical thinking.
Enrollment requirement: CHEM 151.

CHEM 197C: General Chemistry Lecture II: Chemical Thinking Supplemental Instruction (1 - 2 units)
Description: This course is designed to complement CHEM 152. Students enrolled in the course will participate in weekly problem sessions pertaining to material covered in CHEM 152.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Workshop Required
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Department enrollment required.
Enrollment requirement: Currently enrolled in CHEM 152.

CHEM 199: Independent Study (1 - 6 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 12 times.
Course typically offered:
Main Campus: Fall, Spring, Summer 1 and 2

Recommendations and additional information: CHEM 199 enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms

CHEM 199H: Honors Independent Study (1 - 6 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 12 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: CHEM 199(H) enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https: //cbc.arizona.edu/education/undergrad/forms
Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course

CHEM 241A: Lectures in Organic Chemistry (3 units)
Description: General principles of organic chemistry.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Course Components: Lecture Required
Equivalent to: CHEM 242A, CHEM 246A
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: Concurrent registration in CHEM 243A encouraged. Credit allowed for one of the following, CHEM 241A, CHEM 242A, CHEM 246A.
Enrollment requirement: CHEM 105B, CHEM 142, CHEM 152 or CHEM 162.
Shared Unique Number: SUN# CHM 2235

CHEM 241B: Lectures in Organic Chemistry (3 units)
Description: General principles of organic chemistry.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Course Components: Lecture Required
Equivalent to: CHEM 242B, CHEM 246B
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: Concurrent registration in CHEM 243B is encouraged. Credit allowed for only one of the following: CHEM 241B or CHEM 242B or CHEM 246B.
Enrollment requirement: CHEM 241A or CHEM 242A or CHEM 246A.
Shared Unique Number: SUN# CHM 2236

CHEM 242A: Honors Lectures in Organic Chemistry (3 units)
Description: General principles of organic chemistry.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Equivalent to: CHEM 241A, CHEM 246A
Course typically offered:
Main Campus: Fall

Enrollment requirement: Student must be active in the Honors College. CHEM 152 or CHEM 105B or CHEM 142 or CHEM 162.
Honors Course: Honors Course
Honors Course: Honors Course

CHEM 242B: Honors Lectures in Organic Chemistry (3 units)
Description: General principles of organic chemistry.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Equivalent to: CHEM 241B, CHEM 246B
Course typically offered:
Main Campus: Spring

Recommendations and additional information: Credit is allowed for only one of the following, CHEM 241B, CHEM 242B or CHEM 246B.
Enrollment requirement: CHEM 242A. Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course

CHEM 243A: Organic Chemistry Laboratory I (1 unit)
Description: An introduction to the organic chemistry laboratory with an emphasis on development of laboratory skills and techniques, observation of chemical phenomena, data collection, and the interpretation and reporting of results in formal laboratory reports. Heavy emphasis on microscale techniques, laboratory safety and waste disposal. The experiments are designed to complement the principles concurrently presented in the corresponding lecture class and require knowledge of the lecture material.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Flat Fee: $120
Course Components: Laboratory Required
Equivalent to: CHEM 244A, CHEM 245A, CHEM 247A
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: Credit allowed for one of the following: CHEM 243A or CHEM 247A.
Enrollment requirement: CHEM 105B/106B or CHEM 142/144 or CHEM 152 or CHEM 162/164, completion or concurrent enrollment in CHEM 241A, CHEM 242A or CHEM 246A.
Shared Unique Number: SUN# CHM 2235

CHEM 243B: Organic Chemistry Laboratory II (1 unit)
Description: An introduction to the organic chemistry laboratory with an emphasis on development of laboratory skills and techniques, observation of chemical phenomena, data collection, and the interpretation and reporting of results in formal laboratory reports. Heavy emphasis on microscale techniques, laboratory safety and waste disposal. The experiments are designed to complement the principles concurrently presented in the corresponding lecture class and require knowledge of the lecture material. Chemistry majors who take CHEM 243B instead of CHEM 247B or 244B, must take CHEM 243C in a subsequent semester.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Flat Fee: $120
Course Components: Laboratory Required
Equivalent to: CHEM 244B, CHEM 245B, CHEM 247B
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: Concurrent or prerequisite, CHEM 241B or CHEM 242B or CHEM 246B. Credit allowed for only one of the following, CHEM 243B or CHEM 244B or CHEM 245B or CHEM 247B.
Enrollment requirement: CHEM 243A or CHEM 247A.
Shared Unique Number: SUN# CHM 2236

CHEM 244A: Honors Organic Chemistry Laboratory (1 unit)
Description: An introduction to the organic chemistry laboratory with an emphasis on development of laboratory skills and techniques, observation of chemical phenomena, data collection, and the interpretation and reporting of results in formal laboratory reports. Heavy emphasis on microscale techniques, laboratory safety, waste disposal and biochemical applications.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $120
Course Components: Laboratory Required
Equivalent to: CHEM 243A, CHEM 245A, CHEM 247A
Course typically offered:
Main Campus: Fall

Recommendations and additional information: Credit Allowed for only one of the following, CHEM 243A or CHEM 244A or CHEM 247A.
Enrollment requirement: Student must be active in the Honors College. CHEM 152 or (CHEM 105B and CHEM 106B). Pre-requisite or concurrent requisite CHEM 241A or CHEM 242A or CHEM 246A.
Honors Course: Honors Course
Honors Course: Honors Course

CHEM 246A: Lectures in Organic Chemistry (3 units)
Description: General principles of organic chemistry. Designed for students planning to take more advanced coursework in chemistry, especially chemistry, biochemistry and chemical engineering majors. Required for Chemistry majors.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Course Components: Lecture Required
Equivalent to: CHEM 241A, CHEM 242A
Course typically offered:
Main Campus: Fall

Recommendations and additional information: Credit is allowed for only one of the following: CHEM 241A, CHEM 242A, or CHEM 246A.
Enrollment requirement: CHEM 105B, CHEM 142, CHEM 152 or CHEM 162.

CHEM 246B: Lectures in Organic Chemistry (3 units)
Description: General principles of organic chemistry. Designed for students planning to take more advanced coursework in chemistry, especially chemistry, biochemistry and chemical engineering majors. Required for chemistry majors.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Course Components: Lecture Required
Equivalent to: CHEM 241B, CHEM 242B
Course typically offered:
Main Campus: Spring

Recommendations and additional information: Prerequisites: CHEM 246A or consent of instructor. Credit is allowed for only one of the following, CHEM 241B or CHEM 242B or CHEM 246B.
Enrollment requirement: CHEM 241A or CHEM 242A or CHEM 246A.

CHEM 247A: Organic Chemistry Laboratory (2 units)
Description: Similar to 243A. Designed for chemistry and biochemistry majors and chemical engineers.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $120
Course Components: Laboratory Required
Equivalent to: CHEM 243A, CHEM 244A, CHEM 245A
Course typically offered:
Main Campus: Fall

Recommendations and additional information: Credit is allowed for only one of the following, CHEM 243A or CHEM 244A, or CHEM 245A or CHEM 247A.
Enrollment requirement: CHEM 105B/106B or CHEM 142/144 or CHEM 152 or CHEM 162/164, completion or concurrent enrollment in CHEM 241A, CHEM 242A or CHEM 246A.

CHEM 247B: Organic Chemistry Laboratory (2 units)
Description: Similar to 243B. Designed for chemistry and biochemistry majors and chemical engineers.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Flat Fee: $120
Course Components: Laboratory Required
Equivalent to: CHEM 243B, CHEM 244B, CHEM 245B
Course typically offered:
Main Campus: Spring

Recommendations and additional information: Prerequisites or concurrent enrollment in CHEM 241B, CHEM 246B or CHEM 242B. Credit allowed for only one of the following, CHEM 243B or CHEM 244B or CHEM 245B or CHEM 247B.
Enrollment requirement: CHEM 243A or CHEM 247A or CHEM 244A.

CHEM 257A: The Organic Chemistry and Materials Science of Art and Archaeological Objects (3 units)
Description: We explore the roles of organic chemistry and materials science in the formulation, ageing and conservation of art and archaeological objects. Topics include color and bonding theories, and the organic molecules in paints, paper, gels, dyes, textiles, adhesives and polymers.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Equivalent to: ANTH 257A, CHEM 257A, ENGR 257A
Also offered as: ANTH 257A, ENGR 257A, MSE 257A
Course typically offered:
Main Campus: Fall

Home department: Materials Science & Engineering
General Education: Tier 2 Natural Sciences
Honors Course: Honors Contract
Honors Course: Honors Contract

CHEM 291: Preceptorship (1 - 3 units)
Description: Specialized work on an individual basis, consisting of instruction and practice in actual service in a department, program, or discipline. Teaching formats may include seminars, in-depth studies, laboratory work and patient study. Requires faculty member approval, preceptor application on file with department.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated for a maximum of 6 units.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: CHEM 291 enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.

CHEM 291H: Honors Preceptorship (1 - 3 units)
Description: Specialized work on an individual basis, consisting of instruction and practice in actual service in a department, program, or discipline. Teaching formats may include seminars, in-depth studies, laboratory work and patient study. Requires faculty member approval preceptor application on file with department.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated for a maximum of 6 units.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: CHEM 291H enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.
Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course

CHEM 297: General Chemistry Preceptor Content Preparation Workshop (1 unit)
Description: The course is designed to challenge preceptors to both refresh content knowledge of the courses and improve their depth of understanding to better prepare them for assisting students in and out of the classroom. Activities in the stock notes are presented to the preceptors, evaluated for their objectives, and assessed for the level of task difficulty. Preceptors are expected to strategize methods for guiding student learning through the challenges of different stages of the activities and how to push students further in their content knowledge.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Workshop Required
Repeatable: Course can be repeated a maximum of 2 times.
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: CHEM 297 enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.
Field trip: NA
Enrollment requirement: CHEM 151

CHEM 299: Independent Study (1 - 5 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: CHEM 299 enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.

CHEM 299H: Honors Independent Study (1 - 6 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: CHEM 299H enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.
Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course

CHEM 302A: Scientific Glassblowing (1 unit)
Description: Methods of design and construction of scientific glass apparatus.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Flat Fee: $40
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Restricted to chemistry majors or approval by a CBC advisor.

CHEM 325: Analytical Chemistry (2 units)
Description: Principles of modern quantitative analysis, including consideration of stoichiometry, equilibrium principles, treatment of experimental data, titrimetric and photometric analysis, potentiometric analysis, and analytical separation processes.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Course Components: Lecture Required
Equivalent to: CHEM 322
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Concurrent enrollment in CHEM 326 encouraged.
Enrollment requirement: Completion of CHEM 105B, CHEM 142, CHEM 152 or CHEM 162. Completion or concurrent registration in Math 129.

CHEM 326: Analytical Chemistry Laboratory (2 units)
Description: Experiments in modern quantitative analysis, including statistical analysis of data, acid/base equilibrium, gravimetric analysis, potentiometric analysis, analytical separations, spectroscopy, and mass spectrometry. Emphasis on data reporting and interpretation. Designed for chemistry majors.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Flat Fee: $140
Course Components: Laboratory Required
Equivalent to: CHEM 323
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Credit is allowed for only one course or sequence in each group, CHEM 326 or CHEM 323.
Enrollment requirement: Prerequisite or concurrent registration, CHEM 325.

CHEM 380: Mathematical Physics for Chemistry (3 units)
Description: This course covers the fundamentals and techniques of mathematics with applications to common problems in chemistry and chemical physics. CHEM 380 is designed to be a survey of applied math as encountered in chemistry. Application oriented (rather than proof-driven), covering at an introductory level most types of math encountered in a typical chemistry curriculum. Mathematical tools are introduced and explored in a chemistry context.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall, Spring, Summer

Enrollment requirement: MATH 129 or MATH 223. (PHYS 141 or 140 or 102/181 or 161H recommended)

CHEM 392: Directed Research (1 - 6 units)
Description: Individual or small group research under the guidance of faculty.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated for a maximum of 12 units.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: CHEM 392 enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms
Student Engagement Activity: Discovery
Student Engagement Competency: Innovation and Creativity

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CHEM 392H: Honors Directed Research (1 - 6 units)
Description: Individual or small group research under the guidance of faculty.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 12 times.
Course typically offered:
Main Campus: Fall, Spring, Summer 1 and 2

Recommendations and additional information: CHEM 392H enrollment is completed manually by a CBC Advisor in Old Chemistry 210, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms
Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course
Student Engagement Activity: Discovery
Student Engagement Competency: Innovation and Creativity

CHEM 395A: Chemistry Majors Colloquium (1 unit)
Description: Chemistry majors colloquium is designed to provide an array of information that will assist chemistry majors in the successful completion of the degree and in preparation for employment. The main objective of the course is to improve familiarity with the opportunities and tools available to chemistry majors, and thus to enhance the undergraduate experience and participation of chemistry majors in chemically related activities beyond the classroom.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Colloquium Required
Course typically offered:
Main Campus: Spring

Enrollment requirement: Prerequisite or concurrent registration in (CHEM 241A or CHEM 242A or CHEM 246A) and CHEM majors only or instructor consent.

CHEM 399: Independent Study (1 - 5 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: CHEM 399 enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.
Student Engagement Activity: Discovery
Student Engagement Competency: Innovation and Creativity

CHEM 399H: Honors Independent Study (1 - 6 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: CHEM 399H enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.
Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course
Student Engagement Activity: Discovery
Student Engagement Competency: Innovation and Creativity

CHEM 400A: Chemical Measurements Laboratory (3 units)
Description: Laboratory in modern chemical measurements and instrumentation, containing both quantitative and qualitative chemical analysis. Lab work includes electronic circuits in instrumentation, spectroscopy, chromatography, electrophoresis, electrochemical methods, and mass spectrometry. Focus on independent experimental design and data interpretation, and a student-designed analysis of a real-world sample.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $140
Course Components: Laboratory Required
Course typically offered:
Main Campus: Fall

Enrollment requirement: CHEM 401A
Student Engagement Activity: Discovery
Student Engagement Competency: Innovation and Creativity
Writing Emphasis: Writing Emphasis Course

CHEM 400B: Chemical Measurements Laboratory (3 units)
Description: This course concerns the teaching of modern experimental methods in physical chemistry. The goal is to illustrate concepts in thermodynamics, quantum mechanics, and chemical kinetics, taught in the lecture courses 480A and 480B, through experiments concerning heat capacities, liquid/vapor equilibria, surface tension, viscosity, quantum dots, and atomic and molecular spectroscopy. Practical training is provided in the use of vacuum systems, detection electronics, oscilloscopes, simple lasers, and other modern tools in the physical chemistry laboratory, as well as in quantitative error analysis and scientific writing.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $120
Course Components: Laboratory Required
Lecture Required
Course typically offered:
Main Campus: Spring

Enrollment requirement: Prerequisite (CHEM 480A OR CHEM 480B OR CHEM 481) AND prerequisite or concurrent completion of the (CHEM 480A and CHEM 480B/481 series).
Writing Emphasis: Writing Emphasis Course

CHEM 401A: Instrumental Analysis (3 units)
Description: A basic course in measurement science, intended to provide the student with an overall view of modern analytical chemistry and the instrumental methods of analysis used throughout industrial laboratories and research environments.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Spring

Enrollment requirement: (CHEM 241B, 242B or 246B) and (CHEM 243B, 244B or 247B) and (CHEM 322 or 325) and prerequisite or concurrent registration in (CHEM 323 or 326) and prerequisite or concurrent registration in (PHYS 103/182, PHYS 241 or PHYS 261H).

CHEM 404A: Inorganic Chemistry (3 units)
Description: Fundamentals of inorganic chemistry, including quantum mechanical descriptions of bonding and structure in small molecules and solids, symmetry and group theory, and structure, bonding and electronic spectra of coordination compounds.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Equivalent to: CHEM 404
Course typically offered:
Main Campus: Spring

Enrollment requirement: CHEM 241B, CHEM 242B or CHEM 246B.

CHEM 404B: Inorganic Chemistry II (3 units)
Description: Utilizing the fundamental basis of 404A, this course provides an overview of the modern applications of inorganic chemistry. Core concepts such as catalysis, inorganic reaction mechanisms and reactivity will be presented in the context of relevance to renewable energy and fuels, inorganic materials, organometallics, biological applications, nanotechnology and the environment.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Enrollment requirement: CHEM 404A.

CHEM 405: Chemical Safety (1 unit)
Description: Fundamental principles of the safe handling, use, storage and disposal of hazardous chemical substances. Survey of protective and emergency equipment, hazard evaluation, laws and regulatory statutes and liability.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Enrollment requirement: Prerequisite or concurrent registration (CHEM 241B or CHEM 242B or CHEM 246B) or instructor consent.

CHEM 412: Inorganic Preparation (3 units)
Description: Standard inorganic laboratory preparations, including coordination compounds, isomeric, organometalic, bioinorganic, air sensitive compounds, and compounds typifying the groups of the periodic table. High temperature, inert atmosphere, materials synthesis, and characterization of products by various spectroscopic techniques.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $140
Course Components: Laboratory Required
Lecture Required
Co-convened with: CHEM 512
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: CHEM 404A.
Writing Emphasis: Writing Emphasis Course

CHEM 436: Scientific and Ethical Aspects of Modifying Human Behavior (3 units)
Description: Modern chemistry, biology and medicine in conjunction with the neuroscience revolution are providing tools which can modify basic human behaviors (learning, addictive, aggressive, feeding, etc.). An examination of the scientific, cultural, religious and ethical issues related to this emerging science will be examined. Basic knowledge of chemistry and biology (two years of each) and of social sciences (psychology, philosophy, religious studies, etc.) are useful prerequisites or consent of instructor.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Equivalent to:
Co-convened with: CHEM 536
Course typically offered:
Main Campus: Spring

CHEM 437: Surface Science (3 units)
Description: Fundamental material, electrical, and chemical properties of solid metal, semiconductor, insulator, and organic surfaces applied to selected gas/solid surface chemical reactions important in semiconductor processing and heterogeneous catalysis. This course is designed to introduce students to the chemistry and physics of solid surfaces and interfaces with an emphasis on the gas/solid interface. The first half of the course will be devoted to learning the fundamental material, electrical, and chemical properties of solid surfaces. The fundamentals will be applied in the second half of the course to topics in chemical catalysis and integrated circuit manufacture.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Equivalent to: CHEM 437, MSE 437
Also offered as: CHEE 437, MSE 437
Co-convened with: CHEM 537
Course typically offered:
Main Campus: Spring

Home department: Chemical & Environmental Engineering
Enrollment requirement: Adv Stdg: Engineering or major or minor in Chemistry, Physics or Optical Sciences. Junior or Senior status.

CHEM 439A: Central Ideas in the Chemical Science (3 units)
Description: This is a culminating course in the preparation of chemistry teachers. It is required for students in the College of Science Teacher Preparation Program who plan to teach chemistry. The course focuses on the analysis and understanding of central ideas in the chemical sciences traditionally included in the secondary school science curriculum. Additionally, the course helps students identify and assess chemistry concepts that secondary level students are likely to have difficulty understanding and evaluate the implications for teaching and learning science.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: Open to pre-service and in-service secondary school teachers with a minimum of 18 units of College level chemistry course work.
Enrollment requirement: STCH 250, STCH 310. Concurrent enrollment or prerequisite, STCH 410.

CHEM 446: Organic Preparations (3 units)
Description: Special experimental methods for the synthesis of organic compounds.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $140

Course Components:	Laboratory	Required
	Lecture	Required

Course typically offered:
Main Campus: Fall

Enrollment requirement: (CHEM 241B or CHEM 242B or 246B) and (CHEM 243B or CHEM 247B).

CHEM 447: Organic Structural Analysis Laboratory (3 units)
Description: Determination of structure and composition of organic compounds and mixtures using modern spectroscopic and separation methods.
Grading basis: Regular Grades
Career: Undergraduate
Flat Fee: $140

Course Components:	Laboratory	Required
	Lecture	Required

Equivalent to: CHEM 440
Co-convened with: CHEM 547
Course typically offered:
Main Campus: Spring

Enrollment requirement: (CHEM 241B, CHEM 242B, or CHEM 246B), and (CHEM 243B, CHEM 244B or CHEM 247B).

CHEM 448A: Plant Biochemistry and Metabolic Engineering (3 units)
Description: Covering topics in plant metabolic engineering; photosynthesis; carbohydrate, nitrogen and lipid metabolism; specialized metabolism. This course covers biochemical processes specific to plants and allows students to gain an understanding and appreciation of how (bio)chemical components are synthesized and utilized by plants during growth and development and in their interactions with their environment, as well as how these processes can be manipulated. A background in plant biology, general biochemistry or chemistry is expected. Note that concurrent registration in any of these courses will NOT meet this requirement. Students must have completed both semesters of O-chem and a biochemistry course that covers general metabolism prior to taking this course.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Equivalent to: BIOC 448A, CHEM 448A, ECOL 448A, MCB 448A
Also offered as: BIOC 448A, ECOL 448A, MCB 448A, PLS 448A
Co-convened with: CHEM 548A
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CHEM 241A/B or CHEM 242A/B; BIOC 462A/B or BIOC 460 or consent of instructor.
Home department: School of Plant Science

CHEM 450: Synthetic and Mechanistic Organic Chemistry (3 units)
Description: Commonly used reactions for organic synthesis will be discussed. Examples, limitations, and mechanistic considerations will be examined.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Lecture Required
Co-convened with: CHEM 550
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CHEM 241B or CHEM 242B or CHEM 246B or instructor consent.
Enrollment requirement: CHEM 241B or CHEM 242B or CHEM 246B or instructor consent.

CHEM 480A: Physical Chemistry (3 units)
Description: Fundamental principles of physical chemistry. The course is designed for undergraduate majors in chemistry, chemical engineering, biochemistry and the life sciences, and related majors. Topics covered include properties of solids, liquids, gases; thermodynamics; and chemical kinetics.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall

Enrollment requirement: (CHEM 105B, CHEM 142, CHEM 152 or CHEM 162) and (MATH 223 or MATH 254 or CHEM 380) and (PHYS 102/181 or PHYS 141 or PHYS 140 or PHYS 161H).

CHEM 480B: Physical Chemistry (3 units)
Description: Fundamental principles of physical chemistry. Course design includes quantum mechanics; atomic and molecular structure; molecular spectroscopy; statistical mechanics and transport.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Course Components: Discussion May Be Offered
Lecture Required
Course typically offered:
Main Campus: Fall, Spring

Enrollment requirement: (CHEM 105B or CHEM 142 or CHEM 152 or CHEM 162) and (MATH 223 or MATH 254 or CHEM 380) and (PHYS 103 or 182 or 241 or 240 or 261H).

CHEM 481: Biophysical Chemistry (3 units)
Description: Fundamental principles of physical chemistry as applied to biological systems. Course design emphasizes physical theories and laws with applications to proteins, membranes, and nucleic acids. Topics include quantum mechanics and molecular structure; biomolecular spectroscopy; crystallography; biopolymers; statistical mechanics and transport.
Grading basis: Student Option ABCDE/PF
Career: Undergraduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: Credit allowed for only one of the following: CHEM 480B or CHEM 481.
Enrollment requirement: (CHEM 152 or CHEM 105B/106B or CHEM 103B/104B) and (MATH 223 or MATH 254 or CHEM 380) and (PHYS 103/182 or PHYS 241 or PHYS 240 or PHYS 261H).

CHEM 491: Preceptorship (1 - 3 units)
Description: Specialized work on an individual basis, consisting of instruction and practice in actual service in a department, program, or discipline. Teaching formats may include seminars, in-depth studies, laboratory work and patient study. Requires faculty member approval, preceptor application on file with department
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: CHEM 491 enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.

CHEM 491H: Honors Preceptorship (1 - 3 units)
Description: Specialized work on an individual basis, consisting of instruction and practice in actual service in a department, program, or discipline. Teaching formats may include seminars, in-depth studies, laboratory work and patient study. Requires faculty member approval, preceptor application on file with department.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated for a maximum of 6 units.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: CHEM 491H enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.
Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course

CHEM 492: Directed Research (1 - 6 units)
Description: Individual or small group research under the guidance of faculty.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated for a maximum of 12 units.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: CHEM 492 enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.
Student Engagement Activity: Discovery
Student Engagement Competency: Innovation and Creativity

CHEM 492H: Honors Directed Research (1 - 6 units)
Description: Individual or small group research under the guidance of faculty.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 12 times.
Course typically offered:
Main Campus: Fall, Spring, Summer 1 and 2

Recommendations and additional information: CHEM 492H enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.
Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course
Student Engagement Activity: Discovery
Student Engagement Competency: Innovation and Creativity

CHEM 493: Internship (1 - 5 units)
Description: Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: CHEM 493 enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.
Student Engagement Activity: Discovery
Student Engagement Competency: Innovation and Creativity

CHEM 496D: Chemistry Discovery (1 unit)
Description: Chemistry Discovery is an undergraduate chemistry course and a chemistry outreach program. Students are exposed to the rewarding experience of promoting chemistry among younger students from local elementary and middle schools. The main objective for the course is the design, development and execution of a series of workshops for visiting schools at the University of Arizona Flandrau Science Center. Students learn how to connect chemistry knowledge with everyday life as they develop inquiry-based activities that facilitate chemistry learning.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Seminar Required
Repeatable: Course can be repeated a maximum of 3 times.
Co-convened with: CHEM 596D
Course typically offered:
Main Campus: Fall

Enrollment requirement: CHEM 105B, CHEM 142, CHEM 152 or CHEM 162.
Student Engagement Activity: Leadership
Student Engagement Competency: Innovation and Creativity

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CHEM 498: Senior Capstone (3 units)
Description: A culminating experience for majors involving a substantive project that demonstrates a synthesis of learning accumulated in the major, including broadly comprehensive knowledge of the discipline and its methodologies. Senior standing required.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: CHEM 498 enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.
Student Engagement Activity: Discovery
Student Engagement Competency: Innovation and Creativity

CHEM 498H: Honors Thesis (3 units)
Description: An honors thesis is required of all the students graduating with honors. Students ordinarily sign up for this course as a two-semester sequence. The first semester the student performs research under the supervision of a faculty member; the second semester the student writes an honors thesis.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated for a maximum of 9 units.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: CHEM 498H enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.
Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course
Student Engagement Activity: Discovery
Student Engagement Competency: Innovation and Creativity
Writing Emphasis: Writing Emphasis Course

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CHEM 499: Independent Study (1 - 6 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Alternative Grading: S, P, F
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: CHEM 499 enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms.
Student Engagement Activity: Discovery
Student Engagement Competency: Innovation and Creativity

CHEM 499H: Honors Independent Study (1 - 6 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.
Grading basis: Regular Grades
Career: Undergraduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

Recommendations and additional information: CHEM 499H enrollment is completed manually by a CBC Academic Advisor, and requires a completed proposal form found at https://cbc.arizona.edu/education/undergrad/forms
Enrollment requirement: Student must be active in the Honors College.
Honors Course: Honors Course
Honors Course: Honors Course
Student Engagement Activity: Discovery
Student Engagement Competency: Innovation and Creativity

CHEM 501A: Instrumental Analysis (3 units)
Description: A basic course in measurement science, intended to provide the student with an overall view of modern analytical chemistry and the instrumental methods of analysis used throughout industrial laboratories and research environments. Graduate-level requirements include a separate discussion section and separate exams.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Co-convened with: CHEM 401A
Course typically offered:
Main Campus: Spring

CHEM 510: Advanced Inorganic Chemistry (3 units)
Description: Aspects of modern inorganic chemistry including symmetry and structure, group theory and bonding, spectroscopic and magnetic properties, and reactions of transition metal compounds. Selected topics and new directions in inorganic chemistry are also discussed, including main group elements, catalysis and bioinorganic chemistry.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CHEM 404 or consent of instructor.

CHEM 512: Inorganic Preparations (3 units)
Description: Standard inorganic laboratory preparations, including coordination compounds, isomeric, organometalic, bioinorganic, air sensitive compounds, and compounds typifying the groups of the periodic table. High temperature, inert atmosphere, materials synthesis, and characterization of products by various spectroscopic techniques. Graduate level requirements include an individual synthesis project.
Grading basis: Regular Grades
Career: Graduate
Flat Fee: $140
Course Components: Laboratory Required
Lecture Required
Co-convened with: CHEM 412
Course typically offered:
Main Campus: Fall

CHEM 514: Organometallic Compounds (3 units)
Description: Compounds containing carbon-metal bonds, with emphasis on those of the transition elements, their reactivity, and the determination of their structure.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall

CHEM 515: Physical Methods in Inorganic Chemistry (3 units)
Description: Selected topics in the area of physical characterization of inorganic molecules and materials, with particular emphasis on ligand field theory, symmetry aspects, spectral properties and magnetic behavior of transition metal complexes.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CHEM 510.

CHEM 518: Computational Chemistry (3 units)
Description: Molecular modeling and computations in all areas of chemistry and related disciplines ranging from molecular mechanics, conformational analysis and molecular dynamics to advanced electronic structure computations by state-of-the-art methods; the course emphasizes guidance in hands-on experience with modern computational tools and actual practical application of the methods to the student's own research or chemical interests.
Grading basis: Regular Grades
Career: Graduate
Flat Fee: $140
Course Components: Lecture Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: Consent of instructor.

CHEM 521A: Advanced Analytical Chemistry (3 units)
Description: Principles of electronics, principles of signal processing hardware and software, instrumental principles of atomic and molecular spectroscopy, statistical treatment of data, chemometrics.
Grading basis: Regular Grades
Career: Graduate
Flat Fee: $50
Course Components: Laboratory Required
Lecture Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CHEM 325, CHEM 401A, CHEM 480B.

CHEM 522: Electroanalytical Chemistry (3 units)
Description: Principles of electrochemistry and electroanalysis, including topics on electrochemical equilibria, electrode kinetics, potentiometry, coulometry, voltammetry and spectroelectrochemistry.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CHEM 401A or consent of instructor.

CHEM 523A: Bioanalytical Chemistry (3 units)
Description: Bioanalytical chemistry covers the principles behind the essential measurements used for analysis of biological systems, including but not limited to separations, mass spectrometry, microarrays, immunoassays, and DNA sequencing. The current literature is examined to understand today's research questions in bioanalysis, developments in the biotech industry, and opportunities to have a creative impact on improving human health.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall (odd years only)

CHEM 525A: Mass Spectrometry (3 units)
Description: Modern mass spectrometric techniques and instrumentation.
Grading basis: Regular Grades
Career: Graduate
Course Components: Laboratory — May Be Offered
Lecture — Required
Course typically offered:
Main Campus: Fall, Spring

CHEM 526B: Analytical Spectroscopy (3 units)
Description: Principles of molecular absorption, emission and scattering spectroscopies for chemical analysis.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture — Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CHEM 401A or consent of instructor.

CHEM 527: Analytical Separations (3 units)
Description: Fundamentals of separation processes including single and multistage analytical chromatographic methods.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture — Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CHEM 401A or consent of instructor.

CHEM 528B: Advanced Analytical Chemistry Laboratory (3 units)
Description: Advanced laboratory experiments in analytical instrumentation and chemical analysis.
Grading basis: Regular Grades
Career: Graduate
Flat Fee: $140
Course Components: Laboratory — Required
Lecture — Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CHEM 401A, CHEM 480B, and CHEM 521A.

CHEM 529: Methods of Surface and Materials Analysis (3 units)
Description: Fundamentals of electron, atomic and molecular spectroscopies for surface and materials analysis. This course is suitable for enrollment by advanced undergraduates.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CHEM 401A or consent of instructor.

CHEM 530: Introduction to Molecular Therapeutics and Drug Discovery (2 units)
Description: This will be a two-unit team taught introductory course offered by the faculty of the Drug Discovery and Development (DDD) and Pharmacology/Toxicology (PharmTox) graduate tracks of the College of Pharmacy. The course is intended to familiarize first year graduate or senior undergraduate students with (i) critical concepts of drug discovery, (ii) inclusion of basic pharmacological principles, and (iii) exemplary molecular therapeutics of historic and contemporary importance.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Also offered as: CBIO 530, PCOL 530, PHSC 530
Course typically offered:
Main Campus: Fall

Home department: Pharmaceutical Sciences

CHEM 534B: Practical NMR Spectroscopy Lecture (3 units)
Description: The course will cover the theory and interpretation of a wide variety of NMR methods useful in organic chemistry research, at a level appropriate for organic chemists. Both one-dimensional and two-dimensional methods will be covered, with emphasis on up-to-date methods with practical application to research problems. A coherent theoretical basis for understanding NMR experiments will be presented, without a rigorous basis in physics and mathematics, starting with the classical spinning-top model and adding just enough of the quantum picture to provide an accurate description.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required

CHEM 536: Scientific and Ethical Aspects of Modifying Human Behavior (3 units)
Description: Modern chemistry, biology and medicine in conjunction with the neuroscience revolution are providing tools which can modify basic human behaviors (learning, addictive, aggressive, feeding, etc.). An examination of the scientific, cultural, religious and ethical issues related to this emerging science will be examined. Basic knowledge of chemistry and biology (two years of each) and of social sciences (psychology, philosophy, religious studies, etc.) are useful prerequisites or consent of instructor. Graduate-level requirements include a more extensive term paper.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Equivalent to: RELI 536
Also offered as: RELI 536
Co-convened with: CHEM 436
Course typically offered:
Main Campus: Spring

CHEM 537: Surface Science (3 units)
Description: Fundamental material, electrical, and chemical properties of solid metal, semiconductor, insulator, and organic surfaces applied to selected gas/solid surface chemical reactions important in semiconductor processing and heterogeneous catalysis. This course is designed to introduce students to the chemistry and physics of solid surfaces and interfaces with an emphasis on the gas/solid interface. The first half of the course will be devoted to learning the fundamental material, electrical, and chemical properties of solid surfaces. The fundamentals will be applied in the second half of the course to topics in chemical catalysis and integrated circuit manufacture. Graduate-level requirements include completion of two projects of their choice with the approval of the instructor.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Equivalent to: CHEM 537, MSE 537
Also offered as: CHEE 537, MSE 537
Co-convened with: CHEM 437
Course typically offered:
Main Campus: Spring

Home department: Chemical & Environmental Engineering

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CHEM 541: Mechanisms of Organic Reactions (3 units)
Description: Detailed analysis of the factors which influence the rates and courses of organic processes.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CHEM 241B or CHEM 242B or CHEM 246B or consent of instructor.
Enrollment requirement: (CHEM 450 or CHEM 550) and CHEM 480B or consent of instructor.

CHEM 542B: Polymer Chemistry (3 units)
Description: Synthesis, stereochemistry, and mechanisms of formation of high polymers. Vinyl polymers.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CHEM 542A is not prerequisite to CHEM 542B.

CHEM 545: Laboratory Methods for Organic Chemistry (4 units)
Description: The course will provide a substantial training with the methods that are most useful and commonly encountered in organic research laboratories. Students will gain experience using the proper equipment and techniques for carrying out a broad range of organic synthesis reactions, purifications, and characterizations.Simultaneously, students will gain experience with spectroscopic methods relevant to organic chemistry research from a theoretical perspective and, importantly, by practical application in the laboratory. The skills gained are expected to be broadly applicable to many different areas of graduate research
Grading basis: Regular Grades
Career: Graduate
Flat Fee: $140
Course Components: Laboratory Required
Lecture Required
Course typically offered:
Main Campus: Fall

Enrollment requirement: CHEM 446 or instructor consent.

CHEM 546: Advanced Organic Chemistry (3 units)
Description: Advanced topics in organic chemistry, such as peptide chemistry, computer simulations, bio-organic chemistry, and other topics characterized by faculty expertise. Topics will vary each semester.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Repeatable: Course can be repeated a maximum of 2 times.
Course typically offered:
Main Campus: Spring

Recommendations and additional information: Consult department before enrolling.

CHEM 547: Organic Structural Analysis Laboratory (3 units)
Description: Determination of structure and composition of organic compounds and mixtures using modern spectroscopic and separation methods. Graduate-level requirements include additional laboratory experiments.
Grading basis: Regular Grades
Career: Graduate
Flat Fee: $140
Course Components: Laboratory Required
Lecture Required
Co-convened with: CHEM 447
Course typically offered:
Main Campus: Spring

Recommendations and additional information: Consent of instructor.

CHEM 548: Advanced Synthetic Organic Chemistry (3 units)
Description: Reactions and methods used for organic synthesis. Emphasis is placed on the development and application of modern methods for the synthesis of complex organic compounds.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CHEM 450 or CHEM 550 or consent of instructor.

CHEM 548A: Plant Biochemistry and Metabolic Engineering (3 units)
Description: Covering topics in plant metabolic engineering; photosynthesis; carbohydrate, nitrogen and lipid metabolism; specialized metabolism. This course covers biochemical processes specific to plants and allows students to gain an understanding and appreciation of how (bio)chemical components are synthesized and utilized by plants during growth and development and in their interactions with their environment, as well as how these processes can be manipulated. A background in plant biology, general biochemistry or chemistry is expected. Note that concurrent registration in any of these courses will NOT meet this requirement. Students must have completed both semesters of O-chem and a biochemistry course that covers general metabolism prior to taking this course. Graduate-level requirements include 2 or 3 short individual oral presentations and a term paper.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Equivalent to: BIOC 548A, CHEM 548A, ECOL 548A, MCB 548A
Also offered as: BIOC 548A, ECOL 548A, MCB 548A, PLS 548A
Co-convened with: CHEM 448A
Course typically offered:
Main Campus: Fall

Home department: School of Plant Science

CHEM 550: Synthetic and Mechanistic Organic Chemistry (3 units)
Description: Graduate-level requirements include mastery of additional topics from the textbook and writing a term paper based on these topics.
Grading basis: Regular Grades
Career: Graduate
Course Components: Discussion May Be Offered
Lecture Required
Co-convened with: CHEM 450
Course typically offered:
Main Campus: Fall

-SA represents a Student Abroad & Student Exchange offering
-CC represents a Correspondence Course offering
May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

CHEM 571A: Topics in Organic Chemistry for Teachers (3 units)
Description: This course focuses on the discussion of fundamental principles of organic chemistry as applied to chemical systems of central importance in our world. This course is designed for in-service science teachers who need to develop a deeper understanding of central ideas in organic chemistry. Core topics in the course include organic structure and reactivity as well as a discussion of some key classes of organic molecules that play an important role in our everyday world. This course is designed to be online. The course will be offered as an elective for teachers enrolled in the Natural Science for Teachers M.S. Program offered by the College of Science.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Recommendations and additional information: Requires one year of undergraduate general chemistry such as CHEM 151 & 152 or the equivalent.

CHEM 571B: Topics in Acid-Base Chemistry for Teachers (3 units)
Description: Fundamental principles of acid-base chemistry as applied to chemical systems of central importance to our world. This course is designed for prospective and in-service science teachers who need to develop a deeper understanding of central ideas in chemistry. Core topics include the thermodynamic and kinetics of acid-base reactions. This course is designed to be online.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required

CHEM 580: Introduction to Quantum Chemistry (3 units)
Description: An introduction to quantum mechanics, with applications to atomic structure and spectra, the nature of chemical bonding and molecular structure.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CHEM 480B or consent of instructor.
Enrollment requirement: CHEM 587 or equivalent

CHEM 581: Mathematical Methods for Chemists (3 units)
Description: The course covers the fundamentals and techniques of mathematics with applications to common problems in chemistry and chemical physics.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CHEM 480B or consent of instructor.

CHEM 582: Statistical Thermodynamics (3 units)
Description: Introduction to classical and quantum statistical thermodynamics with application to ideal gases and simple solids; equations of state and elementary solution theory.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CHEM 480B or consent of instructor.

CHEM 584: Nuclear Magnetic Resonance Spectroscopy (3 units)
Description: Basic theory and interpretation of nuclear magnetic resonance (NMR) methods from a multidisciplinary perspective. The course covers experimental NMR methods; nuclear spin interactions; relaxation and dynamics; solid state NMR; liquid state NMR; and magnetic resonance imaging (MRI). Emphasis is placed on a unified description of magnetic resonance phenomena at a level appropriate for chemists, physicists, biochemists, and engineers.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Repeatable: Course can be repeated a maximum of 2 times.
Equivalent to: BIOC 584, PHYS 584
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CHEM 480B or CHEM 481; or PHYS 371 or equivalent or consent of instructor.
Interdisciplinary Interest Area: BIOC - Biochemistry
Interdisciplinary Interest Area: PHYS - Physics

CHEM 587: Introduction to Molecular Spectroscopy (3 units)
Description: Modern molecular spectroscopy including rotational, vibrational, and electronic spectroscopy and their various combinations.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CHEM 480A, CHEM 480B or consult department before enrolling.

CHEM 593: Internship (1 - 3 units)
Description: Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Summer

CHEM 595A: Professional Development Part 1 (1 unit)
Description: This course will deal with two aspects of professional training necessary for Chemistry and Biochemistry graduate students. The course will train the graduate students to be effective teachers, and it will provide them with the necessary instruments for ethical conduct in research. Completion of Chem 595A and Chem 595B (Professional Development Part I and II) will fulfill the federal requirement for Responsible Conduct in Research (RCR) training.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Colloquium Required
Course typically offered:
Main Campus: Fall

CHEM 595B: Professional Development Part II (1 unit)
Description: This course is the second semester of a two semester course sequence. It will deal with two aspects of professional training necessary for Chemistry and Biochemistry graduate students. The course will train the graduate students to be effective teachers, and it will provide them with the necessary instruments for ethical conduct in research. Completion of Chem 595A and Chem 595B (Professional Development Part I and II) will fulfill the federal requirement for Responsible Conduct in Research (RCR) training.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Colloquium Required
Course typically offered:
Main Campus: Spring

CHEM 595C: College Teaching (1 unit)
Description: This course serves as the weekly group meeting for those who are currently teaching Chemistry laboratory courses, and serves the purpose of maintaining consistency in the delivery of education in chemistry labs. Weekly discussions address how to prepare for lectures, grade lab reports using an established rubric, assess student learning and performance, and how to navigate safety issues relevant to the experiments. Current issues in teaching college-level labs and development of the teaching skills and methods utilized by course participants are also discussed as necessary. Graduate level enrollment requires students to be teaching assistants in the Chemistry Department.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Colloquium Required
Repeatable: Course can be repeated a maximum of 2 times.
Co-convened with: CHEM 495C

CHEM 596D: Chemistry Discovery (1 unit)
Description: Chemistry Discovery is a graduate chemistry course and a chemistry outreach program. Students are exposed to the rewarding experience of promoting chemistry among younger students from local middle schools. The main objective for the course is the design, development and execution of a series of workshops for visiting schools at the University of Arizona Flandrau Science Center.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Seminar Required
Co-convened with: CHEM 496D
Course typically offered:
Main Campus: Fall

CHEM 599: Independent Study (1 - 3 units)
Description: Qualified students working on an individual basis with professors who have agreed to supervise such work. Graduate students doing independent work which cannot be classified as actual research will register for credit under course number 599, 699, or 799.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

CHEM 640: Advanced Organic Synthesis (3 units)
Description: Theory and practice of molecular design and construction as applied to synthesis of complex organic molecules.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Fall

Recommendations and additional information: CHEM 540 or consult department before enrolling.

CHEM 680: Quantum Chemistry (3 units)
Description: Principles of quantum mechanics with applications to the properties of molecules.
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CHEM 580.

CHEM 686: Chemical Physics in the Condensed Phase (3 units)
Description: Applications of Quantum Mechanics to the interpretation of structure and dynamics in condensed phase systems (liquids and solids).
Grading basis: Regular Grades
Career: Graduate
Course Components: Lecture Required
Course typically offered:
Main Campus: Spring

Recommendations and additional information: CHEM 580, CHEM 582 or consent of instructor.

CHEM 695A: Chemical Research Opportunities (1 unit)
Description: Enrollment is restricted to new students in the Chemistry graduate program. This course involves weekly attendance at group meetings, and the exchange of scholarly information in the form of lectures and presentations by group participants involved in chemical research with specific faculty members. Participants will be expected to identify a research advisor at the end of this experience.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Colloquium Required
Course typically offered:
Main Campus: Spring

CHEM 695B: Exchange of Chemical Information (1 - 3 units)
Description: Enrollment is restricted to students in the Chemistry graduate program. This course involves the weekly attendance at group meeting, and the exchange of scholarly information in the form of lectures and presentations by group participants involved in chemical research with specific faculty members.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Colloquium Required
Repeatable: Course can be repeated for a maximum of 10 units.
Course typically offered:
Main Campus: Fall, Summer

CHEM 695L: Advanced Topics: Modulation of the Biology of Aging by Inflammation, Infection and Immunity (1 unit)
Description: An interactive graduate-level course focused on how inflammation and immune function/dysfunction contributes to key biological and medical aspects of aging. This course will evaluate the basic biology of aging with a focus on how the aging immune system impacts geriatric principles of care, common geriatric syndromes and aging-associated disease, the biologic basis of health disparities (where known), and other unique issues related to aging research. The course is open to both graduate students and medical students/residents. Graduate students funded through the Training Grant will be required to attend in their 3rd and 4th year in place of Journal Club. The course is comprised of three aspects: literature review, topic discussion, and attendance in the Advances in Aging Lecture Series (Grand Rounds). Students will be assigned relevant literature to review in advance of in-class discussion on topics in aging research. Each discussion will be led by an expert in the field. The Advances in Aging Lecture Series are 1-hour Grand Rounds that meet once per month and will add clinical perspective to the field of aging research. More information on Advances in Aging Lecture Series topics and archived lectures is available at http://aging.arizona.edu/program/advances-aging-lecture-series. Topics that will be covered in the course include: Introduction to Aging Research, Aging Theories, and Model Organisms; Replicative Senescence as a Driver of Age-Associated Inflammation; DNA Damage, Repair, and Oncogenesis; Mitochondrial Aging and Metabolism; Musculoskeletal Changes in Aging and Frailty; Infection and Immunosenescence; Aging with HIV in the age of ART; Microbiota in Aging; Neural Changes, Neurodegeneration, and Alzheimer's Disease; Cardiovascular Aging and Stroke; Stem Cell Aging and Longevity Extension/Rejuvenation Research.
Grading basis: Regular Grades
Career: Graduate
Course Components: Colloquium Required
Repeatable: Course can be repeated a maximum of 2 times.
Also offered as: BIOC 695L, CMM 695L, CPH 695L, IMB 695L, NURS 695L, PHCL 695L, PSIO 695L
Home department: Immunobiology

CHEM 696A: Analytical Chemistry (1 - 3 units)
Description: Enrollment is restricted to students in the Chemistry graduate program or to those with instructor approval. The scope of work shall consist of attendance at the weekly seminar associated with the Analytical division; along with individual research by course registrants within their groups, and the development and exchange of scholarly information through discussion, reports, and/or papers.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Seminar Required
Repeatable: Course can be repeated for a maximum of 10 units.
Course typically offered:
Main Campus: Fall, Spring, Summer

CHEM 696B: Inorganic Chemistry (1 - 3 units)
Description: Enrollment is restricted to students in the Chemistry graduate program or to those with instructor approval. The scope of work shall consist of attendance at the weekly seminar associated with the Inorganic division; along with individual research by course registrants within their groups, and the development and exchange of scholarly information through discussion, reports, and/or papers.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Seminar Required
Repeatable: Course can be repeated for a maximum of 10 units.
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Open to students in the Chemistry graduate program or consent of instructor.

CHEM 696C: Organic Chemistry (1 - 3 units)
Description: Enrollment is restricted to students in the Chemistry graduate program or to those with instructor approval. The scope of work shall consist of attendance at the weekly seminar associated with the Organic division; along with individual research by course registrants within their groups, and the development and exchange of scholarly information through discussion, reports, and/or papers.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Seminar Required
Repeatable: Course can be repeated for a maximum of 10 units.
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Open to students in the Chemistry graduate program or consent of instructor.

CHEM 696D: Physical Chemistry and Chemical Physics (1 - 3 units)
Description: Enrollment is restricted to students in the Chemistry graduate program or to those with instructor approval. The scope of work shall consist of attendance at the weekly seminar associated with the Physical division; along with individual research by course registrants within their groups, and the development and exchange of scholarly information through discussion, reports, and/or papers.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Seminar Required
Repeatable: Course can be repeated for a maximum of 10 units.
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Open to students in the Chemistry graduate program or consent of instructor.

CHEM 696E: Advanced Seminar (1 - 3 units)
Description: Enrollment is restricted to students in the Chemistry graduate program or to those with instructor approval. The scope of work shall consist of preparing and presenting a seminar on individual research conducted by course registrants within their divisional research groups.
Grading basis: Regular Grades
Career: Graduate
Course Components: Seminar Required
Repeatable: Course can be repeated for a maximum of 10 units.
Course typically offered:
Main Campus: Fall, Spring

Recommendations and additional information: Open to students in the Chemistry graduate program or consent of instructor.

CHEM 900: Research (1 - 10 units)
Description: Individual research, not related to thesis or dissertation preparation, by graduate students.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

CHEM 910: Thesis (1 - 12 units)
Description: Research for the master's thesis (whether library research, laboratory or field observation or research, artistic creation, or thesis writing). Maximum total credit permitted varies with the major department.
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring, Summer

CHEM 920: Dissertation (1 - 9 units)
Description: Research for the doctoral dissertation (whether library research, laboratory or field observation or research, artistic creation, or dissertation writing).
Grading basis: Alternative Grading: S, P, F
Career: Graduate
Course Components: Independent Study Required
Repeatable: Course can be repeated a maximum of 99 times.
Course typically offered:
Main Campus: Fall, Spring, Summer