

# Chemistry

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**Note:** Students may not register for a course lower in number than that required by their major. When a change in degree requirements forces a student to take a higher number course after completing a lower number course, a maximum of two credits (earned in Chem 299) will be awarded for the higher number course. Students should check the curricular requirements for their major to be sure they are registered for the correct chemistry class.

**Related Fields:** See microbiology, molecular biology and biochemistry.

**Vertically-related courses in this subject field are:** Chem 111-112-253; 101-275.

## **Chem 050 Chemistry Fundamentals (0 cr)**

Chemical problem solving, SI unit conversion, mole concept, chemical stoichiometry, solution concentration problems, periodic table, chemical formulas and nomenclature, and equation balancing. Graded P/N/F. A special fee is charged for this course.

## **Chem 101 Introduction to Chemistry I (4 cr)**

*May be used as core credit in J-3-b.* Full credit may be earned in only one of the following: Chem 101, or 111. General treatment of the fundamentals of chemistry. Three lec and one 3-hr lab a wk. Does not satisfy the prereq for Chem 112.

## **Chem 111 Principles of Chemistry I (4 cr)**

*May be used as core credit in J-3-b.* Full credit may be earned in only one of the following: Chem 101, or 111. Intensive treatment of principles and applications of chemistry. Three lec and one 3-hr lab a week. Recommended Preparation: A grade of 'B' or better in a high school chemistry course.

**Prereq:** Chem 050 or min 560 SAT math or min 25 ACT math or min 49 COMPASS College Algebra, or a grade of 'C' or better in Math 143, 160, or 170; or Permission

## **Chem 112 Principles of Chemistry II (5 cr)**

*May be used as core credit in J-3-b.* Continuation of Chem 111. Some work in inorganic chemistry, kinetics, equilibrium, liquids, solids, acid-base, electrochemistry, nuclear chemistry, thermodynamics, and qualitative inorganic analysis. Three lec, one recitation, and one 3-hr lab a wk.

**Prereq:** Chem 111 or Permission

## **Chem 121 Glassblowing (1 cr)**

Techniques used in constructing scientific apparatus from glass. Graded P/F. One 3-hr lab a wk.

**Prereq:** Permission of department

## **Chem 200 (s) Seminar (cr arr)**

## **Chem 204 (s) Special Topics (cr arr)**

## **Chem 253 Quantitative Analysis (5 cr)**

Fundamental principles and techniques of chemical analysis; intro to sampling, standardization, data evaluation, gravimetric/volumetric methods, and instrumental techniques. Three lec and two 3-hr labs a wk. (Fall only)

**Prereq:** Chem 112

## **Chem 275 Carbon Compounds (3 cr)**

Aspects of organic chemistry important to students in the life sciences.

**Prereq:** Chem 101, 111, or Permission

## **Chem 276 Carbon Compounds Lab (1 cr)**

Lab to accompany Chem 275; for students who need only 1 cr of lab. One 3-hr lab a wk.

**Prereq or Coreq:** Chem 275 or 277

## **Chem 277 Organic Chemistry I (3 cr)**

Principles and theories of organic chemistry; properties, preparation, and reactions of organic compounds.

**Prereq:** Chem 112

## **Chem 278 Organic Chemistry I: Lab (1 cr)**

One 3-hr lab a wk.

**Prereq or Coreq:** Chem 277

## **Chem 299 (s) Directed Study (cr arr)**

**Chem 302 Principles of Physical Chemistry (3 cr)**

Emphasis on topics important to biological and agricultural science. (Fall only)

**Prereq:** Chem 112, Math 160 or 170 or 175, and Phys 111, or Permission

**Chem 303 Principles of Physical Chemistry Lab (1 cr)**

Lab to accompany Chem 302. One 3-hr lab a wk. (Fall only)

**Prereq or Coreq:** Chem 302

**Chem 305 Physical Chemistry (3 cr)**

Kinetic theory, thermodynamics, quantum mechanics, and spectroscopy. (Fall only)

**Prereq:** Chem 112, and Math 275

**Prereq or Coreq:** Phys 212 or 213

**Chem 306 Physical Chemistry (3 cr)**

Kinetic theory, thermodynamics, quantum mechanics, and spectroscopy.

**Prereq:** Chem 112, and Math 275 (Spring only)

**Prereq or Coreq:** Phys 212 or 213

**Chem 307 Physical Chemistry Lab (1 cr)**

Lab to accompany Chem 305-306. One 3-hr lab a wk. (Fall only)

**Prereq or Coreq:** Chem 305

**Chem 308 Physical Chemistry Lab (1 cr)**

Lab to accompany Chem 305-306. One 3-hr lab a wk. (Spring only)

**Prereq or Coreq:** Chem 306

**Chem 372 Organic Chemistry II (3 cr)**

Continuation of Chem 277. (Spring only)

**Prereq:** Chem 277

**Chem 374 Organic Chemistry II: Lab (1 cr)**

Lab to accompany Chem 372; includes synthesis, structure determination, and mechanisms. One 3-hr lab a wk. (Spring only)

**Prereq:** Chem 278

**Prereq or Coreq:** Chem 372

**Chem 400 (s) Seminar (cr arr)****Chem 404 (s) Special Topics (cr arr)****Chem 409 Proseminar (1 cr)**

Current publications in chemistry and chemical engineering with reports on typical scientific papers. Preparation of application materials for graduate work and/or careers in chemistry.

**Prereq:** Chem 372 and junior standing

**Chem J414/J514 Applications of Nanomaterials in Biomolecular Engineering (3 cr)**

Interdisciplinary approach to the fundamental chemistry, physics, biology and engineering of matter and processes at the crossroads of microscopic and molecular scales; integration of the language and tools of multiple disciplines toward technological applications of nanomaterials in the life sciences and medicine. Additional projects/assignments required for graduate credit. (Spring only)

**Prereq:** Senior or Graduate standing in the Colleges of Science or Engineering

**Chem J418/J518 Environmental Chemistry (3 cr)**

Chemistry of atmosphere, soil, and water; pollution monitoring and remediation; treatment of waste in the environment. Additional projects/assignments reqd for grad cr. (Spring only)

**Prereq:** Chem 253, and Chem 275 or 277, or Permission

**Chem 454 Instrumental Analysis (4 cr)**

For students in chemistry and allied fields. Techniques in operating new and specialized instruments for qualitative and quantitative analysis and analytical methods of an advanced nature. Three lec and one 4-hr lab a wk. (Spring only)

**Prereq:** Chem 253 and 305

**Prereq or Coreq:** Chem 306

**Chem 455 Survey of Analytical Chemistry (3 cr)**

Fundamentals of modern analytical chemistry. Open only to chemistry M.S. and Ph.D. students. Cr is not allowed in both Chem 454 and 455.

**Prereq:** Chem 306 and Permission

**Chem 463 Inorganic Chemistry (3 cr)**

Principles, complex ions and coordination compounds, theory of acids and bases, bonding theory, non-aqueous solvents, familiar elements and their relationship to the periodic table. (Fall only)

**Prereq:** Chem 305 or Permission

**Chem J464/ID-J564 Inorganic Chemistry (3 cr) WSU Chem 507**

Principles, complex ions and coordination compounds, theory of acids and bases, bonding theory, non-aqueous solvents, familiar elements and their relationship to the periodic table. Additional projects/assignments reqd for grad cr. (Spring only)

**Prereq or Coreq:** Chem 463, or 466, or Permission

**Chem 465 Inorganic Chemistry Laboratory (1 cr)**

Lab to accompany Chem 464. One 3-hr lab a wk. (Spring only)

**Coreq:** Chem 464

**Chem 466 Survey of Inorganic Chemistry (3 cr)**

Fundamentals of modern inorganic chemistry. Open only to chemistry M.S. and Ph.D. students. Cr is not allowed in both Chem 463 and 466.

**Prereq:** Chem 306 and Permission

**Chem 468 Organometallic Chemistry (2-3 cr, max 3)**

Structure, bonding, and reaction chemistry of organotransition metal compounds; applications to homogeneous catalysis. (Alt/yrs)

**Prereq:** Chem 305-306

**Prereq or Coreq:** Chem 463 or 466 or Permission

**Chem J472/J572 Medicinal Chemistry (3 cr)**

Synthetic chemistry necessary for design and preparation of medicinal agents, and mechanistic chemistry germane to action of pharmaceuticals. Graduate students are required to write an original research proposal on a topic related to drug discovery. (Alt/yrs)

**Prereq or Coreq:** Chem 473 or 476; or Permission

**Chem 473 Intermediate Organic Chemistry (3 cr)**

Theories and mechanisms of organic chemistry. (Fall only)

**Prereq:** Chem 372

**Prereq or Coreq:** Chem 306

**Chem 476 Survey of Organic Chemistry (3 cr)**

Fundamentals of modern organic chemistry. Open only to chemistry M.S. and Ph.D. students. Cr is not allowed in both Chem 473 and 476.

**Prereq:** Chem 306 and Permission

**Chem 491 (s) Research (1-6 cr, max 12)**

Submission of a report of the research done for placement in the permanent dept files is required.

**Prereq:** Permission of department

**Chem 495 Thermodynamics and Kinetics (3 cr)**

(Fall only)

**Prereq:** Chem 306 or Equivalent

**Chem 496 Survey of Physical Chemistry (3 cr)**

Fundamentals of modern physical chemistry. Open only to chemistry M.S. and Ph.D. students. Cr is not allowed in both Chem 495 and 496.

**Prereq:** Chem 306 and Permission

**Chem 498 (s) Internship (cr arr)**

**Chem 499 (s) Directed Study (cr arr)**

**Chem 500 Master's Research and Thesis (cr arr)**

**Chem 501 (s) Seminar (cr arr)**

**Chem 502 (s) Directed Study (cr arr)**

**Chem 504 (s) Special Topics (cr arr)**

**Chem 506 Introduction to Teaching and Research Skills (2 cr)**

Skills required of teaching assistants in laboratory, recitations, office hours, help sessions; skills required for research; use of library; introduction to faculty research. Graded P/F. (Fall only)

**Prereq:** Permission

**Chem 509 Advanced Physical Chemistry (3 cr)**

Application of quantum theory to chemical bonding, molecular spectroscopy, and molecular structure. (Spring only)

**Prereq:** Chem 306, 495, 496, or Permission

**Chem 514 Applications of Nanomaterials in Biomolecular Engineering (3 cr)**

See Chem J414/J514.

**Chem 518 Environmental Chemistry (3 cr)**

See Chem J418/J518.

**Chem 535 Principles of Chemical Instrumentation (2-4 cr, max 4)**

Practical theory and application of modern analog/digital electronics and small computers to chemical measurement and control systems. Registration for Chem 535 requires completion of an additional term paper or other assignment. One hr of lec and one 3-hr lab a wk. (Fall only)

**Prereq:** Chem 253 or 454, Phys 212, or Permission

**Chem 542 Biochemistry and Molecular Biology (3 cr)**

See MMBB J442/J542.

**Chem 550 Radioanalytical Chemistry (2-3 cr, max 3)**

Fundamental concepts of radiochemistry, including the principles of radioactive decay processes and counting techniques; in-depth treatment of radioanalytical techniques, especially neutron activation and isotope dilution methods; decay processes as sources of x-rays; the use of synchrotron radiation in analytical chemistry. (Alt/yr)

**Prereq:** Chem 454, or 455, or Permission

**Chem 551 Electronic Spectrometry (2-3 cr, max 3)**

A brief review of fundamental concepts, including electronic transitions, optical properties of materials, and laws of radiation absorption; detailed coverage of instrumentation used for ultraviolet and visible absorption spectroscopy, with regard to optical components, overall design strategy, and signal processing; analytical performance related to these aspects and presented from both theoretical and practical standpoints; in-depth coverage of luminescence spectroscopy, including phosphorimetry and fluorimetry; atomic spectroscopy (both flame and plasma-based versions), including principles of operation, instrumental requirements, and analytical application; survey of x-ray absorption and fluorescence spectroscopy. (Alt/yr)

**Prereq:** Chem 454, 455 or Permission

**Chem 552 Analytical Vibrational Spectrometry (2-3 cr, max 3)**

Introduction to vibrational transitions, optical properties of materials, and laws of radiation absorption and emission (including why they are not always obeyed in practice); detailed discussion of instrumentation used for mid-infrared, near infrared, and Raman spectrometry; illustration of transmission spectrometry with examples including microscopy and spectral imaging, open-path monitoring, and spectroscopy of aqueous solutions and hyphenated techniques; introduction of time- and phase-resolved measurements; detailed coverage of specular reflection, reflection-absorption of thin films, diffuse reflection, attenuated total reflection spectrometry, and remote measurements through optical fibers; discussion of application of near infrared spectroscopy to agricultural commodity analysis and process monitoring. (Alt/yr)

**Prereq:** Chem 454, 455 or Permission

**Chem 553 Separation Theory and Chromatography (2-3 cr, max 3)**

Gas and liquid chromatography and related fields. Students enrolled in Chem 553 are required to complete additional written assignments. (Alt/yr)

**Prereq:** Chem 306

**Chem 556 Molecular Spectroscopy (3 cr)**

Interpretation of IR, UV, NMR, and mass spectra. Registration for Chem 556 requires completion of additional assignments.

**Prereq:** Chem 306 or Permission

**Chem 558 Electrochemistry (2-3 cr, max 3)**

Fundamental concepts of electrochemistry, including the principles of redox processes; in-depth treatment of electroanalytical techniques, especially voltammetric and potentiometric methods; advanced treatment of selected topics, including ultramicro and in vivo electrochemical techniques. (Alt/yr)

**Prereq:** Chem 454, or 455, or Permission

**Chem 561 Advanced Inorganic Chemistry (3 cr)**

Theoretical approach to the underlying principles of inorganic chemistry; integration of theory and descriptive chemistry. (Alt/yr)

**Prereq:** Chem 306, 463, 466, or Permission

**Chem ID564 Inorganic Chemistry (3 cr)**

See Chem J464/J564.

**Chem ID565 (s) Topics in Inorganic Chemistry (1-9 cr, max 9) WSU Chem 508**

Coordination compounds; halogens; less familiar elements; clathrate, interstitial, nonstoichiometric compounds; chemical bonding; inorganic reaction mechanisms.

**Prereq:** Chem 463, 466, or Permission

**Chem 567 Inorganic Spectroscopy (2-3 cr, max 3)**

Applications of spectroscopic methods to investigation of inorganic and organometallic compounds; topics include multinuclear and multidimensional NMR, IR and Raman, EPR, mass spectroscopy, Mossbauer spectroscopy, and x-ray crystallography. Additional projects/assignments reqd for grad cr. (Alt/yrs)

**Prereq:** Chem 306 and 454

**Chem 571 (s) Topics in Organic Chemistry (1-9 cr, max 9)**

Selected topics from the current literature.

**Prereq:** Chem 473, 476, or Permission

**Chem 572 Medicinal Chemistry (3 cr)**

See Chem J472/J572.

**Chem 590 Doctoral Research Proposal (1 cr)**

Taken no later than one semester after completion of cumulative exams; required for advancement to Ph.D. candidacy. Includes review of relevant literature and original research proposal describing the student's intended research project.

**Chem 600 Doctoral Research and Dissertation (cr arr)**