

Chemistry (CHM)

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Chemists study the structure and transformations of matter, and create entirely new substances such as pharmaceuticals, conducting polymers, and synthetic fibers. A degree in chemistry can prepare a student for employment in a private or government laboratory; medical, dental, veterinary, or law school; secondary school teaching; a position in a scientific firm; or graduate study and research in the sciences or engineering.

The chemistry department offers courses covering the major areas of chemistry (analytical, biological, inorganic, organic, and physical chemistry), with laboratory experience an important part of nearly every course. The nearby corporate research and development laboratories offer many internship opportunities; planning for an internship should begin no later than the junior year. Chemistry majors are encouraged to participate in research, which can be undertaken in several ways: carrying out a research project under the supervision of a faculty member, participating in academic year or summer research programs at Argonne National Laboratory or a nearby corporate lab, or participating in a summer research program at a large university.

Degrees offered: B.A. and B.S.

Major Requirements:

B.A. Degree: At least 29.75 credit hours in chemistry are required, including at least 22.25 credit hours at the 200-level or above;
 one of CHM 405, 410, 420, 425, or 465;
 one course (3 credit hour minimum) in physical chemistry and one course (3 credit hour minimum) in each of three of the remaining four areas of chemistry (analytical, biological, inorganic, organic);
 chemical information retrieval - CHM 375;
 research seminar - CHM 475*;
 Note: CHM 397 and CHM 497 may not be counted toward the 29.75 credit hours minimum or the area requirement.

Required support courses for the B.A. Degree in Chemistry: Calculus I and II (MTH 151 and 152), Physics I and II (PHY 111-112 or PHY 131-132), plus completion of the foreign language requirement.

Foreign Language Requirement: Students must complete two years of high school foreign language or eight credit hours of college foreign language or the equivalent of FRN, GER, JPN or SPN 103. Students who test into FRN, GER, JPN, or SPN 201 fulfill the language requirement without any additional coursework. Students may also fulfill the language requirement by participating in an intensive language immersion program such as NCC's study abroad/internship experience in Costa Rica.

B.S. Degree: At least 44.25 credit hours in chemistry, including:
 ten core courses covering the five areas of chemistry:
 analytical chemistry - CHM 210, 410
 biological chemistry - CHM 141 or 365

inorganic chemistry - CHM 205, 405
 organic chemistry - CHM 220, 221, 222
 physical chemistry - CHM 340, 341
 chemical information retrieval - CHM 375
 research seminar - CHM 475*
 at least three additional credit hours at the 400-level
 introductory physics - PHY 131 and 132 or nine credit hours in physics in
 addition to CHM/PHY 340, at least three of which must be at the 200-level or
 higher
 mathematics - MTH 151, 152, and 153
 statistics - one of PSY 250, MTH 342, or ECB 241
 additional requirements - one additional math or physics course to be chosen
 from: MTH 254, MTH 255, MTH 300, MTH 355, PHY 210, PHY 233 or
 PHY 335.

*Chemistry majors must complete a research project by taking one of CHM 405, 410, 420, 425, 465, 480, or by participating in a non-credit research program (including off-campus programs). Each student presents the results of this research in the chemistry seminar course, CHM 475. CHM 475 is taken over three (usually nonconsecutive) terms. During the first two terms the student participates as an observer and questioner and enrolls in CHM 475 for no credit. CHM 190 may be substituted for one of these. During the third term the student gives the research presentation and enrolls in CHM 475 for one credit hour.

Minor requirements: At least 22 credit hours in chemistry, which must include at least 15 credit hours numbered 200 or higher and must cover two areas of chemistry.

TYPICAL COURSE SEQUENCE FOR THE FIRST TWO YEARS

| | | | |
|--------------|---------------------------|--|----------------------------------|
| | FALL | WINTER | SPRING |
| FIRST YEAR: | CHM 141 MTH 125 or 151 | CHM 142 or 205 or 210 MTH 151 or 152 | CHM 205 or 210 MTH 152 or 153 |
| SECOND YEAR: | CHM 220 | CHM 221 PHY 131 | CHM 222 CHM 475 PHY 132 |

MTH 151-152 should be completed no later than the winter term of the second year.

100 Chemistry Today (3.50)

A chemistry course for non-science majors. A quest for understanding those facets of chemistry that most directly affect daily existence through a study of selected topics in inorganic, organic, and biological chemistry. Does not count towards a chemistry major. May not be taken after any higher level chemistry course. Laboratory. Prerequisite: HS Algebra or MTH 095. Core: Science (Lab). Offered: Annually.

140 Nutrition (3.50)

(Same as: BIO 140.) A study of food, the nutrients in foods, their biochemical function, and how they interact in relation to physical and mental development and performance in humans. Laboratory. Prerequisite: One of BIO 100, CHM 100, or two years of high school science. Core: Science (Lab). Offered: Annually.

141 General Chemistry I: Bio-organic Molecules (3.75)

An introduction to chemical principles through examples from the chemistry of carbon compounds and the molecules found in living systems, such as simple organic compounds, synthetic polymers, carbohydrates, lipids, proteins, and nucleic acids. Major topics include atomic and electronic structure, ions, molecules, bonding energies, hybridization, acid/base chemistry, thermodynamics, kinetics, stereochemistry, and polymer chemistry. Laboratory. Prerequisite: One year of high school chemistry; two years of high school algebra or MTH 095. Core: Science (Lab). Offered: Annually.

142 General Chemistry II: Environmental Chemistry (4.00)

An introduction to chemical principles within the context of the environmental issues of building copper mines, water treatment, and acid rain. Major chemical topics include aqueous reactions, properties of solutions, thermochemistry, equilibria, acid/base, buffers, redox, electrochemistry, coordination chemistry, metallurgy, and kinetics. Laboratory. Prerequisite: CHM 141. Offered: Annually.

190 ACCA Seminar (0.00)

Study of a current topic in chemistry. The topic is provided by the annual seminar series of the Associated Colleges of the Chicago Area, and attendance at the seminars is the major part of the course. May be repeated once with new content. May be substituted for one of the required non-credit CHM 475 courses. Prerequisite: One term of a 100 level CHM course. Offered: Annually.

205 Descriptive Inorganic Chemistry (4.00)

Theoretical concepts of bonding, acid/base, and redox chemistry. Descriptive chemistry of the elements highlighting their relationship to the biological world. Laboratory. Prerequisite: CHM 142. Offered: Annually.

210 Analytical Chemistry I: Quantitative Analysis (3.75)

Quantitative analysis including theory and techniques for gravimetric, volumetric, and spectrophotometric methods. Two laboratory sessions per week. Prerequisite: CHM 142. Offered: Annually.

215 Organic Chemistry I (4.00)

Survey of the various classes of carbon compounds, with emphasis upon molecular structure, stereochemistry, and mechanisms of chemical reactions. Techniques for isolating and purifying organic compounds are learned in the laboratory. Prerequisite: Seven hours in chemistry. Offered: Summer.

216 Organic Chemistry II (4.00)

Continuation of CHM 215. This course builds on previously learned concepts to further explore the mechanisms of organic reactions. The emphasis shifts from physical organic to synthetic organic chemistry. Laboratory. Prerequisite: CHM 215. Offered: Summer.

220 Organic Chemistry I (2.75)

Survey of the various classes of carbon compounds, emphasizing molecular structure, stereochemistry, and mechanisms of chemical reactions. Techniques for isolating and purifying organic compounds are learned in the laboratory. Laboratory. Prerequisite: Seven credit hours in chemistry. Offered: Annually.

221 Organic Chemistry II (2.75)

Continuation of CHM 220, emphasizing the chemistry of aromatic compounds, carbonyl containing functional groups, and alcohols. The synthesis and

chemical transformations of organic molecules is studied in more depth. Laboratory work focuses on synthetic techniques as well as physical and spectroscopic methods for molecular structure determination. Prerequisite: CHM 220. Offered: Annually

222 Organic Chemistry III (2.75)

Continuation of CHM 221, with emphasis on the chemistry of nitrogen containing compounds, natural products and heterocyclic chemistry. Laboratory work will focus on multi-step synthesis, protecting group strategies and the proper keeping of a laboratory research notebook. Prerequisites: CHM 221. Offered: Annually.

299 Independent Study (1.00-9.00)

Offered: Annually.

340 Thermodynamics (4.00)

(Same as: PHY 340.) A study of the relationship of temperature to other properties of matter, using both macroscopic and microscopic viewpoints. Applications to chemical equilibrium, phase transitions, and thermal properties of gases and solids. Laboratory. Prerequisites: MTH 152; PHY 112 or PHY 132; and seven credit hours in chemistry. Offered: Annually.

341 Kinetics, Quantum Theory, & Spectroscopy (4.00)

Survey of experimental and theoretical physical chemistry, including methods for determining rates and mechanisms of chemical reactions, quantum theory of atomic structure and chemical bonding, and spectroscopic methods used to determine molecular structure. Laboratory. Prerequisites: Seven credit hours in chemistry; MTH 152; and PHY 112 or PHY 132. Offered: Annually.

365 Biochemistry (3.75)

(Same as: BIO 365.) Survey of the major classes of biological molecules. Enzyme kinetics and the major metabolic pathways are discussed. Laboratory. Prerequisite: CHM 222. Offered: Annually.

375 Chemical Information Retrieval (0.50)

Strategies and methods for efficient retrieval of information from the chemical literature. Sources of published chemical information, choosing appropriate sources to solve specific chemical information problems, practice in computer-based searching of chemical information databases. Prerequisite: One 200-level CHM course. Offered: 2003-04.

397 Internship (0.00-9.00)

Offered: Annually.

399 Independent Study (1.00-9.00)

Offered: Annually.

405 Advanced Inorganic Chemistry (3.75)

Coordination chemistry of the transition metals including isomerism, symmetry, group theory, molecular orbital theory, crystal field theory, uv-visible spectroscopy, and kinetics and mechanisms of ligand substitution reactions. Laboratory required. Prerequisite: CHM 341. Offered: 2004-05.

410 Instrumental Analysis (4.00)

Theory and practice of instrumental analytical chemistry. Major topics include potentiometric and voltammetric methods, chromatography, spectrophotometry, mass spectrometry, and nuclear magnetic resonance spectrometry. Two laboratory sessions per week. Prerequisites: CHM 210; PHY 112 or PHY 132. Offered: 2003-04.

420 Advanced Organic Chemistry (3.75)

Topics in organic chemistry which build on the principles covered in CHM 220 and 221. The course explores one topic in depth, with emphasis on organic synthesis and natural products chemistry. Laboratory. Prerequisite: CHM 222. Offered: 2004-05.

425 Organometallic Chemistry (3.75)

Structure and bonding, ligands, reactions, and catalysis in chemical industry and pharmaceuticals. Laboratory required. Prerequisite: CHM 341. Offered: 2003-04.

430 Special Topics (1.00-3.75)

Advanced topics in chemistry. May be repeated with new content. Prerequisite: Varies with topic. Offered: Occasionally.

465 Advanced Biochemistry (3.75)

(Same as: BIO 465.) Current topics in biochemistry are studied allowing students to synthesize previous biology, chemistry and general education coursework. Ethical considerations in scientific research and recent primary literature are discussed. Laboratory. Prerequisite: One of BIO/CHM 365, BIO 340, or BIO 360. ACR: Leadership, Ethics and Values. Offered: 2003-04.

475 Seminar (0.00-1.00)

Each student presents the results of a 400-level chemistry laboratory research project in a scientific meeting format. Prerequisite: If taken for no credit, none. If taken for one credit hour, one 400-level CHM course. Offered: Annually.

480 Research (1.00-6.00)

Individual laboratory investigation of a problem in chemistry, undertaken with guidance of a faculty member. May be repeated up to a maximum of six credit hours. Offered: Annually.

497 Internship (0.00-9.00)

Offered: Annually.

499 Independent Study (1.00-9.00)

Offered: Annually.

Classical Civilization

See **Modern and Classical Languages** for a description of courses and programs of study in Greek and Latin.