

## DEPARTMENT OF CHEMISTRY

125 Smith Hall  
(585) 395-2182

*Chair and Professor:* Stephen A. Godleski, PhD, Princeton University; *Professors:* Thomas K. Finley, PhD, University of Rochester; Thomas W. Kallen, PhD, Washington State University; J. Emory Morris (Emeritus), PhD: University of Wisconsin; *Associate Professors:* Mark P. Heitz, PhD, SUNY Buffalo; Markus M. Hoffmann, PhD, Washington University; Margaret E. Logan, PhD, University of Rochester; *Assistant Professor:* Michael A. Brown, PhD, University of Memphis; *Instructor:* Dawn M. Lee, MS, Rochester Institute of Technology.

### Chemistry Programs

Chemists study atoms and molecules with the goal of understanding the composition, properties and changes that substances undergo. They identify individual components of materials found in nature, and measure how much of them are present. They also recombine atoms and molecules to deduce the rules of combination and to make new substances. Chemistry is also central to understanding other branches of science—the biological, earth, medical, and materials sciences, along with aspects of physics and astronomy. Knowledge of chemistry is crucial to understanding the manufacture and uses of many common materials such as metals, plastics, fibers, paper, glasses and ceramics; food products and food supplements, flavors and cosmetics; detergents and household chemicals; and pharmaceuticals, pesticides, paints, dyes and inks. Chemistry is used in medical and criminal investigations, and in studying causes, effects, and cures for pollution. Finally, chemistry is central to authenticating, conserving, restoring, and preserving cultural treasures including rare books and documents, fine art, architectural works, and artifacts of the recent and distant past.

Students who major in chemistry and who choose appropriate electives are well prepared for advanced study in chemistry or related sciences such as biochemistry and molecular biology, computer sciences (with appropriate undergraduate work in computer science), engineering (especially chemical or environmental), environmental studies, forensic science, information science, materials science, neuroscience, pathology, pharmacology, physiology, or technical writing, and for advanced study in the health care professions: medicine, dentistry, and veterinary medicine. Students who major in chemistry are also well prepared to enter careers in:

1. Commerce and industry: quality control, research and development, manufacturing, marketing and sales, and management.
2. Education: teaching at the primary or secondary level or, after advanced study, at the university level.
3. Government: laboratories, regulatory agencies and legislative staffs.
4. Private and foundation-supported organizations conducting any of these kinds of activities.

Students at The College at Brockport interested in the study of chemistry may choose: a major in chemistry; a major in chemistry with American Chemical Society Certification; a major in chemistry following the biochemistry track; dual majors in chemistry and another science, mathematics or computer science; chemistry and teacher certification; chemistry and business administration; or chemistry and a non-science discipline. They may also enter the 3+2 program leading to a dual BS in Chemistry and Chemical Engineering. Some of these dual programs may require more than eight semesters and 120 credits to complete. Minors in chemistry can be designed to emphasize organic chemistry (synthesis and mechanisms), biochemistry, or analytical and physical chemistry. All minors require a minimum of 18 credits.

Students interested in the study of chemistry should speak with their chemistry instructors, the department chair, or the departmental advisor as early in their careers at The College at Brockport as possible, since the study of chemistry is highly sequential. Some advanced courses require previous courses in chemistry, physics, and/or calculus.

**Major in Chemistry**

The student must earn a minimum of 34 credits in chemistry, complete three semesters of calculus and one year of calculus-based physics with lab.

**Required Courses (34 credits)**

<b>The following courses are required of all majors:</b>		<b>Credits</b>
CHM 205–206	College Chemistry I, II	8
CHM 301	Chemical Safety	1
CHM 303	Quantitative Chemical Analysis	4
CHM 305–306	Organic Chemistry I, II	8
CHM 400–401	Seminar I, II	2
CHM 405–406	Physical Chemistry I, II	6
CHM 408–409	Physical Chemistry Laboratory I, II	2
	Elective(s) <sup>1</sup>	3
<b>Total Credits in Chemistry:</b>		<b>34</b>

MTH 201-202-203	Calculus I, II, III	12
PHS 201–202	College Physics I, II	8

**Total Credits in Math and Physics: 20**

<sup>1</sup>Three credits of electives from the 300/400-level in chemistry, excluding Contemporary Issues courses (suffix I).

Students completing two majors may, by petition to the Department of Chemistry, substitute a relevant upper-division course in another natural or mathematical science for three credits of chemistry elective.

To make normal progress in the major, a student should complete CHM 205–206 in the freshman year, and CHM 301, 303, 305–306, PHS 201–202, and MTH 201, 202, 203 before entering the junior year.

**American Chemical Society (ACS) Certification**

The American Chemical Society, through its Committee on Professional Training, establishes a professional standard for the undergraduate curriculum in chemistry. This committee also evaluates undergraduate programs and approves those departments which meet its standards. The College at Brockport Department of Chemistry is on the list of approved departments. Students whose goal is employment as a chemist or entry into chemistry graduate programs are advised to complete the program outlined below, which meets the requirements of the Committee on Professional Training for certification. Graduates who complete the program are also eligible for immediate election to membership in the ACS.

**ACS Certified Major in Chemistry**

Required courses for the major in chemistry (first 31 credits listed previously), plus:

		<b>Credits</b>
CHM 341	Advanced Organic Chemistry Laboratory I	1
CHM 414	Instrumental Methods II	3
CHM 416	Instrumental Laboratory	1
CHM 431	Inorganic Chemistry	3
CHM 432	Inorganic Chemistry Laboratory	1
CHM 467	Biochemistry I	3
CHM 342	Advanced Organic Laboratory II	1
	<b>OR</b>	
CHM 470	Biochemistry Laboratory	1
	Electives	3
<b>Total Credits in Chemistry:</b>		<b>47</b>

MTH 201–203	Calculus I, II, III	12
PHS 201–202	College Physics I, II	8

**Total Credits in Math and Physics: 20**

### Major in Chemistry: Biochemistry Track

Required courses for the major in chemistry (first 31 credits listed previously), plus:

		Credits
CHM 467–468	Biochemistry I, II	6
CHM 470	Biochemistry Laboratory	1

**Total Credits in Chemistry: 38**

BIO 201	Biology I	4
BIO 202	Biology II	4
BIO 301	Cell Biology (spring only)	4
BIO 302	Genetics (fall only)	4
BIO 415	Molecular Biology	3

**Total Credits in Biology: 19**

MTH 201–203	Calculus I, II, III	12
PHS 201–202	College Physics I, II	8

**Total Credits in Math and Physics: 20**

<sup>2</sup>Three credits of electives chosen from the 300/400-level in chemistry, excluding CHM 457 and Contemporary Issues courses (suffix I). This elective credit requirement may also be satisfied either by an advanced course in mathematics or physics (for which calculus is a prerequisite) or, by petition to the Department of Chemistry, a relevant upper-division course in another of the natural and mathematical sciences.

### Minor in Chemistry

The student must complete CHM 205–206 and a minimum of 10 additional credits of chemistry chosen from courses having CHM 206 as a prerequisite. Normally the 10 additional credits are chosen from CHM 301, 303, 305–306, 405–406, and 408–409. Contemporary Issues (suffix I) courses are excluded.

### DEPARTMENT OF CHEMISTRY COURSES

**CHM 111 Introduction to Chemistry (A).** *Prerequisite:* MTH 110 or waiver for MTH 110. For persons who need to upgrade their chemistry skills in preparation for a technically related career or for enrollment in CHM 205. No prior knowledge of chemistry is assumed. Includes introduction to structure and bonding, the application of basic algebra to frequently used chemical calculations, and formula and chemical equation writing. Is illustrated with in-class demonstrations. Three hours lecture and demonstrations per week. 3 Cr. Spring.

**CHM 121 Chemistry and Scientists (A,L,W,Y).** Covers atomic structure, nuclear chemistry, chemical bonds, inorganic and organic nomenclature, molecular structures, biochemistry, inorganic chemical equations and quantitative problems.

Examines the contributions of women and minorities to physical science. Three hours lecture and two hours lab per week. 4 Cr. Every Semester.

**CHM 171 Elements of Forensic Science (A,N).** *Prerequisites:* MTH 112 or equivalent math background. Shows how principles and techniques of biology, chemistry and physics are used to develop evidence for legal proceedings. Includes topics such as types and handling of physical evidence; finger prints; impressions; chromatography; spectroscopy, microscopy; toxicology; and serology (including blood and DNA typing). (Closed to students who have completed CRJ 371.) DOES NOT FULFILL ELECTIVE REQUIREMENTS FOR CHEMISTRY MAJOR OR MINOR. Three hours of lecture/discussion per week. 3 Cr. Fall.

**CHM 205 College Chemistry I (A,L).** Course fee. *Prerequisite:* MTH 112 or equivalent. Covers atomic structure, chemical periodicity, inorganic nomenclature, chemical bonding, molecular orbitals, molecular structures, properties of solids, liquids, gases, and solutions, chemical equations, and quantitative problems. Three hours lecture and three hours lab per week. 4 Cr. Every Semester.

**CHM 206 College Chemistry II (A).** Course fee. *Prerequisite:* CHM 205. Covers strong and weak electrolytes, reactions, buffer systems, structure and bonding of coordination complexes, kinetics, homogeneous and heterogeneous equilibrium, thermodynamics, chemical equations and quantitative problems. Three hours lecture and three hours lab per week. 4 Cr. Spring.

**CHM 260 Chemistry for the Health Professions (A,L).** Course fee. *Prerequisites:* MTH 112 or equivalent and HS chemistry or CHM 111. Emphasizes the thoughts and actions of modern chemists as they seek a broader understanding of the molecular basis of living systems. Entails theory and mathematics appropriate for beginning students, directed towards an appreciation of the relationships between molecular structure and the ability to diagnose and treat disease. Develops the notion of decision making in the intellectual discourse of science. Three hours lecture and two hours lab per week. 4 Cr. Spring.

**CHM 301 Chemical Safety (A).** *Prerequisite:* CHM 206. The safe and responsible practice of the chemical sciences, including regulatory obligations, information sources, record keeping, and responses to emergency situations. Describes hazards in chemical labs and prudent measures to minimize risks: fire; reactivity; health effects; electrical, mechanical, cryogen and laser hazards; and storage and responsible disposal of chemicals. One hour lecture per week. 1 Cr.

**CHM 303 Analytical Chemistry I (A).** Course fee. *Prerequisite:* CHM 206. Introduction to analytical methods with emphasis on statistical evaluation of quantitative data and sampling strategies, analytical applications of acid-base equilibria, and chromatographic separations. Also includes a survey of classical volumetric methods, quantitative absorption spectrophotometry, and an introduction to ion selective electrode potentiometry. Three hours lecture and four hours lab per week. 4 Cr.

**CHM 305 Organic Chemistry I (A).** Course fee. *Prerequisite:* CHM 206. The chemistry of carbon-containing compounds: structure and bonding; nomenclature; functional groups; properties; acids and bases; isomers and stereochemistry; kinetics and thermodynamics; energy diagrams, reaction mechanisms, and their underlying concepts; reactions of hydrocarbons; substitution and

elimination reactions of organic halides and related compounds; spectroscopy; and separations. Three hours of lecture and four hours of laboratory per week. 4 Cr.

**CHM 306 Organic Chemistry II (A).** *Prerequisite:* CHM 305. Continuation of CHM 305: aromaticity; the chemical reactions of aromatic compounds; the nomenclature, structure, and chemistry of carbonyl compounds; oxidation and reduction reactions; carbohydrate chemistry; amino acids, peptides and proteins; polymers; spectroscopy; multistep synthesis; and the chemical literature. Three hours of lecture and four hours of laboratory per week. 4 Cr.

**CHM 341 Advanced Organic Laboratory I (A).** Course fee. *Prerequisite:* CHM 305. Selected advanced reactions and techniques, which may include: vacuum and fractional distillation, catalytic hydrogenation, organometallic reagents, phase transfer reagents, and other advanced experiments. Four hours of laboratory per week. 1 Cr.

**CHM 342 Advanced Organic Laboratory II (A).** Course fee. *Prerequisite:* CHM 341. Continuation of advanced techniques begun in CHM 341. Four hours of laboratory per week. 1 Cr.

**CHM 372 Environmental Issues (A,I).** Covers a wide range of environmental issues such as air pollution, acid rain, the greenhouse effect, pesticides, food additives and nuclear power. Also examines risk assessment methods, and the psychological factors and personal values that shape public attitudes. DOES NOT FULFILL ELECTIVE REQUIREMENTS FOR THE CHEMISTRY MAJOR OR MINOR. Three hours of lecture/discussion per week. 3 Cr. Spring.

**CHM 373 American Women Scientists in Contemporary Society (A,I,W,Y).** *Prerequisite:* Completion of Knowledge Area courses. Examines the contributions women have made in scientific fields. Also seeks to determine the validity of the claims of looming deficiencies of scientists in the near future. Assesses the roles that women scientists can and should play in meeting this problem. DOES NOT FULFILL ELECTIVE REQUIREMENTS FOR CHEMISTRY MAJOR OR MINOR. Three hours of lecture/discussion per week. 3 Cr. Spring.

**CHM 399 Independent Study in Chemistry (A).** *Prerequisites:* Junior or senior status, a minimum of 2.00 GPA overall, 2.5 GPA in chemistry. To be defined in consultation with the professor-sponsor prior to registration. 1-6 Cr. Every Semester.

**CHM 400 Seminar I (A).** *Prerequisite:* Departmental major's advisor or course instructor's permission; permission normally requires completion of 20 credits of the chemistry major. Includes attendance

at seminars, critique writing, and participation in career and employment workshops. One hour per week. *1 Cr. Fall.*

**CHM 401 Seminar II (A).** *Prerequisite: CHM 400.* Continuation of CHM 400. Includes preparation and presentation of a technical speech by each registrant. One hour per week. *1 Cr. Spring.*

**CHM 404 Physical Chemistry for the Biological Sciences (A).** *Corequisite: CHM 467 or prerequisites: MTH 202 and PHS 210 or PHS 240.* Principles of physical chemistry and their applications in the biological sciences: biochemical thermodynamics, equilibria, ion and electron transport, kinetics of life processes, biomolecular structure, macromolecules and self-assembly, optical and magnetic resonance spectroscopy, and photobiology with illustrations of how these principles apply to fundamental problems in biochemistry. *3 Cr. Offered Irregularly.*

**CHM 405 Physical Chemistry I (A).** The principles of quantum mechanics and their application to the proper description of chemical systems, spectroscopic phenomena, and chemical bonding. Three hours of lecture per week. *3 Cr. Fall.*

**CHM 406 Physical Chemistry II (A).** *Prerequisite: CHM 405.* Kinetic-molecular theory of gases; kinetics; thermodynamics, with an introduction to statistical thermodynamics; and applications of thermodynamics to phase equilibria and chemical equilibria. Three hours of lecture per week. *3 Cr.*

**CHM 408 Physical Methods Laboratory I (A).** *Cross-listed as PHS 408. Prerequisites: MTH 203, PHS 202 and CHM 206.* Covers the statistical treatment of data, propagation of errors, graphs, and report writing. Requires students to conduct experiments using modern physical measurement techniques, produce written scientific reports, and make oral presentations describing and analyzing the methods and their results. Three hours lab per week. *1 Cr. Fall.*

**CHM 409 Physical Methods Laboratory II (A).** *Cross-listed as PHS 409. Prerequisite: CHM 408.* Requires students to conduct experiments using modern physical measurement techniques, produce written scientific reports, and make oral presentations describing and analyzing the methods and their results. *1 Cr. Spring.*

**CHM 413 Instrumental Methods I: Spectral Interpretation (A).** *Prerequisite: CHM 305.* Covers proton and carbon-13 nuclear magnetic resonance, ultraviolet and visible, infrared, and mass spectrometry data for the identification and structural elucidation of organic compounds. Three hours of lecture/discussion per week. *3 Cr. Odd Spring.*

**CHM 414 Instrumental Methods II: Quantitative Spectrometry and Electro-analytical Techniques (A).** *Prerequisites: CHM 303 and CHM 406.* Theory and application to quantitative analyte determination of optical, spectroscopic, electro-analytical, and chromatographic instrumental techniques. Optimization of instrumental and analytical parameters and strategies for data acquisition are also discussed. Three hours of lecture per week. *3 Cr.*

**CHM 416 Instrumental Methods Laboratory (A).** *Course fee. Prerequisite or corequisite: CHM 414.* The use of various electro-analytical, spectroscopic, and chromatographic instruments to perform chemical analyses. Emphasis is on optimizing instrumental selectivity, sensitivity and resolution. Organization and analysis of data are also discussed. Four hours of laboratory per week. *1 Cr.*

**CHM 417 Computational Chemistry (A).** *Cross-listed as CPS 417. Prerequisites: CHM 206, MTH 203, CPS 201 and PHS 201.* Offered by the Department of Computational Science. *3 Cr.*

**CHM 423 Standard and Modern NMR Tech- a Nuts & Bolts Hands-on Wkshp (A).** Students receive instruction and hands-on training in widely used nuclear magnetic resonance (NMR) techniques. *2 Cr.*

**CHM 431 Inorganic Chemistry (A).** *Prerequisite or corequisite: CHM 405.* Studies trends within the periodic table, atomic structure, ionic and covalent bonding models, weak chemical forces, acid-base chemistry, chemistry in aqueous and nonaqueous solutions, and coordination compound bonding, structure, and reactivity. Three hours lecture per week. *3 Cr. Spring.*

**CHM 432 Inorganic Chemistry Laboratory (A).** *Course fee. Prerequisites: CHM 405 and CHM 408.* Explores use of classical synthetic methods to prepare coordination compounds. Applies advanced physical theory and instrumental methods to the problems of defining the composition, structure, bonding, and reactivity of these compounds. Four hours lab per week. *1 Cr. Spring.*

**CHM 457 Geochemistry (A).** *Course fee. Cross-listed as GEL 457. Prerequisites: CHM 205, CHM 206 and GEL 101.* Applies basic chemical principles of thermodynamics, kinetics, and equilibrium to the investigation of common geologic problems ranging from crystallization of silicate melts to surface reactions on soil minerals. Focuses on laboratory exercises on application of good laboratory practices to wet chemical and instrumental techniques involving geologic materials. Three hours lecture and three hours lab per week. *4 Cr.*

**CHM 467 Biochemistry I (A).** *Cross-listed as BIO 467. Prerequisite: CHM 306; a college course in biology is strongly recommended.* Covers the chemistry of proteins, lipids, carbohydrates, nucleic acids and other biomolecules, with an emphasis on buffers, structures, experimental methods, main energy production pathways, biosynthesis, the deduction of structures, functional roles and mechanisms. Three hours lecture per week. 3 Cr. Fall.

**CHM 468 Biochemistry II (A).** *Cross-listed as BIO 468. Prerequisite: CHM 467 or BIO 467.* Provides a continuation of CHM 467. Covers additional metabolic pathways, human nutrition, chromosomes and genes, protein biosynthesis, cell walls, immunoglobulins, muscle contraction, cell motility, membrane transport and excitable membranes and sensory systems. Investigates experimental evidence for the structures and functions of biomolecules. Three hours of lecture/discussion per week. 3 Cr. Spring.

**CHM 470 Biochemistry Laboratory (A).** *Cross-listed as BIO 470. Course fee. Prerequisite or corequisite: CHM 467 or BIO 467.* Covers biochemical analyses, including preparation, separations and characterization of products from a variety of biological sources; and experiments with enzymes and experiments designed to measure changes inherent in the dynamics of living systems. Four hours lab per week. 1 Cr.

**CHM 480 Practical Chemistry Laboratory Pedagogy (B).** *Prerequisites: CHM 301 or NAS 468, CHM 303 and CHM 306, and at least one semester as a chemistry lab assistant at The College at Brockport (this experience carries no credit but is paid).* For students working toward teacher certification in secondary chemistry and general science. Requires students to develop preparation notes, solutions, and reagents for lab experiments. Requires each student to develop a lesson plan, lead a class in the experiment, develop a grading scheme and do the actual grading for a selected experiment. Introduces troubleshooting of simple instruments. Requires a hands-on experience in the practical aspects of lab instruction. Does not satisfy the elective requirement for students not seeking teacher certification. 3 Cr. By Arrangement.

**CHM 499 Independent Study in Chemistry (A).** *Prerequisites: Senior status, and 2.00 overall GPA, 2.50 GPA in chemistry.* To be defined in consultation with the professor-sponsor prior to registration. 1-6 Cr. Every Semester.