CHEMISTRY AND BIOCHEMISTRY

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Faculty
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Academic Programs	Credits
BS: Chemistry	38
BS: Chemistry (Approved by the American Chemical Society (ACS) Committee on Professional Training)	
BS: Biochemistry	34
Minor in Chemistry	20

Students who plan to major in chemistry or biochemistry are expected to have entrance credit in the preparatory subjects of chemistry and mathematics (including algebra and trigonometry); a background in physics is desirable. Those who do not have entrance credit or equivalent training in these subjects, particularly mathematics, may not fulfill the department graduation requirements in four years.

Students are encouraged to plan early for an on-campus or off-campus research experience required of all students in the Bachelor of Science degree programs in chemistry and strongly recommended for those in the Bachelor of Science degree program in biochemistry. This experience may take the form of a cooperative educational-research experience or research in an academic, industrial, or governmental laboratory setting. Interested students should consult the department chair.

American Chemical Society Certification

Students desiring American Chemical Society certification must

- Complete the required courses for the (ACS) Bachelor of Science degree in chemistry as spelled out in this bulletin
- Achieve a minimum GPA of 3.00 in all chemistry courses taken at Andrews University
- Satisfactorily complete a research or cooperative educational experience in chemistry
- Pass at least one advanced course selected from the following: CHEM470, 474 or 475.

A complete statement of certification requirements is available from the department chair.

Undergraduate Programs

Core Courses–30
CHEM131, 132, 200, 231, 232, 241, 242, 311, 312, 411, 412, 431, 441, BCHM421

BS: Chemistry—38

Major Requirements: Core plus CHEM415, 440.
Research/Cooperative Experience: An on-campus or off-campus research or cooperative educational experience. The student may satisfy this requirement by matriculating in CHEM495, HONS497, 498 or IDSC380.
Cognate Courses: CPTR125 or CPTR151; MATH141, 142; PHYS241, 242, 271, 272.

BS: Chemistry—44

(American Chemical Society approved)
Major Requirements: Core plus CHEM440, 415, 432, 442; and one course selected from the following: CHEM470, 474, or 475.
Research/Cooperative Experience: An on-campus or off-campus research or cooperative educational experience. The student may satisfy this requirement by matriculating in CHEM495, HONS497,498 or IDSC380.
Cognate Courses: MATH141, 142, 286; CPTR125 or CPTR151; PHYS241, 242, 271, 272.

Courses in economics and marketing are strongly recommended. A reading knowledge of German or French, although not required for professional undergraduate education in chemistry, is strongly recommended for students planning advanced study.

BS: Biochemistry—34

Major Requirements: Core plus BCHM422, 430.
Cognate Courses: BIOL165, 166; MATH141, 142; PHYS141, 142 (or PHYS241, 242, 271, 272); and two courses selected from BIOL371, 372; FDNT485; ZOOL315, 464, 465.

Students desiring a career in biochemistry might be better served by adding the biochemistry courses to the Bachelor of Science degree in chemistry, but the Bachelor of Science degree in biochemistry can be strengthened by the addition of CHEM415, 440, and 495.

Minor in Chemistry—20

CHEM131, 132, 231, 232, 241, 242, plus 4 credits of majors level chemistry or biochemistry.

Graduate Program

The Department of Chemistry and Biochemistry collaborates in offering the MS: Mathematics and Science with the departments of Mathematics, Biology, and Physics. See the program description under Mathematics and Science, p. 160.

Courses (Credits)

See inside front cover for symbol code.

BCHM120 **$ (4)**
Introduction to Biological Chemistry
A survey of major concepts in biochemistry such as structures of biological molecules, their functions, energy metabolism, regulation of biochemical pathways; for nursing, dietetics, and allied health students. Weekly: 3 lectures, 1 recitation, and a 3-hour lab. Not applicable towards a major or minor in chemistry or biochemistry. Prerequisite: CHEM110. *Spring*

BCHM421 **♦ (4)**
Biochemistry I
Study of the fundamental principles of enzyme kinetics and mechanisms based on the structure and chemistry of biomolecules including amino acids, carbohydrates, lipids, proteins, nucleotides, nucleic acids, and biological membranes. Weekly: 4 lectures. Prerequisite: CHEM232. *Fall*

BCHM422 **♦ (3)**
Biochemistry II
Continuation of BCHM421 including selected topics of hormone and regulatory biochemistry, and the study of the four primary neurotransmitter systems–acetylcholine, catecholamines, serotonin, and gamma-aminobutyric acid. Weekly: 3 lectures. Prerequisites: BCHM421. *Spring*

BCHM430 **♦ $ (1)**
Biochemistry Lab
Introduction to quantitative and qualitative methods for the isolation, purification and identification of biological materials and applications of enzyme kinetics. Weekly: 4 hours of lab. Prerequisite: BCHM421 and registration in BCHM422. *Spring*

CHEM100 **$ (4)**
Consumer Chemistry
A one-semester course primarily for non-science majors presenting an introduction to fundamental concepts of chemistry to convey an appreciative understanding of the nature of chemistry and how it is applied to our daily lives. Topics of consumer chemistry to be studied will be selected from fuels, energy, polymers, fertilizers, pesticides, food and food additives, household cleaners, cosmetics and personal care chemicals, pharmaceuticals, and air and water pollution. Meets the physical science general education requirement. Three lectures per week and one 3-hour laboratory. Not applicable toward a major or minor in chemistry or biochemistry.

CHEM110 **$ (4)**
Introduction to Inorganic and Organic Chemistry
An introduction to the principles and applications of inorganic and organic chemistry; for nursing, dietetics, and allied health students. Meets the natural/physical science general education restricted choice requirement. Weekly: 3 lectures, 1 recitation, and a 3-hour lab. *Fall*

CHEM131 **$ (4)**
General Chemistry I
This first course in chemistry is for students planning to major in science and engineering. Topics include stoichiometry, atomic and molecular structure, bonding, states of matter, solutions, chemical kinetics, and chemical equilibrium. Weekly: 3 lectures, 2 recitations, and a 3-hour lab. Prerequisite: MPE≥P3 or MATH166 or MATH141; High school chemistry or physics strongly recommended. *Fall*

CHEM132 **$ (4)**
General Chemistry II
A continuation of CHEM131 with topics including thermodynamics, acid and base chemistry, descriptive and nuclear chemistry. Weekly: 3 lectures, 2 recitations, and a 3-hour lab. Prerequisite: a grade of C- or better in CHEM131. *Spring*

CHEM200 **$ (4)**
Quantitative Analysis
Lecture topics include statistics, chemical equilibrium, titrimetric procedures, gravimetric procedures, and electrochemistry. Laboratory experiments include gravimetric procedures and titrimetric procedures of acid and base systems and redox systems, electrochemistry, and an introduction to instrumental methods. Weekly: 2 lectures and two 4-hour labs. Prerequisite: CHEM132. *Fall*

CHEM231 **(3)**
Organic Chemistry I
The chemistry of carbon-containing compounds with emphasis on nomenclature, molecular structure, spectra-structure relationships, and a mechanistic approach to organic reactions. Weekly: 3 lectures and 2 recitations. Prerequisite: CHEM132. *Fall*

CHEM232 **(3)**
Organic Chemistry II
This course is a continuation of CHEM231. Weekly: 3 lectures and 2 recitations. Prerequisite: a grade of C- or better in CHEM231. *Spring*

CHEM241 **$ (1)**
Organic Chemistry Laboratory I
Experiments related to the course content of CHEM231. Weekly: one 4-hour laboratory. Prerequisite: CHEM231 or concurrent enrollment in CHEM231. *Fall*

CHEM242 **$ (1)**
Organic Chemistry Laboratory II
Experiments related to the course content of CHEM232. Weekly one 4-hour laboratory. Prerequisite: CHEM232 or concurrent enrollment in CHEM232. *Spring*

CHEM300 **Alt $ (2)**
Laboratory Glassblowing
Practice of fundamental glassblowing skills common to both scientific and creative glass blowing. Two projects are required. The student may choose between scientific and creative projects. Weekly: 1 lecture demonstration and 4 hours of lab. Not applicable towards a major or minor in chemistry or toward the General Education requirement in natural science. Offered *Fall* (even years or as needed)

CHEM311 **(.5)**
Seminar in Chemistry
Departmental seminar series devoted to topics in current chemical research by students, faculty, and guest speakers. This course is required of, and open only to, junior chemistry and biochemistry majors, and attendance for both semesters is required for one credit; freshmen and sophomores are encouraged to attend. Grading is on an S/U basis. A deferred grade (DG) is assigned Fall Semester and is removed upon successful completion of CHEM312. Weekly: 1 seminar. Prerequisite: CHEM232. *Fall*

CHEM312 **(.5)**
Seminar in Chemistry
Continuation of CHEM311. This course is required of, and open only to, junior chemistry and biochemistry majors; freshmen and sophomores are encouraged to attend. Grading is on S/U basis. Weekly: 1 seminar. Prerequisite: CHEM311. *Spring*

CHEM340 **$ (4)**
Environmental Chemistry
A survey of environmental and energy-related problems. Topics include air, soil, and water pollution, energy and other resources, solid wastes and recycling, and toxic chemicals. Weekly: 3 lectures and one 4-hour lab. Not applicable towards a major in chemistry or biochemistry. Prerequisites: CHEM132; CHEM232 or CHEM200 strongly recommended. *Spring* (odd years or as needed)

CHEM410 **♦ $ (2)**
Forensic Chemistry
Principles of chemistry as applied to the methods of analysis and identification of drugs. Rules of evidence as they apply to testimony in court. Observation of drug-related court procedures. Weekly: 1 lecture and two 3-hour labs. Participation must be arranged with the instructor at least 2 months prior to beginning of course. Prerequisites: CHEM200, 232. *Spring*

CHEM411 **(.5)**
Seminar in Chemistry
First half of semester consists of two meetings per week: one is an introduction to chemical literature and computer searching of Chemical Abstracts and chemical databases, the other meeting is the regular seminar series presented by students, faculty, and invited speakers. During the semester, each student prepares and presents a seminar. This course is required of, and open only to, senior chemistry and biochemistry majors, and attendance for both semesters is required for one credit. A deferred grade (DG) is assigned Fall Semester and is removed upon successful completion of CHEM412. Weekly: Two meetings during first half of semester, one meeting remainder of semester. Prerequisite: CHEM312. *Fall*

CHEM412 **(.5)**
Seminar in Chemistry
Continuation of CHEM411. During the semester, each student prepares and presents a seminar. This course is required of, and open only to, seniors. Prerequisite: CHEM411. *Spring*

CHEM415 **♦ (4)**
Advanced Inorganic Chemistry
Atomic and molecular structure, symmetry, group theory, solid state, acids and bases; structure, bonding, spectra, and reaction mechanisms of d-metal complexes, systematic chemistry of non-metals; organometallic chemistry and catalysis. Weekly: 4 lectures. Prerequisites: CHEM232, 431. *Spring*

CHEM431 **♦ (3)**
Physical Chemistry I
Fundamental concepts in chemical thermodynamics, free energy, chemical equilibria, phase changes, solutions, molecular transport, chemical dynamics, and electrochemistry. Weekly: 3 lectures. Prerequisites: CHEM200, MATH142, PHYS142 (or 242, 272). *Fall*

CHEM432 **♦ (3)**
Physical Chemistry II
Wave mechanics, atomic and molecular structure, chemical bonding, atomic and molecular spectroscopies, and applications to chemical dynamics and statistical thermodynamics. Weekly: 3 lectures. Prerequisites: CHEM431, MATH286; MATH240 strongly recommended. *Spring*

CHEM440 **♦ $ (4)**
Instrumental Analysis
Theory and practice of analytical separations and chemical analyses by chromatographic, optical, and electrochemical methods. Introduction to interface of instruments with microcomputers. Instruments used include emission and absorption spectrometers, lasers, mass spectrometer, chromatographs, microcomputers, analog and digital devices. Weekly: 2 lectures and two 4-hour labs. Prerequisites: CHEM200, MATH142. *Fall*

CHEM441 **♦ $ (1)**
Physical Chemistry Laboratory I
Experiments related to the course content of CHEM431. Weekly: one 4-hour laboratory. Prerequisite: concurrent enrollment in CHEM431. *Fall*

CHEM442 **♦ $ (1)**
Physical Chemistry Laboratory II
Experiments related to the course content of CHEM432. Weekly: one 4-hour laboratory. Prerequisite: concurrent enrollment in CHEM 432. *Spring*

CHEM470 **♦ $ (2)**
Modern Synthetic Techniques
An advanced laboratory course designed to incorporate a wide variety of modern synthetic techniques of organic, organometallic, and inorganic chemistry. Weekly: two 4-hour labs. Prerequisites: CHEM474,415 or concurrent enrollment in CHEM415. *Spring*

CHEM474 **(2)**
Advanced Topics in Organic Chemistry
Study of the principles of modern synthetic organic chemistry with applications from one or more of the following areas: natural product, medicinal, or polymer chemistry. Weekly: 2 lectures. Prerequisite: CHEM232. *Fall*

CHEM475 **♦ (2)**
Advanced Topics in Physical Chemistry
Advanced study of molecular spectroscopy, statistical thermodynamics, chemical dynamics, or the application of quantum mechanics. Prerequisites: CHEM432 or CHEM431 and permission of the instructor.

CHEM495 **♦ (1-4)**
Independent Research
An opportunity for chemistry and biochemistry majors to gain research experience by joining with a faculty member in study of an area of special interest.

Graduate

CHEM530 **(2-4)**
Topics in Teaching Chemistry
Each time the course is offered, it treats one of the following areas:
- Concepts in Chemistry
  Fundamental ideas of chemistry
- Demonstrations
  Simple experiments which illustrate chemical principles
- Problem-Solving Strategies
  Exploration into the mental processes and logic behind problem-solving.

None of the above areas are to occur twice in one student's program. Prerequisite: CHEM232. Repeatable to 6 credits.

CHEM540 **(2-4)**
Topics in Chemistry
Independent readings to be chosen in consultation with the instructor. A written report and an oral presentation covering the materials read are required. A minimum of 60 hours of work is required for each credit. Prerequisite: CHEM431. Repeatable to 6 credits.