

# Chemistry

College of Natural Science and Mathematics  
Department of Chemistry and Biochemistry  
(907) 474-5510  
www.uaf.edu/chem/

## B.A., B.S. Degrees

Minimum Requirements for Degrees: 130 credits

Graduates qualify for employment as teachers of chemistry; supervisors in industry; technical sales personnel; research chemists in federal, state, municipal, academic or industrial laboratories; in pre-medicine; and as laboratory technicians. Graduates also find positions in the environmental sciences, oceanography and related interdisciplinary fields. Many chemistry graduates elect to pursue advanced M.S., Ph.D., pharmacology or M.D. degrees.

The chemistry curriculum meets the American Chemical Society standards of introducing the basics of general, organic, inorganic, physical and analytical chemistry, and biochemistry. Undergraduate research leading to publications is strongly encouraged and many of the laboratory-based courses have a research component built into them. There are also options for an ACS-accredited degree which provides students additional exposure to environmental chemistry, biochemistry or forensic chemistry. Limited teaching assistantships are often available for upper division students, which strengthens leadership and communication skills.

The Bachelors degree in Environmental Chemistry prepares students for public and private sector jobs related to Environmental Science and Technology, or for graduate programs in Environmental Chemistry and related disciplines. The degree program is designed to provide students with core training in the chemical sciences, while providing exposure to a broad range of related disciplines. Students work with a faculty advisor to select required elective courses that best meets their interests and academic goals.

Students are also required to enroll in research credits with a focus on an Environmental Chemistry topic. This provides an opportunity for students to gain first hand experience working on advanced topics that are generally outside of the scope of an undergraduate curriculum. For a description of the field of Environmental Chemistry, see the Environmental Chemistry graduate program.

The chemistry and biochemistry department is housed in the Natural Sciences Facility, which is equipped with research-grade instrumentation, including a high field nuclear magnetic resonance spectrometer, FT infrared spectrometers, atomic absorption spectrometer, UV-VIS diode array spectrometers, two gas chromatographs interfaced with mass spectrometers, a gas chromatograph with a flame ionization detector, high performance liquid chromatograph, capillary electrophoresis and a modern glove box for handling air sensitive chemicals. Equipment for specialized X-ray diffractometry, electron microscopy, liquid scintillation counting, atomic force-field microscopy, dynamic light scattering analyses, etc. is available in cooperation with other UAF departments and institutes. Two computer laboratories equipped with modern chemical software (HyperChem, ACD Labs, ChemDraw, Chem Sketch, Mestrec) and other software such as Word, Excel, PowerPoint and Endnote are available for all students enrolled in 200-level or above courses.

## Major—B.A. Degree

1. Complete the general university requirements. (See page 116. As part of the core curriculum requirements, complete: MATH 200X; PHYS 103X and PHYS 104X, or PHYS 211X and PHYS 212X.)
2. Complete the B.A. degree requirements. (See page 120. As part of the B.A. degree requirements, complete: MATH 201X.)

3. Complete the following program (major) requirements:\*
  - CHEM 105X—General Chemistry..... 4
  - CHEM 106X—General Chemistry..... 4
  - CHEM 202—Basic Inorganic Chemistry..... 3
  - CHEM 212—Chemical Equilibrium and Analysis..... 3
  - CHEM 313—Chemical Analysis of Dynamic Systems..... 2
  - CHEM 321—Organic Chemistry ..... 3
  - CHEM 322—Organic Chemistry ..... 3
  - CHEM 324W—Organic Laboratory ..... 4
  - CHEM 331—Physical Chemistry..... 3
  - CHEM 332—Physical Chemistry..... 3
  - CHEM 412—Instrumental Analytical Methods..... 3
  - CHEM 413W—Analytical Instrumental Laboratory..... 3
  - CHEM 434W—Instrumental Methods in Physical Chemistry ..... 3
  - CHEM 481—Seminar..... 1
  - CHEM 482O—Seminar..... 2

4. Complete the following:
  - MATH 202X—Calculus..... 4
5. Minimum credits required.....130

\* Student must earn a C grade or better in each course.

## Major—B.S. Degree

1. Complete the general university requirements. (See page 116. As part of the core curriculum requirements, complete: MATH 200X; PHYS 103X and PHYS 104X, or PHYS 211X and PHYS 212X.)
2. Complete the B.S. degree requirements. (See page 121. As part of the B.S. degree, complete: MATH 201X. Chemistry foundation courses may be used toward partial fulfillment of the natural science requirement.)
3. Complete the program (major) requirements as listed under Chemistry—B.A. Degree.
4. Complete the following:\*
  - CHEM 402—Inorganic Chemistry\*\* ..... 3
  - CHEM 451—General Biochemistry—Metabolism..... 3
  - CHEM 488—Undergraduate Chemistry and Biochemistry Research\*\* ..... 4
5. Minimum credits required.....130

\* Student must earn a C grade or better in each course.

\*\* Advanced courses in the physical or biological sciences or mathematics may be substituted with permission of the head of the chemistry and biochemistry department. However, the student will not receive an ACS-certified degree.

Note: Upon completing the recommended curriculum and fulfilling all general university requirements, the student will receive a bachelor's degree certified by the American Chemical Society.

Note: The electives must include at least 6 credits at the upper-division level (to satisfy the UAF general degree requirements for 39 upper-division.)

## Concentrations: Biochemistry/Molecular Biology, Environmental Chemistry, Forensic Chemistry

### Biochemistry/Molecular Biology

1. Complete the general university requirements. (See page 116. As part of the core curriculum requirements, complete: MATH 200X; PHYS 103X and PHYS 104X, or PHYS 211X and PHYS 212X.)
2. Complete the B.S. degree requirements. (See page 121. As part of the B.S. degree requirements, complete: MATH 201X. Chemistry foundation courses may be used toward partial fulfillment of the natural science requirement.)

- Complete the following program (major) requirements:\*
 

|   |   |
|---|---|
| BIOL 105X—Fundamentals of Biology I.....              | 4 |
| BIOL 106X—Fundamentals of Biology II .....            | 4 |
| BIOL 342—Microbiology (4)                             |   |
| or BIOL 362—Principles of Genetics (4)                |   |
| or BIOL 418W—Developmental Biology (4)                |   |
| or BIOL 461—Cell Biology (4) .....                    | 4 |
| CHEM 105X—General Chemistry .....                     | 4 |
| CHEM 106X—General Chemistry.....                      | 4 |
| CHEM 212—Chemical Equilibrium and Analysis.....       | 3 |
| CHEM 313—Chemical Analysis of Dynamic Systems.....    | 2 |
| CHEM 321—Organic Chemistry .....                      | 3 |
| CHEM 322—Organic Chemistry .....                      | 3 |
| CHEM 324W—Organic Laboratory .....                    | 4 |
| CHEM 331—Physical Chemistry.....                      | 3 |
| CHEM 332—Physical Chemistry.....                      | 3 |
| CHEM 413W—Analytical Instrumental Laboratory** (3)    |   |
| or CHEM 434W—Instrumental Methods in                  |   |
| Physical Chemistry (3) .....                          | 3 |
| CHEM 451—General Biochemistry—Metabolism.....         | 3 |
| CHEM 452—Biochemistry Laboratory (3)                  |   |
| or CHEM 488—Undergraduate Chemistry and               |   |
| Biochemistry Research (3) .....                       | 3 |
| CHEM 481—Seminar .....                                | 1 |
| CHEM 482O—Seminar.....                                | 2 |
| Major elective (approved by department head)*** ..... | 6 |
- Complete the following:
 

|                         |   |
|-------------------------|---|
| MATH 202X—Calculus..... | 4 |
|-------------------------|---|
- Minimum credits required.....130
 

\* Student must earn a C grade or better in each course.

\*\* Requires CHEM 412 as prerequisite.

\*\*\* CHEM 202, 402 required for ACS-accredited degree.

#### Environmental Chemistry

- Complete the general university requirements. (See page 116. As part of the core curriculum requirements, complete: MATH 200X; PHYS 103X and PHYS 104X, or PHYS 211X and PHYS 212X.)
- Complete the B.S. degree requirements. (See page 121. As part of the B.S. degree, complete: MATH 201X. Chemistry foundation courses may be used toward partial fulfillment of the natural science requirement.)
- Complete the following:\*
 

|  |   |
|--|---|
| CHEM 105X—General Chemistry.....                           | 4 |
| CHEM 106X—General Chemistry .....                          | 4 |
| CHEM 202—Basic Inorganic Chemistry.....                    | 3 |
| CHEM 212—Chemical Equilibrium and Analysis.....            | 3 |
| CHEM 313—Chemical Analysis of Dynamic Systems.....         | 2 |
| CHEM 321, 322—Organic Chemistry .....                      | 6 |
| CHEM 324W—Organic Laboratory .....                         | 4 |
| CHEM 331, 332—Physical Chemistry.....                      | 6 |
| CHEM 412—Instrumental Analytical Methods.....              | 3 |
| CHEM 413W—Analytical Instrumental Laboratory.....          | 3 |
| CHEM 434W—Instrumental Methods in Physical Chemistry ..... | 3 |
| CHEM 451—General Biochemistry—Metabolism.....              | 3 |
| CHEM 481—Seminar.....                                      | 1 |
| CHEM 482O—Seminar.....                                     | 2 |
| CHEM 488—Undergraduate Chemistry and Biochemistry          |   |
| Research (Environmental Topic) .....                       | 2 |
- Complete the following:
 

|                           |   |
|---------------------------|---|
| MATH 202X—Calculus.....   | 4 |
| STAT 300—Statistics ..... | 3 |
- Complete two of the following courses:\*
 

|  |   |
|--|---|
| BIOL 105X—Fundamentals of Biology I.....           | 4 |
| BIOL 106X—Fundamentals of Biology II .....         | 4 |
| GEOS 101X—The Dynamic Earth.....                   | 4 |
| GEOS 125X—Humans, Earth, and the Environment ..... | 4 |
| ATM 101X—Weather and Climate of Alaska.....        | 4 |

- Complete one of the following advanced courses:\*
 

|   |   |
|---|---|
| BIOL 271—Principles of Ecology.....               | 4 |
| BIOL 342—Microbiology .....                       | 4 |
| BIOL 443W—Microbial Ecology.....                  | 3 |
| BIOL 483—Stream Ecology.....                      | 3 |
| ENVE 458—Energy and the Environment.....          | 3 |
| NRM 380W—Soils and the Environment.....           | 3 |
| ATM 401—Introduction to Atmospheric Science ..... | 3 |
| CHEM 402—Advanced Inorganic Chemistry .....       | 3 |
- Complete one of the following advanced courses:\*
 

|   |   |
|---|---|
| BIOL 442W,O/2—Advanced Microbiology .....   | 4 |
| CHEM 406—Atmospheric Chemistry.....         | 3 |
| CE 441—Environmental Engineering.....       | 4 |
| GEOS 417—Introduction to Geochemistry ..... | 3 |
- Minimum credits required.....130
 

\* Student must earn a C grade or better in each course.

#### Forensic Chemistry

- Complete the general university requirements. (See page 116. As part of the core curriculum requirements, complete: MATH 200X; PHYS 103X and PHYS 104X, or PHYS 211X and PHYS 212X.)
- Complete the B.S. degree requirements. (See page 121. As part of the B.S. degree, complete: MATH 201X. Chemistry foundation courses may be used toward partial fulfillment of the natural science requirement.)
- Complete the program (major) requirements as listed under Chemistry—B.A. degree.
- Complete the following chemistry requirements:\*
 

|  |   |
|--|---|
| CHEM 402—Inorganic Chemistry.....                          | 3 |
| CHEM 451—General Biochemistry—Metabolism.....              | 3 |
| CHEM 488—Undergraduate Chemistry and Biochemistry Research |   |
| (Environmental Topic).....                                 | 2 |
- Complete the following justice requirements:\*
 

|   |   |
|---|---|
| JUST 110—Introduction to Justice .....              | 3 |
| JUST 222—Research Methods.....                      | 3 |
| JUST 251—Criminology .....                          | 3 |
| JUST 300X—Ethics and Justice** .....                | 3 |
| JUST 354—Procedural Law.....                        | 3 |
| JUST 454W—Advanced Problems in Procedural Law ..... | 3 |
- Minimum credits required.....130
 

\* Student must earn a C grade or better in each course.

\*\* JUST 300X may not be used to fulfill core ethics requirement.

#### Requirements for Chemistry Teachers (grades 7–12)

- Complete all the requirements of the chemistry B.A. or B.S. degree you wish to seek.
- All prospective chemistry teachers must complete the following:
 

|   |   |
|---|---|
| CHEM 451—General Biochemistry—Metabolism.....     | 3 |
| CHEM 488—Undergraduate Chemistry and Biochemistry |   |
| Research .....                                    | 4 |
- All prospective science teachers must complete one of the following:
 

|  |   |
|--|---|
| PHIL 380—Conceptual Foundations of Science (3)   |   |
| or PHIL 382—Science and Technological Limits (3) |   |
| or PHIL 481—Philosophy of Science (3).....       | 3 |

*Note: We strongly recommend that prospective secondary science teachers seek advising from the UAF School of Education early in your undergraduate degree program so that you can be appropriately advised of the state of Alaska requirements for teacher licensure. You will apply for admission to the UAF School of Education's post-baccalaureate teacher preparation program, a one-year intensive program, during your senior year. Above requirements apply to all candidates who apply to the UAF School of Education Spring 2006 or later for licensure in chemistry.*

**Minor****Chemistry**

- Complete the following:
  - CHEM 105X—General Chemistry ..... 4
  - CHEM 106X—General Chemistry ..... 4
- Complete the following approved electives:
  - CHEM 212—Chemical Equilibrium and Analysis\* ..... 3
  - CHEM 321 & CHEM 322—Organic Chemistry ..... 6
  - CHEM 331 & CHEM 332—Physical Chemistry ..... 6
- Complete two of the following chemistry lab courses:
  - CHEM 202—Basic Inorganic Chemistry ..... 3
  - CHEM 313—Chemical Analysis of Dynamic Systems\* ..... 2
  - CHEM 324—Organic Chemistry Lab ..... 4
- Minimum credits required ..... 22-24

\* CHEM 324W may be substituted for both of these courses.

**Biochemistry**

- Complete the following foundation courses:
  - CHEM 105X—General Chemistry ..... 4
  - CHEM 106X—General Chemistry ..... 4
- Complete the following:
  - CHEM 321—Organic Chemistry ..... 3
  - CHEM 322—Organic Chemistry ..... 3
  - CHEM 331—Physical Chemistry ..... 3
  - CHEM 451—General Biochemistry—Metabolism ..... 3
- Complete two of the following chemistry lab courses:
  - CHEM 202—Basic Inorganic Chemistry ..... 3
  - CHEM 313—Chemical Analysis of Dynamic Systems ..... 2
  - CHEM 324—Organic Chemistry Lab ..... 4
- Minimum credits required ..... 25-27

**Baccalaureate Core Requirements**

All degrees (e.g. B.A., B.S., etc.) require additional courses.  
Refer to specific degree and program requirements.

**COMMUNICATION (9)****Complete the following:**

ENGL 111X ..... (3) \_\_\_\_\_  
ENGL 190H may be substituted.

**Complete one of the following:**

ENGL 211X OR ENGL 213X ..... (3) \_\_\_\_\_

**Complete one of the following:**

COMM 131X OR COMM 141X ..... (3) \_\_\_\_\_

**PERSPECTIVES ON THE HUMAN CONDITION (18)****Complete all of the following four courses:**

ANTH 100X/SOC 100X ..... (3) \_\_\_\_\_  
ECON 100X OR PS 100X ..... (3) \_\_\_\_\_  
HIST 100X ..... (3) \_\_\_\_\_  
ENGL/FL 200X ..... (3) \_\_\_\_\_

**Complete one of the following three courses:**

ART/MUS/THR 200X, HUM 201X OR ANS 202X ..... (3) \_\_\_\_\_

**Complete one of the following six courses:**

BA 323X, COMM 300X, JUST 300X, NRM 303X,  
PS 300X OR PHIL 322X ..... (3) \_\_\_\_\_

**OR complete 12 credits from the above courses PLUS**

- two semester-length courses in a single Alaska Native language or other non-English language OR
- three semester-length courses (9 credits) in American Sign Language taken at the university level.

**MATHEMATICS (3)****Complete one of the following:**

MATH 103X, MATH 107X, MATH 161X OR STAT 200X ..... (3-4) \_\_\_\_\_  
\* No credit may be earned for more than one of MATH 107X or 161X.

**OR complete one of the following:\***

MATH 200X, MATH 201X, MATH 202X,  
MATH 262X OR MATH 272X ..... (4) \_\_\_\_\_

\*Or any math course having one of these as a prerequisite

**NATURAL SCIENCES (8)****Complete any two (4-credit) courses:**

ATM 101X ..... (4) \_\_\_\_\_  
BIOL 100X ..... (4) \_\_\_\_\_  
BIOL 103X ..... (4) \_\_\_\_\_  
BIOL 104X ..... (4) \_\_\_\_\_  
BIOL 105X ..... (4) \_\_\_\_\_  
BIOL 106X ..... (4) \_\_\_\_\_  
BIOL 111X ..... (4) \_\_\_\_\_  
BIOL 112X ..... (4) \_\_\_\_\_  
CHEM 100X ..... (4) \_\_\_\_\_  
CHEM 103X ..... (4) \_\_\_\_\_  
CHEM 104X ..... (4) \_\_\_\_\_  
CHEM 105X ..... (4) \_\_\_\_\_  
CHEM 106X ..... (4) \_\_\_\_\_  
GEOG 205X ..... (4) \_\_\_\_\_  
GEOS 100X ..... (4) \_\_\_\_\_  
GEOS 101X ..... (4) \_\_\_\_\_  
GEOS 112X ..... (4) \_\_\_\_\_  
GEOS 120X ..... (4) \_\_\_\_\_  
GEOS 125X ..... (4) \_\_\_\_\_  
MSL 111X ..... (4) \_\_\_\_\_  
PHYS 102X ..... (4) \_\_\_\_\_  
PHYS 103X ..... (4) \_\_\_\_\_  
PHYS 104X ..... (4) \_\_\_\_\_  
PHYS 115X ..... (4) \_\_\_\_\_  
PHYS 116X ..... (4) \_\_\_\_\_  
PHYS 175X ..... (4) \_\_\_\_\_  
PHYS 211X ..... (4) \_\_\_\_\_  
PHYS 212X ..... (4) \_\_\_\_\_  
PHYS 213X ..... (4) \_\_\_\_\_

**LIBRARY AND INFORMATION RESEARCH (0-1)**

Successful completion of library skills competency test OR

LS 100X or 101X prior to junior standing ..... (0-1) \_\_\_\_\_

**UPPER-DIVISION WRITING AND ORAL COMMUNICATION (0)****Complete the following:**

Two writing intensive courses designated (W) ..... (0) \_\_\_\_\_  
One oral communication intensive course designated (O) ..... (0) \_\_\_\_\_  
OR two oral communication intensive courses designated (O/2), at the upper-division level (see degree and/or major requirements) ..... (0) \_\_\_\_\_

**TOTAL CREDITS REQUIRED** ..... 38-39