

# UNDERGRADUATE CATALOG 2017–18

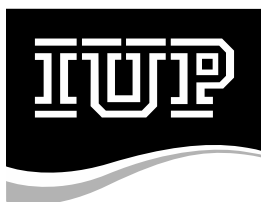
## DEPARTMENT OF CHEMISTRY

COLLEGE OF NATURAL SCIENCES AND MATHEMATICS

[www.iup.edu/chemistry](http://www.iup.edu/chemistry)

This document is a direct extract from the full 2017–18 *Undergraduate Catalog*. As a result, the original page numbering will appear.

For information on other colleges at IUP, or about specific courses, please consult the full 2017–18 catalog, available at [www.iup.edu/registrar/catalog](http://www.iup.edu/registrar/catalog). Earlier catalogs are also available at this web address.



Indiana University of Pennsylvania

## Department of Chemistry

Website: [www.iup.edu/chemistry](http://www.iup.edu/chemistry)

**Anne Kondo, Chairperson;** Ashe, Elcesser, Fair, Ford, Jain, Ko, Kupchella, Kyler, Lake, LeBlond, Long, Maicaneanu, Majumdar, McElroy, See, Southard, Tang, Villemain; and professors emeriti Briggs, Costa, Crumm, Harding, Marks, McKelvey, Patsiga, Ramsey, Scroton, Sowa, Syty, Varghese, Zambotti

Degree programs offered by the Department of Chemistry are the Bachelor of Science (BS) with a major in Chemistry and the Bachelor of Science in Education (BSEd) with a major in Chemistry. Additionally, Pre-medical, Pre-pharmacy, and Interdisciplinary Tracks are available in the BS program. Preparatory programs for other professional schools can also be developed, using the Interdisciplinary Track, and a minor in Chemistry is offered.

Chemistry is a field that has historically enjoyed very strong career possibilities. Many students are employed directly after their undergraduate education by the chemical, pharmaceutical or related industries, in jobs that have excellent career prospects. Graduate school in chemistry or biochemistry usually includes very generous financial support, and can lead to outstanding career paths in industry, government or academic areas. These opportunities are available to students completing any of the degree programs offered by the Department of Chemistry, and graduates of these programs have gone on to industrial leadership positions, and some of the most prestigious graduate programs in the country.

The BS degree with a major in Chemistry is designed for a student intending a career in chemistry and is certified by the American Chemical Society. The advanced courses and strong laboratory component in this degree program gives the student excellent preparation for the challenges of employment or graduate school.

The Pre-medical and Pre-pharmacy Tracks of the BS degree allow students to take all courses required for entrance into their intended professional health program, and gives them the flexibility to tailor their program to meet their individual needs. Students in these tracks retain the option of: (a) attending medical or pharmacy school, (b) attending graduate school in chemistry, biochemistry, pharmacology, or a variety of medically-related PhD programs, (c) employment in the chemistry or pharmaceutical industry. Additionally, the flexibility of these tracks allows students to change the focus of their degree program during their undergraduate experience.

The curriculum leading to the BS—Interdisciplinary Chemistry Track is designed to allow for the workable union of other disciplines with chemistry in such a way as to retain the fundamental science and mathematics requirements needed for a career in chemistry. The Interdisciplinary Chemistry Track can also provide excellent preparation for entrance into a variety of professional schools, including law school—students considering this path should work closely with their advisor to choose courses appropriate to meet professional school requirements. This degree may be of interest to students who have completed a significant number of credits in another degree program and decide they want to earn a degree with a major in chemistry. The Interdisciplinary Chemistry Track can incorporate a minor from almost any other field in the university; some disciplines that make useful combinations include art, biology, business administration, computer science, criminology (forensic science), English (technical writing), geoscience, government, and physics. In particular, a student seeking a career in forensic science should major in chemistry.

The curriculum leading to the BSEd—Chemistry is designed to prepare the student to teach chemistry at the secondary school level. Upon completion of the specified course work and the requirements of the teacher certification process, the student is eligible for Pennsylvania certification by the Pennsylvania Department of Education.

## Bachelor of Science—Chemistry

**Liberal Studies:** As outlined in Liberal Studies section with the following specifications: 44

**Mathematics:** MATH 125

**Natural Science:** PHYS 131-141 and 132-142

**Liberal Studies Elective:** 3cr, MATH 126

**Major:** 50

### Required Courses:

CHEM 111	General Chemistry I <i>or</i>	
<i>or</i> 113	Advanced General Chemistry I	4cr
CHEM 112	General Chemistry II <i>or</i>	
<i>or</i> 114	Advanced General Chemistry II	4cr
CHEM 214	Intermediate Inorganic Chemistry	3cr
CHEM 231	Organic Chemistry I	4cr
CHEM 232	Organic Chemistry II	4cr
CHEM 290	Chemistry Seminar I	1cr
CHEM 325	Analytical Chemistry I	4cr
CHEM 326	Analytical Chemistry II	4cr
CHEM 341	Physical Chemistry I	4cr
CHEM 342	Physical Chemistry II	3cr
CHEM 343	Physical Chemistry Laboratory I	1cr
CHEM 344	Physical Chemistry Laboratory II	1cr
CHEM 390	Chemistry Seminar II	1cr
CHEM 411	Advanced Inorganic Chemistry	3cr
CHEM 490	Chemistry Seminar III	1cr
CHEM 498	Problems in Chemistry	2cr
BIOC 301	Foundations of Biochemistry	3cr

### Controlled Electives:

At least 3cr from CHEM or BIOC at or above the 300 level 3cr

**Other Requirements:** 10

BIOL 202 Principles of Cell and Molecular Biology 4cr

MATH 225 Calculus III/Physics, Chemistry, Mathematics 3cr

One course from the following: MATH 171, 216, or 341 3cr

**Free Electives:** 16

**Total Degree Requirements:** 120

## Bachelor of Science—Chemistry/Interdisciplinary Chemistry Track

**Liberal Studies:** As outlined in Liberal Studies section with the following specifications: 44

**Mathematics:** MATH 125 (1)

**Natural Science:** PHYS 111-121 and 112-122 or 131-141 and 132-142

**Liberal Studies Elective:** 3cr, MATH 126 (1), no course with CHEM prefix

**Major:** 35-37

### Required Courses:

CHEM 111	General Chemistry I <i>or</i>	
<i>or</i> 113	Advanced General Chemistry I	4cr
CHEM 112	General Chemistry II <i>or</i>	
<i>or</i> 114	Advanced General Chemistry II	4cr
CHEM 214	Intermediate Inorganic Chemistry	3cr
CHEM 231	Organic Chemistry I	4cr
CHEM 232	Organic Chemistry II	4cr
CHEM 290	Chemistry Seminar I	1cr
CHEM 325	Analytical Chemistry I	4cr
CHEM 341	Physical Chemistry I	4cr

### Controlled Electives:

CHEM 343 or 390 and 490 (2) 1-2cr

BIOC 301 or CHEM 351 3-4cr

At least 3cr from CHEM or BIOC at or above the 300 level or above (3) 3cr

<b>Other Requirements:</b>	25
BIOL 202 Principles of Cell and Molecular Biology	4cr
One course from the following: MATH 171, 216, 225, or 341	3cr
<b>Minor:</b> (or second major) in a field outside chemistry (4)	18cr
<b>Free Electives:</b>	14-16
<b>Total Degree Requirements:</b>	120
(1) For students transferring into the program, MATH 121 and 122 may be substituted for MATH 125 and 126, respectively.	
(2) Program contains one writing-intensive credit; students need to acquire another W-credit in Liberal Studies, or as a free or controlled elective.	
(3) CHEM 343, 390, and 490 can all be taken, but student still requires at least 1cr additional of CHEM or BIOC courses at the 300 level or above. BIOC 301 and CHEM 351 cannot both be taken.	
(4) A pre-law concentration has been established—information on this and suggested minor programs is available on the chemistry department website. Alternate (non-minor) programs containing at least 18cr are also possible—they must be approved by the advisor and department chair.	

### Bachelor of Science—Chemistry/Pre-medical Track

<b>Liberal Studies:</b> As outlined in Liberal Studies section with the following specifications:	44
<b>Mathematics:</b> MATH 125 (1)	
<b>Natural Science:</b> PHYS 111-121 and 112-122 or 131-141 and 132-142	
<b>Philosophy or Religious Studies:</b> PHIL 122	
<b>Social Science:</b> PSYC 101, SOC 151 or 161 or ANTH 110 or 211 (2, 3)	
<b>Liberal Studies Elective:</b> 3cr, MATH 126 (1), no course with CHEM prefix	
<b>Major:</b>	49
<b>Required Courses:</b>	
CHEM 111 General Chemistry I <i>or</i>	
<i>or</i> 113 Advanced General Chemistry I	4cr
CHEM 112 General Chemistry II <i>or</i>	
<i>or</i> 114 Advanced General Chemistry II	4cr
CHEM 214 Intermediate Inorganic Chemistry	3cr
CHEM 231 Organic Chemistry I	4cr
CHEM 232 Organic Chemistry II	4cr
CHEM 290 Chemistry Seminar I	1cr
CHEM 325 Analytical Chemistry I	4cr
CHEM 341 Physical Chemistry I	4cr
CHEM 390 Chemistry Seminar II	1cr
CHEM 490 Chemistry Seminar III	1cr
CHEM 498 Problems in Chemistry	2cr
BIOC 301 Foundations of Biochemistry	3cr
BIOC 302 Advanced Biochemistry	3cr
<b>Controlled Electives:</b>	
At least 11 additional credits from the following: (2, 3, 4)	11cr
BIOC 311, 312, 481, BIOL 150, 240, 241, 250, 331, CHEM 326, 331, 342, 343, 344, 411, 481, MATH 225	
<b>Other Requirements:</b>	11
BIOL 202 Principles of Cell and Molecular Biology	4cr
BIOL 203 Principles of Genetics and Development	4cr
MATH 216 Probability and Statistics	3cr
<b>Free Electives:</b>	16
<b>Total Degree Requirements:</b>	120
(1) For students transferring into the program, MATH 121 and 122 may be substituted for MATH 125 and 126, respectively.	
(2) The application requirements of specific schools of medicine may result in the need to take additional courses. Students should be aware of the requirements at each program in which they are interested, and plan to take courses accordingly to meet these requirements.	

- (3) Students enrolled at an accredited school of medicine after three years at IUP may count the following toward the requirements for the Bachelor of Science—Chemistry/Pre-medical Track: 3cr of Liberal Studies social science; 11cr of required CHEM courses (see below); 13cr of free electives (total 27cr). Upon completing the first year of medical school, students electing this option are not required to take CHEM 214, 325, and 341. If these CHEM courses are taken, they may be counted toward the controlled elective requirement.
- (4) To qualify for an ACS-certified degree in chemistry, students must take BIOC 311, CHEM 343, and two courses from the following list: BIOC 481, CHEM 326, 331, 342, 411, or 481.

### Bachelor of Science—Chemistry/Pre-pharmacy Track

<b>Liberal Studies:</b> As outlined in Liberal Studies section with the following specifications:	44
<b>Mathematics:</b> MATH 125 (1)	
<b>Natural Science:</b> PHYS 111-121 and 112-122 or 131-141 and 132-142	
<b>Philosophy or Religious Studies:</b> PHIL 122	
<b>Social Science:</b> PSYC 101 and ECON 101 or 122 (2, 3)	
<b>Liberal Studies Elective:</b> 3cr, MATH 126 (1), no course with CHEM prefix	
<b>Major:</b>	49
<b>Required Courses:</b>	
CHEM 111 General Chemistry I <i>or</i>	
<i>or</i> 113 Advanced General Chemistry I	4cr
CHEM 112 General Chemistry II <i>or</i>	
<i>or</i> 114 Advanced General Chemistry II	4cr
CHEM 214 Intermediate Inorganic Chemistry (3)	3cr
CHEM 231 Organic Chemistry I	4cr
CHEM 232 Organic Chemistry II	4cr
CHEM 290 Chemistry Seminar I	1cr
CHEM 325 Analytical Chemistry I (3)	4cr
CHEM 341 Physical Chemistry I (3)	4cr
CHEM 390 Chemistry Seminar II	1cr
CHEM 490 Chemistry Seminar III	1cr
<b>Controlled Electives:</b> (2, 3, 4)	19cr
At least 19cr, consisting of:	
(1) BIOC 301 and 302 (6cr) <i>or</i> CHEM 351 (4cr)	
(2) Courses from the following: BCOM 321 or ENGL 310, BIOC 311, 312, 481, BIOL 150, 240, 241, 250, CHEM 326, 331, 342, 343, 344, 411, 481, 498, MATH 225	
<b>Other Requirements:</b>	11
BIOL 202 Principles of Cell and Molecular Biology	4cr
BIOL 203 Principles of Genetics and Development	4cr
MATH 216 Probability and Statistics	3cr
<b>Free Electives:</b> (2, 3)	16
<b>Total Degree Requirements:</b>	120
(1) For students transferring into the program, MATH 121 and 122 may be substituted for MATH 125 and 126, respectively.	
(2) The application requirements of specific schools of pharmacy may result in the need to take additional courses. Students should be aware of the requirements at each program in which they are interested, and plan to take courses accordingly to meet these requirements.	
(3) Students enrolled at an accredited school of pharmacy after three years at IUP may count the following toward the requirements for the Bachelor of Science—Chemistry/Pre-pharmacy Track: 3cr of Liberal Studies social science; 11cr of required CHEM courses (see below); 13cr of free electives (total 27cr). Upon completing the first year of pharmacy school, students electing this option are not required to take CHEM 214, 325, and 341. If these CHEM courses are taken, they may be counted toward the controlled elective requirement.	
(4) To qualify for an ACS-certified degree in chemistry, students must take BIOC 311 and CHEM 498. Additionally, they must take three lecture courses and one lab course from the following list: BIOC 302, 312,	

481, CHEM 326, 331, 342, 343, 411, or 481. CHEM 326 and 411 count as both a lecture and a lab course

CHEM 112	General Chemistry II <i>or</i>	4cr
<i>or</i> 114	Advanced General Chemistry II	
CHEM 231	Organic Chemistry I	4cr
At least 7cr from the following: CHEM 214, 232, or any CHEM or BIOC course(s) at the 300 level or above		7cr

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### Bachelor of Science in Education—Chemistry (\*)

**Liberal Studies:** As outlined in Liberal Studies section with the following specifications: 44

**Mathematics:** MATH 125

**Natural Science:** PHYS 111-121 and 112-122 or 131-141 and 132-142

**Social Science:** PSYC 101

**Liberal Studies Elective:** 3cr, MATH 126, no course with CHEM prefix

**College:** 31

**Preprofessional Education Sequence:**

ACE 103 Digital Instructional Technology 3cr

EDSP 102 Educational Psychology 3cr

**Professional Education Sequence:**

EDEX 301 Education of Students with Disabilities in Inclusive Secondary Settings 2cr

EDEX 323 Instruction of English Language Learners with Special Needs 2cr

EDSP 477 Assessment of Student Learning: Design and Interpretation of Educational Measures 3cr

EDUC 242 Pre-student Teaching Clinical Experience I 1cr

EDUC 342 Pre-student Teaching Clinical Experience II 1cr

EDUC 441 Student Teaching 12cr

EDUC 442 School Law 1cr

EDUC 451 Teaching Science in the Secondary School 3cr

**Major:** 36-37

**Required Courses:**

CHEM 111 General Chemistry I *or*  
*or* 113 Advanced General Chemistry I 4cr

CHEM 112 General Chemistry II *or*  
*or* 114 Advanced General Chemistry II 4cr

CHEM 214 Intermediate Inorganic Chemistry 3cr

CHEM 231 Organic Chemistry I 4cr

CHEM 232 Organic Chemistry II 4cr

CHEM 325 Analytical Chemistry I 4cr

CHEM 341 Physical Chemistry I 4cr

CHEM 343 Physical Chemistry Laboratory I 1cr

CHEM 390 Chemistry Seminar II (1) 1cr

CHEM 498 Problems in Chemistry (1, 2) 1cr

**Controlled Electives: (2)**

BIOC 301 or CHEM 351 3-4cr

At least 3cr additional CHEM or BIOC at or above the 300 level 3cr

**Other Requirements:** 8

BIOL 202 Principles of Cell and Molecular Biology 4cr

GEOS 201 Foundations of Geology 4cr

**Free Electives: (1)** 0-1

**Total Degree Requirements:** 120

(\*) See requirement leading to teacher certification, titled "3-Step Process for Teacher Education," in the College of Education and Communications section of this catalog.

(1) Program contains one writing-intensive course (CHEM 343); students need to acquire another W-course in Liberal Studies or as an elective.

(2) Students in the Chemistry Education program who wish to earn an ACS-certified degree in chemistry must take 2cr of CHEM 498, including a written report, and complete at least 7cr, including two lab courses, of CHEM or BIOC at or above the 300 level.

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### Minor—Chemistry 19

**Required Courses:**

CHEM 111 General Chemistry I *or* 4cr

*or* 113 Advanced General Chemistry I