

# Department of Chemistry and Biochemistry

(College of Humanities, Arts and Sciences)

[www.chem.uni.edu/](http://www.chem.uni.edu/)

The Department of Chemistry and Biochemistry offers the following programs:

## Undergraduate Majors (B.S.)

- Biochemistry (p. 1)
- Chemistry (p. 2)

## Undergraduate Majors (B.A.)

- Biochemistry (p. 3)
- Chemistry (p. 3)
- Chemistry-Teaching (p. 3)

## Minors

- Chemistry (p. 5)
- Materials Science and Technology (p. 5) (also listed in Department of Physics and Department of Applied Engineering)

Major programs are offered by the Department of Chemistry and Biochemistry in two baccalaureate degree areas:

- the Bachelor of Science and
- the Bachelor of Arts

1. Students considering a baccalaureate chemistry major should complete two semesters of general chemistry, CHEM 1110 and CHEM 1120, in the freshman year. Well-prepared students may be permitted to take CHEM 1130, an accelerated course in general chemistry, during their first semester. It is strongly recommended that chemistry majors complete requirements in mathematics and physics within the first two years.

2. Prior to enrollment in a chemistry course, all pre-requisite courses must be completed with a grade of C- or higher.

3. A student enrolled in a chemistry course during fall or spring semester and who wishes to enroll in the same course in the subsequent spring or fall semester should contact the department. The student will be allowed to register only if space remains after all advance registrations are completed.

4. A student cannot declare a Chemistry minor if they are pursuing any B.A. or B.S. major in the Department of Chemistry and Biochemistry. Two majors cannot be earned within the department except for the combination of the B.A. Chemistry Teaching major and either the B.S. Chemistry or the B.S. Biochemistry major.

## Bachelor of Science Degree Programs

### Biochemistry Major

The B.S. Biochemistry major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

The Bachelor of Science Biochemistry major is accredited by the American Chemical Society. This major prepares students for careers and/or advanced study in biochemistry. It also provides partial preparation appropriate for medical school and other health-related programs.

#### Required

Mathematics:		
MATH 1420	Calculus I *	4
MATH 1421	Calculus II	4
Biology:		
BIOL 2052	General Biology: Cell Structure and Function	4
BIOL 3140	Genetics ***	4
Chemistry and Biochemistry:		
CHEM 1110 & CHEM 1120 or CHEM 1130	General Chemistry I and General Chemistry II (*)	5-8
CHEM 1610	Careers In Chemistry	1
CHEM 2010	Chemical Safety Seminar	1
CHEM 2110	Descriptive Inorganic Chemistry	4
CHEM 2210	Organic Chemistry I	3
CHEM 2220	Organic Chemistry II	3
CHEM 2230	Organic Chemistry Laboratory	2
CHEM 2320	Chemical Analysis	3
CHEM 2330	Chemical Analysis Laboratory	2
CHEM 3600	Undergraduate Research in Chemistry @	2
CHEM 4220/5220 or CHEM 4310/5310	Organic Structure Analysis Instrumental Analysis	3
CHEM 4420/5420	Physical Chemistry I	3
CHEM 4430/5430	Physical Chemistry II	3
CHEM 4440/5440	Physical Chemistry Laboratory	2
CHEM 4510/5510	Biochemistry I	3
CHEM 4520/5520	Biochemistry II	3
CHEM 4530/5530	Biochemistry Laboratory	2
Physics:		
Select one of the following:		8

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PHYSICS 1511 & PHYSICS 1512 OR	General Physics I and General Physics II	
PHYSICS 1701 & PHYSICS 1702	Physics I for Science and Engineering and Physics II for Science and Engineering	
Electives		3-4
3000-level or higher content course(s) in biology or chemistry		
Total hours		72-75

\* Has prerequisite of satisfactory score on ALEKS exam or subsequent remediation.

\*\*BIOL 3140 has a prerequisite of BIOL 2051. BIOL 2051 is waived as a prerequisite for Biochemistry majors.

@This course meets the Bachelor of Science degree undergraduate research course requirement.

### Notes:

1. The elective course should be chosen with the help of the major advisor. This is particularly important for students wishing to earn a certified degree, to assure consistency with the certification guidelines of the American Chemical Society. An appropriate advanced course in another science may be substituted with department head approval.
2. To satisfy American Chemical Society guidelines for certification of the Biochemistry major, the two hours of CHEM 3600 Undergraduate Research required for this program must include completion of a final written report.

## Chemistry Major

The B.S. Chemistry major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

The Bachelor of Science Chemistry major is accredited by the American Chemical Society. This program is recommended for students who wish to prepare for careers as professional chemists. It also provides the most complete preparation for post-graduate study in the field of chemistry.

### Required

Mathematics:		
MATH 1420	Calculus I *	4
MATH 1421	Calculus II	4
Chemistry and Biochemistry:		
CHEM 1110 & CHEM 1120 or CHEM 1130	General Chemistry I and General Chemistry II (*) General Chemistry I-II	5-8
CHEM 1610	Careers In Chemistry	1
CHEM 2010	Chemical Safety Seminar	1
CHEM 2110	Descriptive Inorganic Chemistry	4
CHEM 2210	Organic Chemistry I	3
CHEM 2220	Organic Chemistry II	3

CHEM 2230	Organic Chemistry Laboratory	2
CHEM 2320	Chemical Analysis	3
CHEM 2330	Chemical Analysis Laboratory	2
CHEM 3600	Undergraduate Research in Chemistry @	2
CHEM 4110/5110	Inorganic Chemistry	3
CHEM 4310/5310	Instrumental Analysis	3
CHEM 4420/5420	Physical Chemistry I	3
CHEM 4430/5430	Physical Chemistry II	3
CHEM 4440/5440	Physical Chemistry Laboratory	2
CHEM 4510/5510	Biochemistry I	3
CHEM 4610/5610	Advanced Synthesis Laboratory	2

Physics: 8

PHYSICS 1701 & PHYSICS 1702	Physics I for Science and Engineering and Physics II for Science and Engineering	
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or

PHYSICS 1512 & PHYSICS 1511	General Physics II and General Physics I	
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**Elective 3**

A 3000-level or higher chemistry content course.

**Total Hours 64-67**

\* Has prerequisite of satisfactory score on ALEKS exam or subsequent remediation.

@This course meets the Bachelor of Science degree undergraduate research course requirement.

### Notes:

1. To satisfy American Chemical Society guidelines for certification of the Chemistry major, the two hours of CHEM 3600 Undergraduate Research required for this program must include completion of a final written report.
2. The elective course should be chosen with the help of the major advisor. This is particularly important for students wishing to earn a certified degree, to assure consistency with the certification guidelines of the American Chemical Society. An appropriate advanced course in another science may be substituted with department head approval.
3. Students wishing to earn a non-certified Bachelor of Science degree may omit CHEM 4110/5110, CHEM 4610/5610, and CHEM 4510/5510, but must include six additional elective hours in chemistry at the 4000-level or higher.

## Emphasis-Honors Research

This emphasis is available to qualified students pursuing the Bachelor of Science program by invitation at the beginning of their junior year. Completion of Honors Research requires 5 credit hours in CHEM 3600 Undergraduate Research and the writing of a senior research thesis. The research credit may be applied to the elective hours of the B.S. degree.

## Bachelor of Arts Degree Programs

### Biochemistry Major

The B.A. Biochemistry major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

This program provides experience in most basic areas of chemistry, with a focus on biochemistry. With appropriate choice of university electives, the B.A. Biochemistry major meets the needs of pre-medical students and students preparing for additional study in related areas such as pharmacology, medicinal chemistry, clinical chemistry, and toxicology. It is also suitable for students who wish to combine a chemistry major with a major in another discipline.

#### Required

Mathematics:		
MATH 1420	Calculus I *	4
Biology:		
BIOL 2052	General Biology: Cell Structure and Function	4
BIOL 3140	Genetics **	4
Chemistry and Biochemistry:		
CHEM 1110 & CHEM 1120 or CHEM 1130	General Chemistry I and General Chemistry II (*) General Chemistry I-II	5-8
CHEM 1610	Careers In Chemistry	1
CHEM 2010	Chemical Safety Seminar	1
CHEM 2110	Descriptive Inorganic Chemistry	4-5
or CHEM 2320 & CHEM 2330	Chemical Analysis and Chemical Analysis Laboratory	
CHEM 2210	Organic Chemistry I	3
CHEM 2220	Organic Chemistry II	3
CHEM 2230	Organic Chemistry Laboratory	2
CHEM 4420/5420	Physical Chemistry I	3
CHEM 4510/5510	Biochemistry I	3
CHEM 4520/5520	Biochemistry II	3
CHEM 4530/5530	Biochemistry Laboratory	2
Physics:		
PHYSICS 1511 & PHYSICS 1512 or PHYSICS 1701 & PHYSICS 1702	General Physics I and General Physics II Physics I for Science and Engineering and Physics II for Science and Engineering	8
Electives		3-4
3000-level or higher content course(s) in biology or chemistry		
Total hours		53-58

\* Has prerequisite of satisfactory score on ALEKS exam or subsequent remediation.

\*\*BIOL 3140 has a prerequisite of BIOL 2051. BIOL 2051 is waived as a prerequisite for Biochemistry majors.

### Chemistry Major

The B.A. Chemistry major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

This program provides experience in all basic areas of chemistry. With appropriate choice of university electives, the B.A. Chemistry major meets the needs of pre-medical students and students preparing for additional study in related areas such as biochemistry, industrial hygiene, pharmacology and medicinal chemistry, clinical chemistry, and toxicology. It is also suitable for students who wish to combine a chemistry major with a major in another discipline.

#### Required

Mathematics:		
MATH 1420	Calculus I *	4
MATH 1421	Calculus II	4
Chemistry and Biochemistry:		
CHEM 1110 & CHEM 1120 or CHEM 1130	General Chemistry I and General Chemistry II (*) General Chemistry I-II	5-8
CHEM 1610	Careers In Chemistry	1
CHEM 2010	Chemical Safety Seminar	1
CHEM 2110	Descriptive Inorganic Chemistry	4
CHEM 2210	Organic Chemistry I	3
CHEM 2220	Organic Chemistry II	3
CHEM 2230	Organic Chemistry Laboratory	2
CHEM 2320	Chemical Analysis	3
CHEM 2330	Chemical Analysis Laboratory	2
CHEM 4310/5310	Instrumental Analysis	3
CHEM 4420/5420	Physical Chemistry I	3
CHEM 4430/5430	Physical Chemistry II	3
Physics:		
Select one of the following:		8
PHYSICS 1511 & PHYSICS 1512 or PHYSICS 1701 & PHYSICS 1702	General Physics I and General Physics II Physics I for Science and Engineering and Physics II for Science and Engineering	
<b>Total Hours</b>		<b>49-52</b>

\* Has prerequisite of satisfactory score on ALEKS exam or subsequent remediation.

### Chemistry Major-Teaching

The B.A. Chemistry-Teaching major requires a minimum of 120 total hours to graduate. This total includes UNIFI/General Education requirements, the Professional Experiences requirements, Educator Essentials requirements, and the following specified major requirements, to complete the minimum of 120 hours.

This program provides preparation for chemistry teachers with successful completion leading to recommendation for State of Iowa

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licensure in endorsement #152 5-12 Chemistry. Coursework that leads to additional endorsements is recommended and should be selected in consultation with your advisor.

### Required

Mathematics:		
MATH 1420	Calculus I *	4
Chemistry and Biochemistry:		
CHEM 1110 & CHEM 1120	General Chemistry I and General Chemistry II (*)	8
CHEM 2010	Chemical Safety Seminar	1
CHEM 2040	Applied Organic and Biochemistry	4
CHEM 2110	Descriptive Inorganic Chemistry	4
CHEM 2320	Chemical Analysis	3
CHEM 2330	Chemical Analysis Laboratory	2
CHEM 4420/5420	Physical Chemistry I	3
Physics:		
Select one of the following:		
PHYSICS 1511 & PHYSICS 1512	General Physics I and General Physics II	
or		
PHYSICS 1701 & PHYSICS 1702	Physics I for Science and Engineering and Physics II for Science and Engineering	
<b>Total Hours</b>		<b>37</b>

\* Has prerequisite of satisfactory score on ALEKS exam or subsequent remediation.

### Notes:

- Well-prepared students may substitute *CHEM 1130* for CHEM 1110 and CHEM 1120 ; these students must also substitute CHEM 2210 and CHEM 2230 and CHEM 2220 for CHEM 2040.

## Professional Experiences

Required:

EDUC 2385	Teaching Methods I: Secondary Science *,**	3
EDUC 2485	Teaching Internship I: Secondary Science	3
EDUC 3585/5585	Teaching Methods II: Secondary Science *	3
EDUC 3685/5685	Teaching Internship II: Secondary Science	3
EDUC 4138	Secondary School Teaching	12
<b>Total Hours</b>		<b>24</b>

\* A grade of C (2.00) or higher is required for all Methods courses.

\*\*Chemistry Teaching majors can count EDUC 2385 Teaching Methods I: Secondary Science for category 5 of Educator Essentials.

## Educator Essentials

Required: \*

Select one of the following in each category:

<b>Category 1: The Learner</b>		<b>3</b>
EDPSYCH 1500	Reflections on Learning	
EDPSYCH 2068	Development and Learning in Sociocultural Contexts	
EDPSYCH 2100	Creativity and Higher Order Thinking in the Classroom	
SOCFOUND 2243	Rethinking the Learning Society: Education and Its Future(s)	
<b>Category 2: Social Contexts of Learning</b>		<b>3</b>
SOCFOUND 2119	Social & Cultural Foundations of Education	
SOCFOUND 2134	A Modern History of Education in the United States	
SOCFOUND 2334	Education Policy and Politics of Education	
TESOL 2015	Language Today	
<b>Category 3: Education for All</b>		<b>3</b>
KINES 4152	Adapted Physical Education	
SOCFOUND 3334	Education, Power, and Change	
SOCFOUND 3434	Social Movements and Education	
SPIE 3140	Interdisciplinary and Intersectional Study of Education for All	
SPIE 3150	Meeting the Needs of Diverse Learners in Classrooms	
TESOL 3710	Content Area Strategies for English Language Learners	
<b>Category 4: The Classroom Environment</b>		<b>3</b>
EDPSYCH 3200	Deeper Motivation and the Highly Engaged Classroom	
EDPSYCH 3300	Level Up: Gamified Learning Environments	
ELEMECML 4151	Early Childhood Curriculum Development and Organization	
RTNL 3360	Playful Learning and Project-Based Experiences: Techniques for Ed and Recreational Environments	
SOCFOUND 3219	Critical Perspectives on Technology and Education	
<b>Category 5: Effective Pedagogy</b>		<b>3</b>
ARTED 4600	Expressive Learning Assessment	
LRNTECH 3600	Technology, Pedagogy, and Learning in the Digital Age	
MEASRES 3510	Assessment for Learning	
TEACHING 3500	Effective Teaching through Differentiation, Technology and Assessment	
<b>Category 6: The Professional Educator</b>		<b>3</b>

ELEMECML 3149	Child, Family, School and Community Relationships
SOCFOUND 3519	Teacher Leadership & Educational Change
TEACHING 3177	Collaborative Partnerships for Educators
<b>Total Hours</b>	<b>18</b>

\* A grade of C (2.00) or higher is required in each Educator Essentials course.

## Minors

### Chemistry Minor

A student cannot declare a Chemistry minor if they are pursuing any B.A. or B.S. major in the Department of Chemistry and Biochemistry.

#### Required

Chemistry and Biochemistry:	
CHEM 1110	General Chemistry I
& CHEM 1120	and General Chemistry II (*)
or CHEM 1130	General Chemistry I-II
Electives	14
<b>Total Hours</b>	<b>19-22</b>

\* Has prerequisite of satisfactory score on ALEKS exam or subsequent remediation.

Note: Courses numbered 2000 and above may be used as electives for the Chemistry Minor, with the following exceptions: CHEM 2010, CHEM 4630/5630, and any Cooperative Education, Independent Study, Readings, Research, and Seminar courses.

#### Following are some suggested elective courses to complete the Chemistry Minor:

CHEM 2040	Applied Organic and Biochemistry
CHEM 2110	Descriptive Inorganic Chemistry
CHEM 2210	Organic Chemistry I
CHEM 2220	Organic Chemistry II **
CHEM 2230	Organic Chemistry Laboratory
CHEM 2320	Chemical Analysis
CHEM 2330	Chemical Analysis Laboratory **
CHEM 3305/5305	Environmental Chemistry **
CHEM 4200/5200	Nanoscience **
CHEM 4210/5210	Nanotechnology **
CHEM 4310/5310	Instrumental Analysis **
CHEM 4420/5420	Physical Chemistry I **
CHEM 4430/5430	Physical Chemistry II **
CHEM 4510/5510	Biochemistry I **
CHEM 4520/5520	Biochemistry II **
CHEM 4505/5505	Drugs, Poisons, and Venoms **

\*\*These courses have additional prerequisites.

### Materials Science and Technology Minor

This is an interdisciplinary minor that is jointly offered by the Departments of Chemistry and Biochemistry, Physics, and Applied Engineering.

Materials science and the use of materials in technology requires the use of concepts from multiple disciplines. This interdisciplinary minor gives students the broad foundation they need to learn about the science of materials and an introduction to how these scientific principles are used in the development and application of materials in new technology. This minor is complementary preparation to a major in Chemistry and Biochemistry, Physics or Manufacturing Engineering Technology for students who are interested in working in industry or going on to advanced study in materials science.

#### Required:

**Choose one of the following three options: <sup>+</sup> 5-8**

##### Option 1 Chemistry (8 hours)

CHEM 1110 General Chemistry I

CHEM 1120 General Chemistry II

##### OR

##### Option 2 Chemistry (5 hours)

CHEM 1130 General Chemistry I-II

##### OR

##### Option 3 Chemistry/Technology (7 hours)

CHEM 1020 Chemical Technology <sup>&</sup>

TECH 3127 Applied Thermodynamics <sup>&</sup>

##### Additional requirements (all three options)

Choose one of the following sets of Physics courses: 8

PHYSICS 1511 General Physics I  
& PHYSICS 1512 and General Physics II

##### OR

PHYSICS 1701 Physics I for Science and  
& PHYSICS 1702 Engineering  
and Physics II for Science and  
Engineering

##### Additional required (all three options)

CHEM 4200/5200 Nanoscience \* 3  
or PHYSICS 4200/5200 Nanoscience

TECH 2072 Engineering Materials 3

**Electives (all three options) - choose one of the following: 3-4**

**Note: in order to earn the Materials Science and Technology minor, the elective course students take for the minor cannot be a required course for their primary major.**

CHEM 2110 Descriptive Inorganic Chemistry \*

CHEM 2320 Chemical Analysis #

CHEM 4210/5210 Nanotechnology \*  
or PHYSICS 4210/5210 Nanotechnology

PHYSICS 4750/5750 Physics of Modern Materials #

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TECH 3132/5132 Metallurgy and Phase  
Transformation

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**Total Hours** **22-26**

**+ There are additional prerequisite courses that must be taken along with the required courses in some options – choose the option that aligns with the courses for your major.**

Prerequisites for TECH 3127: TECH 1024; MATH 1150 or MATH 1420.

Prerequisite or corequisites for PHYSICS 1701: MATH 1420.

Prerequisite or corequisites for PHYSICS 1702: MATH 1421.

\* Students who have declared a Materials Science and Technology Minor may take these courses after completing CHEM 1020 Chemical Technology and TECH 3127 Applied Thermodynamics in place of the usual CHEM 1120 General Chemistry II prerequisite.

& These courses are taken by students in the Manufacturing Engineering Technology major.

# Prerequisite for CHEM 2320: CHEM 1120 or CHEM 1130.  
Prerequisite for PHYSICS 4750/5750: PHYSICS 4100/5100 and PHYSICS 4110/5110.