

Department of

# Chemistry



Les Manner, Department Chair

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## Introduction

Chemistry is the study of matter, energy, and their transformations. The principles of this discipline serve as a theoretical basis for a wide variety of fields such as agriculture, biology, dentistry, engineering, geology, medicine, nutrition, and physics. In addition, chemistry's analytical and logical approach to the world is excellent training for fields such as law and government.

The Department of Chemistry offers three degrees:

- Bachelor's of Science in Chemistry (710)
- Bachelor's of Science in Biochemistry (705)
- Bachelor's of Science in Chemistry Education (810)

In addition to the courses offered for chemistry majors, the department offers service courses to support students in technical majors to meet their requirements for graduation. Introductory courses are offered on several skill levels to meet the needs of incoming students with a variety of backgrounds in math and science.

Studying chemistry at Brigham Young University-Idaho is a unique and rewarding experience. The faculty is experienced and well trained. Their commitment to students and teaching, coupled with small class sizes, provide an excellent learning environment.

Further information regarding the department programs and degrees can be obtained by visiting the department web page:

<http://www.byui.edu/chemistry/>

## Chemistry

Brigham Young University-Idaho 2016-2017

BS in Biochemistry (705)			
<b>Introductory Chemistry Core</b> <i>Take these courses:</i> CHEM 105      4 CHEM 106      4 CHEM 351      4 <hr style="width: 50px; margin-left: 0;"/> 12	<i>Take these courses:</i> BIO 180            4 BIO 321            4 CHEM 220          5 CHEM 352          4 CHEM 391          2 CHEM 468          3 CHEM 481          3 CHEM 482          3 CHEM 485          1 CHEM 498          1-3 MATH 113 or 215   3-4 PH 121              3 PH 150              1 PH 220              3 PH 250              1 <hr style="width: 50px; margin-left: 0;"/> 41	<b>Biology Cluster</b> <i>Take these courses:</i> BIO 181            4 BIO 375            3 BIO 376            3 BIO 377            3 <hr style="width: 50px; margin-left: 0;"/> 13	<b>Program Notes:</b> <ul style="list-style-type: none"> <li>• Double Counting allowed in major and minor courses.</li> <li>• Double Counting NOT allowed in major and cluster courses.</li> <li>• No Grade Less Than C- in Major Courses</li> <li>• For a recommended sequence of courses, please refer to the advising information on the department website: <a href="http://www.byui.edu/chemistry/advising">www.byui.edu/chemistry/advising</a></li> <li>• Biochemistry majors may need to request a track adjustment for the Fall/Winter track upon beginning their junior-level chemistry courses. Please consult with faculty advisor.</li> </ul>
<b>Credit Requirements:</b>		<b>Tracks Available:</b>	
Foundations	40	Fall-Winter	Yes
Major	66	Winter-Spring	Yes
Elective	14	Spring-Fall	Yes
Total	120		

BS in Chemistry (710)			
<b>Introductory Chemistry Core</b> <i>Take these courses:</i> CHEM 105      4 CHEM 106      4 CHEM 351      4 <hr style="width: 50px; margin-left: 0;"/> 12	<i>Take these courses:</i> CHEM 220            5 CHEM 352            4 CHEM 391            2 CHEM 420            2 CHEM 421            2 CHEM 461            3 CHEM 462            3 CHEM 464            2 CHEM 470            3 CHEM 471            2 CHEM 481            3 CHEM 498            1-3 PH 220              3 PH 250              1 <hr style="width: 50px; margin-left: 0;"/> 36	<i>Take this Physics and Math Cluster:</i> MATH 215            4 MATH 316            4 PH 121              3 PH 150              1 <hr style="width: 50px; margin-left: 0;"/> 12	<b>Program Notes:</b> <ul style="list-style-type: none"> <li>• Double Counting allowed in major and minor courses.</li> <li>• Double Counting NOT allowed in major and cluster courses.</li> <li>• No Grade Less Than C- in Major Courses</li> <li>• For a recommended sequence of courses, please refer to the advising information on the department website: <a href="http://www.byui.edu/chemistry/advising">www.byui.edu/chemistry/advising</a></li> <li>• Chemistry majors may need to request a track adjustment for the Fall/Winter track upon beginning their junior-level chemistry courses. Please consult with faculty advisor.</li> </ul>
<b>Credit Requirements:</b>		<b>Tracks Available:</b>	
Foundations	40	Fall-Winter	Yes
Major	60	Winter-Spring	Yes
Elective	20	Spring-Fall	Yes
Total	120		

BS in Chemistry Education (810)				
<b>Education Core</b> <i>Take these courses:</i> ED 200            2 ED 304            3 ED 461            3 ED 492            10 SPED 360        2 <hr style="width: 50px; margin-left: 0;"/> 20	<b>Introductory Core</b> <i>Take these courses during your first 2 semesters:</i> CHEM 105            4 CHEM 106            4 PH 121              3 PH 150              1 <hr style="width: 50px; margin-left: 0;"/> 12  <b>Chemistry</b> <i>Take these courses:</i> CHEM 220            5 CHEM 305            2 CHEM 351            4 CHEM 405            3 <hr style="width: 50px; margin-left: 0;"/> 14	<i>Take 1 course:</i> CHEM 461            3 CHEM 468            3 <hr style="width: 50px; margin-left: 0;"/> 3  <i>Take 7 credits:</i> CHEM 352            4 CHEM 420            2 CHEM 421            2 CHEM 462            3 CHEM 464            2 CHEM 470            3 CHEM 471            2 CHEM 481            3 <hr style="width: 50px; margin-left: 0;"/> 7	<b>Mathematics</b> <i>Take 1 course:</i> MATH 113            3 MATH 215            4 <hr style="width: 50px; margin-left: 0;"/> 3  <b>Physics</b> <i>Take this course:</i> PH 220              3 <hr style="width: 50px; margin-left: 0;"/> 3  <i>Take 1 course:</i> PH 123              3 PH 250              1 PH 311              3 <hr style="width: 50px; margin-left: 0;"/> 1	<b>Program Notes:</b> <ul style="list-style-type: none"> <li>• *Double counting allowed in major and minor courses to complete this degree within the 120 credit limit.</li> <li>• No Grade Less Than C- in Major Courses</li> <li>• Students must minor in Math Ed, Physics Ed, or Physical Science Ed to stay within the 120 credit limit.</li> </ul>
<b>Credit Requirements:</b>			<b>Tracks Available:</b>	
Foundations	40	Fall-Winter	Yes	
Major	43	Winter-Spring	Yes	
Education Core	20	Spring-Fall	Yes	
Education Minor*	20			
Total	120			

## Chemistry

Brigham Young University-Idaho 2016-2017

### Minor in Chemistry (146)

<b>Chemistry Courses</b> <i>Take these courses:</i> CHEM 105           4 CHEM 106           4 <hr style="width: 50%; margin-left: 0;"/> 8	<b>Chemistry Electives</b> <i>Take 12 credits:</i> CHEM 220           5 CHEM 351           4 CHEM 352           4 CHEM 461 or 468   3 CHEM 462           3 CHEM 464           2 CHEM 470           3 CHEM 471           2 CHEM 481           3 CHEM 482           3 <hr style="width: 50%; margin-left: 0;"/> 12	<b>Program Notes:</b> •No Grade Less Than C- in Minor Courses
<b>Credit Requirements:</b> Total                   20		<b>Tracks Available:</b> Fall-Winter           Yes Winter-Spring        Yes Spring-Fall            Yes

### Minor in Chemistry Education (172)

<b>Chemistry Courses</b> <i>Take these courses:</i> CHEM 105           4 CHEM 106           4 CHEM 351           4 <hr style="width: 50%; margin-left: 0;"/> 12	<b>Chemistry Electives</b> <i>Take 8 credits:</i> CHEM 220           5 CHEM 352           4 CHEM 461 or 468   3 CHEM 462           3 CHEM 464           2 CHEM 470           3 CHEM 471           2 CHEM 481           3 CHEM 482           3 <hr style="width: 50%; margin-left: 0;"/> 8	<b>Program Notes:</b> •No Grade Less Than C- in Minor Courses. •Students must major in Biology Ed, Physics Ed, or Earth Science Ed.
<b>Credit Requirements:</b> Total                   20		<b>Tracks Available:</b> Fall-Winter           Yes Winter-Spring        Yes Spring-Fall            Yes

### Biochemistry Concentration (D 112)

<b>Introductory Module</b> <i>Take these courses:</i> CHEM 105           4 CHEM 106           4 CHEM 351           4 <hr style="width: 50%; margin-left: 0;"/> 12  <i>Take these courses:</i> BIO 180             4 BIO 377             3 CHEM 220           5 CHEM 481           3 <hr style="width: 50%; margin-left: 0;"/> 15	<b>Chemistry Electives</b> <i>Take 1 course:</i> BIO 321             4 CHEM 352           4 CHEM 482           3 <hr style="width: 50%; margin-left: 0;"/> 3	<b>Interdisciplinary Courses</b> <i>Take these courses:</i> IDS 398R           1-3 IDS 499             2 <hr style="width: 50%; margin-left: 0;"/> 3	<b>Program Notes:</b> •No Grade Less Than C- in Concentration Courses
<b>Credit Requirements:</b> Total                   33		<b>Tracks Available:</b> Fall-Winter           Yes Winter-Spring        Yes Spring-Fall            Yes	

## Chemistry Predefined Cluster

Chemistry		6500
<i>Take 12 credits:</i>		
CHEM 105	General Chemistry I	4
CHEM 106	General Chemistry II	4
CHEM 150*	Introductory Organic and Biochemistry	5
CHEM 220	Quantitative Analysis	5
	<b>Total Credits</b>	<b>12</b>

OR

*Take 12 credits:*

CHEM 105	General Chemistry I	4
CHEM 106	General Chemistry II	4
CHEM 220	Quantitative Analysis	5
CHEM 351*	Organic Chemistry I	4
CHEM 352*	Organic Chemistry II	4
	<b>Total Credits</b>	<b>12</b>

\*CHEM 150 cannot count with CHEM 351 and/or CHEM 352

Animal Health Chemistry		6502
<i>Take at least 12 credits:</i>		
CHEM 105	General Chemistry I	4
CHEM 106	General Chemistry II	4
CHEM 351	Organic Chemistry I	4
CHEM 481	Biochemistry I	3
CHEM 482	Biochemistry II	3
	<b>Total Credits</b>	<b>12</b>

Physical Science and Mathematics		6800
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*Take 12 credits from at least 2 of the following areas:*

Chemistry	
Take any Chemistry class numbered 105 or higher (CHEM 150 and CHEM 153 cannot be taken with CHEM 351 and/or CHEM 352)	0-10

Physics	
Take any Physics class numbered 105 or higher	0-10

Geology	
Take any Geology class numbered 111 and 111L or higher	0-10

Mathematics	
Take any Mathematics class numbered 111 or higher	0-10
<b>Total Credits</b>	<b>12</b>

## Course Descriptions

## Credits\*

**CHEM 101 Introductory General Chemistry (3:3:0:0)**

Prerequisite: The math requirement will be waived with an ALEKS score of 55 or higher  
Co-requisites: FDMAT 108 or FDMAT 110 or FDMAT 112 or MATH 109 or MATH 113 or MATH 119

An introductory course that covers fundamental concepts of chemistry for students preparing for studies in nursing, paramedicine, agriculture, biology, exercise physiology, health science and other disciplines that require a one semester introduction to chemistry. This course serves as a prerequisite for CHEM 150.  
(Fall, Winter, Spring)

**CHEM 101L Introductory General Chemistry Lab (1:0:3:0)**

Corequisite: CHEM 101

This course is an online introduction to chemistry lab that illustrates principles of chemistry and laboratory techniques. Participation in the course requires reading pre-lab materials, completion of a pre-lab quiz, watching videos demonstrating laboratory procedures, recording data and observations in electronic format, and completing a post-lab quiz.  
(Fall, Winter, Spring)

**CHEM 105 General Chemistry I (4:3:4:0)**

Prerequisite: Math can be waived with an ALEKS score of 70 or higher

Co-requisites: MATH 109 or FDMAT 110 or FDMAT 112 or MATH 113 or MATH 119

This is the first semester of a two-semester course designed to meet the general chemistry requirements in engineering, science, and pre-professional majors. This course includes a lecture and laboratory experience.  
(Fall, Winter, Spring)

**CHEM 106 General Chemistry II (4:3:4:0)**

Prerequisites: CHEM 105 and (FDMAT 110 or FDMAT 112 or MATH 109 or MATH 113 or MATH 119)

The math requirement can be waived with an ALEKS score of 70 or higher  
This is the second semester of a two-semester course designed to meet the general chemistry requirements in engineering, science, and pre-professional majors. This course includes a lecture and laboratory experience.  
(Fall, Winter, Spring)

**CHEM 150 Introductory Organic and Biochemistry (5:5:0:0)**

Prerequisites: CHEM 101 or CHEM 105

This course is a one-semester introduction to organic and biochemistry that is a continuation of Chemistry 101 and is designed for students pursuing degrees or advanced training in nursing, dental hygiene, exercise and sports science, or health science. Students who also need an organic and biochemistry laboratory should concurrently register for Chemistry 153. This course is not preparatory for advanced organic and biochemistry courses.  
(Fall, Winter)

**CHEM 153 Introductory Organic and Biochemistry Lab (1:0:2:0)**

Corequisite: CHEM 150

This course is a laboratory experience that provides an introduction to basic techniques in organic chemistry and introduces the physical and chemical properties of some organic molecules.  
(Winter)

**CHEM 220 Quantitative Analysis (5:2:6:0)**

Prerequisite: CHEM 106

This is a one-semester course that introduces quantitative analytical techniques, instrumental analysis, and associated chemical principles. This course includes a lecture and laboratory experience.  
(Fall, Spring)

**CHEM 305 Science Teaching Principles (2:1:1:0)**

Course equivalent to BIO 305, GEOL 305, and PH 305

Prerequisites: ED 200 and CHEM 106

This course is designed to be taken in the 1st semester of the junior year. Students in this class receive experience in lesson preparation and teaching of general biology topics to non-major biology students. This class is based on a mix of classroom discussion on various aspects of science teaching, and preparation and execution of mentor-directed teaching experiences.  
(Fall, Winter)

**CHEM 351 Organic Chemistry I (4:3:4:0)**

Prerequisite: CHEM 106

The first semester of a year-long course that studies the principles and theories of organic chemistry including the properties, preparation, and reactions of organic compounds. The course is designed for students in Chemistry, Chemical Engineering, Pre-medicine, Pre-dentistry, Pre-pharmacy, Pre-veterinary, and Biology. This course includes a lecture and laboratory experience.  
(Fall, Winter, Spring)

**CHEM 352 Organic Chemistry II (4:3:4:0)**

Prerequisite: CHEM 351

The second semester of a year-long course presenting the principles and theories of organic chemistry including the properties, preparation and reactions of organic compounds. The course is designed for students in Chemistry, Chemical Engineering, Pre-medicine, Pre-dentistry, Pre-veterinary and Biology. This course includes a lecture and laboratory experience.  
(Fall, Winter, Spring)

**CHEM 391 Technical Writing in Chemical Literature (2:2:0:0)**

Prerequisites: FDENG 301 and CHEM 106

This course provides instruction and experience in advanced writing techniques for students planning careers in chemistry or related scientific disciplines. The course will help students do the following: 1) prepare for further chemistry courses that require scientific writing as a part of their curriculum, 2) search the chemical literature using relevant database tools, 3) develop practical experience in writing for a professional, technical audience, 4) and become more effective written communicators in their future scientific careers. This course is a prerequisite for CHEM 220, CHEM 464, and CHEM 471.

(Fall, Winter)

**CHEM 405 Science Teaching Methods (3:2:3:0)**

Course equivalent to BIO 405, GEOL 405, and PH 403

Prerequisites: BIO 305

Corequisite: ED 461

The focus of this course is on preparing students to be prepared to in general science teaching methods and will include basic information and variances found within the different science teaching fields (i.e. Life Science, Earth Science, and Physical Science). The scope will include laboratory safety and design, incorporating demonstrations in teaching, designing curricula and assessments specific to science courses, the Next Generation Science Standards, and other teaching methods specific to science subjects. There is a practicum component to the course that will allow the students to practice these methods by teaching students at the junior high level.

(Fall, Winter, Spring)

**CHEM 420 Instrumental Analysis (2:2:0:0)**

Prerequisites: CHEM 220 and CHEM 352 and PH 250

This is a second semester analytical chemistry course building upon and reinforcing principles and concepts introduced in CHEM 220 Quantitative Analysis (e.g., the analytical process, data collection, and data analysis). Emphasis will be placed on the theories and applications of modern chemical instrumentation. The correct use and selection of chemical instrumentation for the purpose of solving chemical problems will be investigated.

(Fall)

**CHEM 421 Instrumental Analysis Lab (2:0:6:0)**

Corequisite: CHEM 420

This course will serve as the accompanying lab to Instrumental Analysis (CHEM 420). Students will gain hands-on experience using a selection of instruments to solve chemical problems. Laboratory experiments will include the use of the following: flame atomic absorption spectrometer, ultraviolet/visible light spectrophotometer, spectrofluorometer, Fourier transform infrared spectrometer, gas chromatograph mass spectrometer, liquid chromatograph, capillary electrophoresis instrument, and a potentiostat.

(Fall)

**CHEM 461 Physical Chemistry (3:3:0:0)**

Prerequisites: (CHEM 351 and PH 220) or (CHEM 351 and MATH 215 and PH 220)

This is the first semester of a course covering the fundamental concepts of physical chemistry. This course provides a theoretical and mathematical description of the physical behavior of chemical systems. The first semester covers quantum mechanics and spectroscopy.

(Fall)

**CHEM 462 Physical Chemistry II (3:3:0:0)**

Prerequisites: CHEM 461 and MATH 316

This is the second semester of a course covering the fundamental concepts of physical chemistry. This course provides a theoretical and mathematical description of the physical behavior of chemical systems. The second semester covers statistical mechanics, thermodynamics, and kinetics.

(Winter)

**CHEM 464 Physical and Instrumental Chemistry Lab (2:0:6:0)**

Prerequisites: CHEM 220 and CHEM 461 and PH 250

Corequisite: CHEM 462

In this course, students will gain laboratory experience with modern instrumentation in performing physical and analytical chemistry experiments and practicing scientific writing.

(Winter)

**CHEM 468 Physical Biochemistry (3:3:0:0)**

Prerequisites: CHEM 481 and PH 220

This course will provide an introduction to physical biochemistry through the application of physical laws of the chemistry to biological systems.

(Winter)

**CHEM 470 Inorganic Chemistry (3:3:0:0)**

Prerequisite: CHEM 461

This course involves a study of structure, physical and chemical behavior, and bond theory as applied to inorganic chemistry. A variety of inorganic systems will be analyzed in a systematic and detailed fashion through using concepts, models, and experimental data. Underlying trends in both the elements and also their compounds will be explored and identified.

(Winter)

**CHEM 471 Advanced Laboratory (2:0:6:0)**

Corequisite: CHEM 470

This laboratory course includes exercises in the preparation and purification of inorganic compounds utilizing modern synthetic techniques and equipment. Characterization of inorganic compounds will be performed by modern spectroscopic techniques such as nuclear magnetic resonance, UV-Vis, infrared, and magnetic susceptibility.

(Winter)

**CHEM 481 Biochemistry I (3:3:0:0)**

Prerequisite: CHEM 351

The first course in a two-semester series in which students explore the structure and function of proteins, carbohydrates, lipids, and nucleic acids. The course is intended for students majoring in chemistry, biochemistry or biology, and those preparing for advanced studies in graduate or professional schools.

(Fall, Winter, Spring)

**CHEM 482 Biochemistry II (3:3:0:0)**

Prerequisite: CHEM 481

The second course in a two-semester series in which students explore the metabolic pathways of carbohydrates, lipids, amino acids, and nucleotides. The course is intended for students majoring in chemistry, biochemistry or biology, and those preparing for advanced studies in graduate or professional schools.

(Fall, Winter)

**CHEM 485 Introduction to Biochemistry Literature (1:1:0:0)**

Prerequisite: CHEM 481

This course is an introduction to literature databases and scholarly articles published in peer-reviewed journals. Students will develop a portfolio and give an oral presentation of their work.

(Winter)

**CHEM 490 Special Topics in Chemistry (1-3:1:0:0)**

Repeatable Course: May earn maximum of 9 credits

Prerequisite: CHEM 351

Course Requirements: Instructor Approval Required

This is a one-semester course emphasizing current topics in chemistry. Each class participant will select a faculty supervisor who will oversee the design and implementation of a curriculum within a specific field of chemistry.

(Fall, Winter, Spring)

**CHEM 492R Student Research (1-2:0:8:0)**

Repeatable Course: May earn maximum of 6 credits

This course is a laboratory and/or field experience in which the student performs meaningful research under the mentorship of a faculty member.

(Fall, Winter, Spring)

**CHEM 498 Chemistry/Biochemistry Internship (1-3:0:0:0)**

Internship Fees: \$81.50 (LDS) \$163 (non-LDS) per credit

Exempt from tuition, but charged this independent course fee

All chemistry majors must find and experience a work internship. This would generally occur the semester after their junior year or during their senior year. The experience could involve working for a government agency, industry, an academic institution, or any organization that employs laboratory chemists on their staff. The credit for the internship would count as the capstone experience required for graduation. The student will have a contract agreement with the employer and be responsible to a faculty supervisor. Upon completion of the internship, a written report and a technical presentation will be made to the BYU-Idaho chemistry department as part of the requirement.

(Fall, Winter, Spring)