

# Chemistry

## University of Michigan - Department of Chemistry

Chemistry is often referred to as the “central science” because atoms and molecules are the foundation of all phenomena – from climate change to COVID vaccines to cosmic events. Chemists are working in diverse fields, helping achieve environmental justice, health equity, and address other big challenges to society. Chemists in our department are synthesizing advanced materials for renewable energy storage, developing new methods to access medicines, and documenting changes in the Arctic atmosphere, among many other impactful projects. Chemists use sophisticated instrumentation to analyze and understand the living world as well as how complex chemical processes proceed.

The Chemistry major offers flexibility in course selection that will prepare you for diverse careers, including: entry to top graduate programs in chemistry or related fields, employment in the chemical industry or government labs, and post graduate programs such as medical school or dental school that are directed towards health-science related careers. Undergraduate research is a strongly encouraged option, particularly for students who plan to pursue graduate studies in chemistry or a related field, but is not a requirement for this degree.

**Prerequisites: 27 credits** (if Chem 262 elected)

Students do not need to complete prerequisite courses before declaring a major.

- AP credit for Math (120 & 121) will fulfill the requirement for Math 115 and Math 116.
- AP credit for Physics (125/127 or 139) & (126/128 or 239) will fulfill the Physics requirement.

Course #	Course Description	Term Typically Offered	Credits
CHEM 125/6 + 130 <small>AP/IB/Test Credit does not fulfill requirement</small> <b>OR</b> 5-Credits Chemistry electives	General Chemistry Laboratory I and II + General Chemistry: Macroscopic Investigation and Reaction Principles	<i>F, W, Su</i>	5
MATH 115	Calculus I	<i>F, W, Sp, Su</i>	4
MATH 116	Calculus II	<i>F, W, Sp, Su</i>	4
<b>One of the following; CHEM 262 or [MATH 215 + 216 or 217]:</b>			
CHEM 262	Mathematical Methods for Chemists	<i>F, W</i>	4
MATH 215 and MATH 216	Calculus III and Introduction to Differential Equations	<i>F, W, Sp, Su</i> <i>F, W, Sp, Su</i>	4 4
MATH 215 and MATH 217	Calculus III and Linear Algebra	<i>F, W, Sp, Su</i> <i>F, W, Sp, Su</i>	4 4

Prerequisite Courses: continue from page 1.		<b>Term Typically Offered</b>	<b>Credits</b>
<b>One of the following groups; 150/151 or 140/141:</b>			
PHYS 150/151 OR PHYS 140/141	Fundamental Physics for the Life Sciences I/ Lab	<i>F, W, Sp</i>	4/1
	General Physics I/Elementary Laboratory I	<i>F, W, Sp</i>	4/1
<b>One of the following groups; 250/251 or 240/241:</b>			
PHYS 250/251 OR PHYS 240/241	Fundamental Physics for the Life Sciences II/ Lab	<i>F, W, Sp</i>	4/1
	General Physics II/ Elementary Laboratory II	<i>F, W, Sp</i>	4/1

**The Chemistry Program must include the following: Core courses (40 credits)**

\*\*45 credits required if using electives to fulfill the general chemistry prerequisite requirement.

<b>Course #</b>	<b>Course Description</b>	<b>Term Typically Offered</b>	<b>Credits</b>
<b>Introductory courses (15-16 credits)</b>			
CHEM 210	Structure and Reactivity I	<i>F, W, Sp</i>	3
CHEM 211	Investigations in Chemistry	<i>F, W, Sp</i>	2
CHEM 241	Introduction to Chemical Analysis	<i>F, W</i>	2
CHEM 242	Introduction to Chemical Analysis Laboratory	<i>F, W</i>	2
CHEM 260 OR CHEM 230 & 261	Chemical Principles	<i>F, W</i>	3
	Physical Chemical Principles and Applications AND Introduction to Quantum Chemistry	<i>F,W</i>	3/1
CHEM 302 OR CHEM 303	Inorganic Chemistry	<i>F,W</i>	3
	Intro Bioinorganic Chemistry: the Role of Metals in Life	<i>F,W</i>	3
<b>Advanced Lecture Courses: three of the following; 215, 351, 402, 447, 461 OR 463 (9-10 credits)</b>			
CHEM 215	Structure and Reactivity II	<i>F, W, Sp</i>	3
CHEM 351	Fundamentals of Biochemistry	<i>F,W</i>	4
CHEM 402	Intermediate Inorganic Chemistry	<i>F24, W26</i>	3
CHEM 447	Physical Methods of Analysis	<i>W</i>	3
CHEM 461 OR CHEM 463	Quantum Mechanics	<i>F</i>	3
	Thermodynamics and Kinetics	<i>W</i>	3
<b>Advanced Laboratory Courses: three of the following; 216, 436, 462, 482, 483 (6-9 credits)</b>			
CHEM 216	Structure and Reactivity II: Laboratory	<i>F, W, Sp</i>	2
CHEM 436	Polymer Synthesis and Characterization	<i>E.O.W.</i>	3
CHEM 462	Computational Chemistry Laboratory	<i>F</i>	1
CHEM 482	Synthesis and Characterization- <i>ULWR</i>	<i>F</i>	3
CHEM 483	Physical and Instrumental Chemistry	<i>W</i>	3
<b>Electives (5-15) credits to total 40 core credits:</b>			
	Chemistry courses numbered 300-or higher, including undergraduate research (Chem399) + honors thesis (Chem499). No more than 4 credits of 399. A list of approved elective courses appears on the following page.		

**Chemistry honors:**

Students may obtain honors in Chemistry by successfully completing all courses required for the Chemistry major with an overall GPA of 3.4. In addition, students obtaining Honors must write a thesis based on their undergraduate research (at least 4 credits of CHEM 399 over at least 2 semesters.) Students must register for one credit of CHEM 499 in the term in which they plan to submit their thesis.

**Chemistry GPA requirement:**

A student must earn a cumulative grade point average (GPA) of at least 2.0 in all courses required for the Chemistry major including prerequisites. Transfer courses are not calculated into the GPA.

**Exclusions:**

Students who elect a major in Chemistry may not elect another major or minor from within the Department of Chemistry.

**List of Possible Chemistry Electives**

Chem 351: Biochemistry Fundamentals (4) *if not selected as one of the advanced lecture courses* (F,W)  
Chem 352: Introductory Biochemistry Lab (2) (F,W)  
Chem 353: Biochemistry Technical Writing Lab (ULWR) (3) (F,W)  
Chem 399: Undergrad Research (1-4) (F,W)  
Chem 402: Intermediate Inorganic Chemistry (3) *if not selected as one of the adv lec courses* (F24, W26)  
Chem 419: Int. Phys Org. Chem (3) (F)  
Chem 420: Int Org. Chem (3) (W)  
Chem 421: Org. Chem of Drug Design (3) (W)  
Chem 425: Special Topics Org Chem (3)  
Chem 436: Polymer Synth and Charact (3) *if not selected as one of the advanced lab courses* (E.O.W.)  
Chem 447: Physical Methods of Analysis (3) *if not selected as one of the advanced lecture courses* (W)  
Chem 451: Advanced Biochemistry I (3) (F,W)  
Chem 453: Biophysical Chemistry I (3) (F)  
Chem 455: Special Topics in Biochemistry (3) (F)  
Chem 461: Quantum Mechanics (3) *if not selected as one of the advanced lecture courses* (F)  
Chem 462: Computational Chemistry Lab (1) *if not selected as one of the advanced lab courses* (F)  
Chem 463: Thermodynamics and Kinetics (3) *if not selected as one of the advanced lecture courses* (W)  
Chem 465: Special Topics Phys Chem (3)  
Chem 474: Environmental Chem (3) (F)  
Chem 482: Synthesis and Characterization (ULWR) (3) *if not selected as one of the adv lab courses* (F)  
Chem 483: Physical and Instrumental Chemistry (3) *if not selected as one of the advanced lab courses* (W)  
Chem 499: Honors Thesis (1) (F,W)  
Chem 511: Materials Chemistry (3) (F)  
Chem 515: Organometallic Chemistry (3) (W)  
Chem 538: Organic Chemistry of Macromolecules (3) (W)

## Advisory Sets of Recommended Course Selections Based on Common Career Paths

### **Recommended Courses for students who plan to attend medical or dental school:**

Adv. Lectures: 215, 351, 447

Adv Lab: 216, 482, 462

Electives: 399 strongly recommended, 352, 421, 451, choose the rest based on interests.

### **Recommended Courses for students who plan to enter the chemical industry (BS-level):**

Adv. Lectures: 215, 447, 351

Adv Lab: 216, 482, 483

Electives: 399 strongly recommended; 352, 436, choose what you like based on interests for the rest  
Sub-discipline focused recommended tracks for students interested in attending graduate programs in Chemistry. Note: students should conduct 2+ years of undergraduate research (Chem 399) to be competitive for top graduate programs in chemistry.

### **Recommended Courses for grad-school bound student w/analytical chem focus:**

Adv. Lectures: 447, 215, 351 if bio-focused. 447, 461, 463 if not bio-focused

Adv Lab: 216, 462, 483 if bio-focused. 483, 462, 463 if not bio-focused

Electives: 465, 436, 351, 451 if bio-focused, 465, 436, 402, 474 if not bio-focused

### **Recommended Courses for grad-school bound student w/environmental chem focus:**

Adv. Lectures: 215, 447, 463

Adv Lab: 216, 462, 483

Electives: 474, 399, 419, 461

### **Recommended Courses for grad-school bound student w/inorganic chem focus:**

Adv. Lectures: 215, 402, 447

Adv Lab: 216, 482, 483

Electives: 461, 462, 463 + one of your choosing depending on subfield of interest (synthetic inorganic, physical inorganic, or bioinorganic)

### **Recommended Courses for grad-school bound student w/materials chem focus:**

Adv. Lectures: 447, then select the other two based on sub-area (organic, inorganic, physical)

Adv Lab: 216, 436, 462

Electives: 399 recommended; choose whatever you like for the rest depending on sub-area of interest (organic, inorganic, physical)

### **Recommended Courses for grad-school bound student w/organic chem focus:**

Adv. Lectures: 215, 447, 463

Adv Lab: 216, 482, 483

Electives: 399, 419, 420 OR 421, 462 recommended; choose whatever you like for the rest (402 if interested in metals/catalysis; 436 if interested in organic materials, etc.)

### **Recommended Courses for grad-school bound student w/physical chem focus:**

Adv. Lectures: 461, 463, 447

Adv Lab: 462, 483, choose the third based on your interests

Electives: 399, 465 recommended; one of 215 OR 351 OR 402 recommended, choose whatever you like for the rest based on your interests