

## REQUIREMENTS FOR THE CHEMISTRY MAJOR

<b>Grade Requirement:</b> All courses required for the Chemistry major (CH, MATH, PHYS courses) must be graded and passed with a grade of C- or better.	
<b>Core Chemistry Courses:</b>	
General Chemistry	CH 221, 222, 223 OR CH 224H, 225H, 226H
General Chemistry Lab	CH 227, 228, 229 OR CH 237, 238, 239
Organic Chemistry*	CH 341, 342, 343
Organic Chemistry Lab	CH 337, 348, 349
Physical Chemistry	CH 411, 412, 413
Physical Chemistry Lab	CH 417, 418, 419
Instrumental Analysis	CH 429
<b>Math &amp; Physics:</b>	
Calculus	MATH 251, 252, 253
Differential Equations	MATH 256
Multivariable Calculus	MATH 281
Physics	PHYS 201, 202, 203 OR PHYS 251, 252, 253
Physics Lab	PHYS 204, 205, 206 OR PHYS 290 x 3
<b>Advanced Electives:</b>	
Option 1) Three approved courses at the 400-level in Chemistry, Geology and Physics	
Option 2) One approved course at the 400-level + six credits of research (CH 401)	
Option 3) Nine credits of research (CH 401)	

In addition to the courses listed above, the UO General Education Requirements must be satisfied (either by taking sufficient Writing, Multicultural, Arts & Letters, and Social Science classes or completing the R. D. Clark Honors College requirements).

### Sample Chemistry Major Program

	Core Chemistry Courses	Recommended Courses	Related Science Courses	Required University
<b>First Year</b>	General Chemistry General Chemistry Lab		Math**	WR 121-122
<b>Second Year</b>	Organic Chemistry Organic Chemistry Lab	Undergraduate Research	Math** Physics Physics Lab	Group satisfying courses from Arts and Letters and Social Sciences (15 credits for each group)
<b>Third Year</b>	Physical Chemistry Physical Chemistry Lab	Advanced Chemistry Electives	Science Electives	2 Multicultural Courses
<b>Fourth Year</b>	Instrumental Analysis			

\* CH 331, 335, 336 may be substituted for CH 341, 342, 343

\*\* If your math placement test does not place you in MATH 251, begin with the course you are placed into and take one math course each term until you finish all required math courses.

Name:

ID#:

## Chemistry: B.S. Degree Checklist

### General Chemistry<sup>1</sup>

- CH 221 or 224H     CH 227 or 237  
 CH 222 or 225H     CH 228 or 238  
 CH 223 or 226H     CH 229 or 239

### Organic Chemistry<sup>1</sup>

- CH 331 or 341     CH 337  
 CH 335 or 342     CH 348<sup>2</sup>  
 CH 336 or 343     CH 349<sup>2</sup>

### Physical Chemistry<sup>1</sup>

- CH 411     CH 417  
 CH 412     CH 418  
 CH 413     CH 419

### Instrumental Analysis<sup>1</sup>

- CH 429

### Advanced Electives<sup>1</sup> (one of the three options below)

- Nine credits of research (CH 401)  
 Six credits of research + one 400-level Chemistry course: CH \_\_\_\_\_  
 Three 400-level Chemistry courses: CH \_\_\_\_\_, CH \_\_\_\_\_, CH \_\_\_\_\_

### Math<sup>1</sup>

- MATH 251     MATH 256  
 MATH 252     MATH 281  
 MATH 253

### Physics<sup>1</sup>

- PHYS 201 or 251     PHYS 204 or 290  
 PHYS 202 or 252     PHYS 205 or 290  
 PHYS 203 or 253     PHYS 206 or 290

### University Requirements

- WR 121     WR 122 or 123  
 Two multicultural courses (check two):  AC  IP  IC  
 Arts & Letters Group (15 cr. – must double up in one subject)<sup>3</sup>  
 Social Science Group (15 cr. – must double up in one subject)<sup>3</sup>  
 180 credits  
 62 upper division credits  
 UO Residency Requirement (After completing 120 cr., at least 45 cr. must be at the UO)  
 168 ABCDP\* credits (ABCDP\* = graded or P if the course is taught P/N only)  
 45 ABCD credits at UO (ABCD = graded credits)

<sup>1</sup> All courses required for the Chemistry major must be graded and passed with a C- or better

<sup>2</sup> CH 338 and CH 339 satisfy the organic lab requirement if taken before Fall 2012

<sup>3</sup> No more than three courses in any subject may be used to satisfy the group requirements

Advisor:

Date:

## List of Approved Advanced Electives for the Chemistry Degree\*:

Pay careful attention to prerequisites when choosing Advanced Electives.

### Chemistry Courses:

**CH 420. Physical Organic Chemistry I.** 4 Credits. Modern physical organic chemistry including chemical bonding, acid-base chemistry, thermochemistry, noncovalent interactions, and introduction to computational chemistry. Sequence with CH 421/521. Prereq: CH 336 or CH 341.

**CH 421. Physical Organic Chemistry II.** 4 Credits. Modern physical organic chemistry including tools to study reaction mechanisms, kinetic analysis, isotope effects, and qualitative molecular orbital theory. Sequence with CH 420/520. Prereq: CH 420.

**CH 431. Inorganic Chemistry.** 4 Credits. Introduction to group theory for molecular symmetry; syntheses, structures, reactions, and reaction mechanisms of coordination complexes and organometallic complexes.

**CH 432. Inorganic Chemistry.** 4 Credits. Bioinorganic chemistry: metals in biological systems; coordination chemistry, reactions, spectroscopy, metaloclusters, and synthetic modeling. Prereq: CH 431.

**CH 433. Inorganic Chemistry.** 4 Credits. Solid-state inorganic chemistry: solid-state structure and its determination; the electrical, magnetic, and mechanical properties of materials and their physical description. Prereq: CH 431.

**CH 441. Quantum Chemistry.** 4 Credits. The principles of time-independent quantum mechanics and their application to model atomic and molecular systems. Prereq: CH 413.

**CH 442. Quantum Chemistry and Spectroscopy.** 4 Credits. Molecular structure theory, perturbation theory, time-dependent quantum mechanics, theory of spectra, selection rules. Prereq: CH 441.

**CH 443. Quantum Chemistry and Spectroscopy.** 4 Credits. Experimental spectra of atomic and molecular systems and surfaces. Prereq: CH 442.

**CH 444. Chemical Thermodynamics.** 4 Credits. The laws of thermodynamics and their applications, including those to nonideal chemical systems. Prereq: CH 413.

**CH 445. Statistical Mechanics.** 4 Credits. Molecular basis of thermodynamics. Applications to the calculation of the properties of noninteracting and weakly interacting systems. Prereq: CH 413.

**CH 446. Chemical Kinetics:** [Topic]. 4 Credits. Repeatable. Description and interpretation of the time evolution of chemical systems. Prereq: CH 413.

**CH 447. Computational Chemistry.** 4 Credits. Introduction to modern computational methods used to understand the properties of molecules. Prereq: CH 411, 412; or PHYS 353.

**CH 451. Advanced Organic-Inorganic Chemistry.** 4 Credits. Principles of organic-inorganic reaction dynamics; kinetics and mechanisms, linear free-energy relationships, isotope effects, substitution reactions, dynamic behavior of reactive intermediates, electron transfer chemistry. Prereq: CH 336 or CH 341.

**CH 452. Advanced Organic Chemistry—Stereochemistry and Reactions.** 4 Credits. Principles and applications of stereochemistry; reagents and reactions, with mechanisms, used in contemporary organic synthesis; examples taken from the current literature.

**CH 454. Advanced Electrochemistry** 4 Credits. Advanced topics in electrochemistry including fundamental concepts (thermodynamics, kinetics, transport) and applications (analytical techniques, electrolysis, batteries). Prereq: CH 411.

**CH 461. Biochemistry.** 4 Credits. Structure and function of macromolecules. Exposure to calculus and physical chemistry recommended. Prereq: CH 336 or CH 343.

**CH 462. Biochemistry.** 4 Credits. Metabolism and metabolic control processes. Energy and sensory transduction mechanisms. Prereq: CH 461.

**CH 463. Biochemistry.** 4 Credits. Mechanisms and regulation of nucleic acid and protein biosynthesis. Other current topics in biochemical genetics. Prereq: CH 461/561; or CH 360 with a grade of B- or better.

**CH 464. RNA Biochemistry.** 4 Credits. Introduction to the diverse field of RNA biochemistry. Prereq: CH 463 or BI 320.

**CH 465. Physical Biochemistry.** 4 Credits. Physical chemical properties of biological macromolecules; forces and interactions to establish and maintain macromolecular conformations; physical bases of spectroscopic, hydrodynamic, and rapid-reaction investigative techniques. Offered alternate years. Prereq: CH 461.

**CH 466. Structural Biochemistry.** 4 Credits. Protein and nucleic acid structures and energetics. Structure determination by x-ray crystallography and nuclear magnetic resonance. Computational methods for structural analysis. Offered alternate years. Prereq: CH 461.

**CH 467. Biochemistry Laboratory.** 4 Credits. Methods of modern molecular biology and protein purification. Prereq: CH 461

### **Geology courses:**

**GEOL 471. Thermodynamic Geochemistry.** 4 Credits. Introduction to geologic application of classical chemical thermodynamics. Gibbs free energy and its temperature, pressure, and composition derivatives; fugacity, activity, and chemical potential. Solutions, ideal and nonideal. Prereq: GEOL 311 or 332, CH 223, MATH 253.

**GEOL 472. Aqueous-Mineral-Gas Equilibria.** 4 Credits. Aqueous chemistry applied to natural waters (geothermal, diagenetic, continental brines). Equilibrium calculations applied to aqueous-mineral-gas systems. Prereq: CH 223; MATH 252.

**GEOL 473. Isotope Geochemistry.** 4 Credits. Introduction to nuclear physics and isotope systematics; techniques of isotope analysis; applications of stable and radioactive isotopes in geochronology and as tracers of geological processes.

### **Physics courses:**

**PHYS 411. Mechanics, Electricity, and Magnetism.** 4 Credits. Fundamental principles of Newtonian mechanics, conservation laws, small oscillations, planetary motion, systems of particles. Electromagnetic phenomena. Series. Prereq: MATH 282.

**PHYS 412. Mechanics, Electricity, and Magnetism.** 4 Credits. Fundamental principles of Newtonian mechanics, conservation laws, small oscillations, planetary motion, systems of particles. Electromagnetic phenomena. Series. Prereq: MATH 281.

**PHYS 413. Mechanics, Electricity, and Magnetism.** 4 Credits. Fundamental principles of Newtonian mechanics, conservation laws, small oscillations, planetary motion, systems of particles. Electromagnetic phenomena. Series. Prereq: PHYS 412.

**PHYS 414. Quantum Physics.** 4 Credits. Planck's and de Broglie's postulates, the uncertainty principle, Bohr's model of the atom, the Schroedinger equation in one dimension, the harmonic oscillator, the hydrogen atom, molecules and solids, nuclei and elementary particles. Sequence. Prereq: PHYS 413.

**PHYS 415. Quantum Physics.** 4 Credits. Planck's and de Broglie's postulates, the uncertainty principle, Bohr's model of the atom, the Schroedinger equation in one dimension, the harmonic oscillator, the hydrogen atom, molecules and solids, nuclei and elementary particles. Sequence. Prereq: PHYS 414

**Note:** Check with the appropriate department to determine when any specific course will be offered.

*\* Other courses may be submitted for consideration and approval by the department*