REQUIREMENTS FOR THE CHEMISTRY MAJOR

Grade Requirement: All courses required for the Chemistry major (CH, MATH, PHYS courses) must be graded and passed with a grade of C- or better.

Core Chemistry Courses:

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		

Math & Physics:

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

Advanced Electives:

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
First Year	General Chemistry General Chemistry Lab		Math**	WR 121-122 Group satisfying courses from Arts and Letters and Social Sciences (15 credits for each group) 2 Multicultural Courses
Second Year	Organic Chemistry Organic Chemistry Lab	Undergraduate Research	Math** Physics Physics Lab	
Third Year	Physical Chemistry Physical Chemistry Lab	Advanced Chemistry Electives	Science Electives	
Fourth Year	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.*

Updated March 2015

Name: *ID#:*

Chemistry: B.S. Degree Checklist

General Chemistry[1]

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

Organic Chemistry[1]

- ☐ CH 331 or 341
- ☐ CH 335 or 342
- ☐ CH 336 or 343
- ☐ CH 337
- ☐ CH 348[2]
- ☐ CH 349[2]

Physical Chemistry[1]

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

Instrumental Analysis[1]

- ☐ CH 429

Advanced Electives[1] (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[1]

- ☐ MATH 251
- ☐ MATH 252
- ☐ MATH 253
- ☐ MATH 256
- ☐ MATH 281

Physics[1]

- ☐ PHYS 201 or 251
- ☐ PHYS 202 or 252
- ☐ PHYS 203 or 253
- ☐ PHYS 204 or 290
- ☐ PHYS 205 or 290
- ☐ 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)[3]
- ☐ Social Science Group (15 cr. – must double up in one subject)[3]
- ☐ 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)

[1] All courses required for the Chemistry major must be graded and passed with a C- or better
[2] CH 338 and CH 339 satisfy the organic lab requirement if taken before Fall 2012
[3] 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 410. Application of Quantum Chemistry. 4 Credits. This course provides and overview of contemporary computational chemistry techniques used to model both single molecule and extended solids. Computations will be conducted on the new University of Oregon super computer, Talapas.

CH 410. Design Principles of Dynamic Biological Systems. 4 Credits. In this course, we will discuss major technological advances over the past 30 years that accelerated scientific discovery at the interface between cell biology and biochemistry. Emphasis will be placed on defining the relationships between protein structure, function, and emergent properties in complex biological systems. Pre req CH 461; MATH 253.

CH 410. Materials. 4 Credits.

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, metalloclusters, 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*