

Objectives/Courses	Chem 1210	Chem 1220	Chem 1230	Chem 1240	Chem 2310	Chem 2320	Chem 2330	Chem 2340	Chem 3060	Chem 3070	Chem 3080	Chem 3090	Chem 3510	Chem 3520	Chem 3600	Chem 3610	Chem 4990	Chem 5520	Chem 5530	Chem 5640	Chem 5650	Chem 5670	Chem 5680	Chem 5700
Comprehend the importance of stoichiometry, chemical equilibrium and kinetics in analysis.	X	X	X	X									X	X	X	X			X			X		X
Deduce chemical structures given chemical composition	X	X	X	X									X	X	X	X			X			X		X
Discuss and apply concepts of chemical structure and bonding to predict chemical structure and chemical reactivity	X	X	X	X									X	X					X	X				X
Compare and contrast the chemistry of metals, non-metals, and semi-metals	X	X	X	X									X	X					X	X				X
Discuss the basic chemical components of living systems, including proteins, nucleic acids, lipids, and carbohydrates	X	X	X	X															X					X
Be able to relate the microscopic and macroscopic properties of matter to each other	X	X	X	X					X	X	X	X							X	X				X
Use physical models to describe energies and forces in atoms and ions and explain the trends of the periodic table	X	X	X	X									X	X					X	X				
Describe gas properties using molecular kinetic theory	X	X	X	X									X	X					X	X				
Use the laws of thermodynamics to discuss and predict chemical reactivity and spontaneity	X	X	X	X																X				
Describe fundamental ways that metals participate in the chemistry of living systems	X	X	X	X									X	X					X	X				
Understand laboratory and chemical safety			X	X				X	X				X	X		X			X			X	X	X
Prepare research report in standard formats			X	X				X	X				X	X					X			X	X	X
Distinguish between qualitative and quantitative measurements and compare and critically select methods for elemental and molecular analyses				X	X									X	X					X		X	X	
Formulate concepts of validation of data and experimental design			X	X										X	X				X			X	X	
Comprehend concept of and perform chemical measurement calibration			X	X										X	X	X			X	X	X		X	
Apply and assess concepts of availability and evaluation of analytical standards and formulate standardization methodology				X											X	X				X	X		X	
Apply concepts of resonance and inductive effects to predict the chemical and physical properties for different functional groups and the reactivity of molecules to which these functional groups are attached.		x			X	X	X	X					x	x					x	x				X
Draw the Lewis structures including reasonable resonance structures and predict chemical properties for various compounds.		x	x		X	X	X	X					x	x										
Identify the types of isomerism in organic and inorganic compounds, identify and classify chiral centers, and explain the difference in chemical and physical properties among these compounds.		x	x		X	X	X	X					x	x										
Propose electron-pushing mechanisms for chemical reactions, and use the concepts of resonance effect, inductive effect, steric hindrance, leaving group effect, nucleophilicity of nucleophile, and solvation to explain the chemo-, regio-, and stereoselectivity of the reactions.					X	X	X	X					x	x					x	x				
Draw and interpret reaction coordinate diagrams, relate the energetic changes associated with chemical reactions to equilibrium constants and rate, and differentiate kinetic versus thermodynamic control of reactions.		x			X	X	X	X					x	x					x	x				
Identify aromatic and antiaromatic compounds and know the chemical consequences of aromaticity.		x			X	X	X	X					x	x					x	x				
Utilize known reactions to propose multi-step synthesis.					X	X	X	X																
Describe the basic issues of nuclear chemistry and radioactivity		X											X						X					X
Professional Ethics		x	x				X	X					x	x					X	X		X	X	X
Make either oral or written criticisms of research articles																								X
Be able to formulate hypotheses and then design real or "thought" experiments to test the hypotheses																								X
Explain the properties of water; impact on chemical reactions	X	X	X	X									X	X										X
Describe the basic organization of living cells																								X
Explain the levels of protein structure and the applicable forces																								X
Describe the action of enzymes; thermodynamics and kinetics																								X
Explain the overarching principles of metabolism																								X
Explain the functions of core metabolic pathways; glycolysis, TCA cycle, oxphosp, photosynth																								X
Demonstrate competency in written and oral communication									X	X	X	X	X						X					X
Demonstrate competency in written and oral communication using mathematics									X	X	X	X	X											X
Apply thermodynamic, kinetic and quantum methods in an integrated way in all areas of chemistry and biochemistry									X	X	X	X												X
Explain what the main research areas of chemistry and biochemistry are and why they are important									X	X	X	X												X
Develop and apply Molecular Orbital models of chemical bonding		X											X	X										
Chemical Information Retrieval																	X				X			
Demonstrate knowledge of sampling methods for all states of matter															X	X			X	X	X	X		
Use statistical methods for evaluating and interpreting data															X	X			X	X	X	X		
Assess sources of error in chemical and instrumental analysis and account for errors in data analysis															X	X			X	X	X	X		
Recognize interferences in chemical and instrumental analysis															X	X			X	X	X	X		
Use quantitative methods to describe chemical transformations																								
Integrate a fundamental understanding of the physics principles of and instrumentation for atomic, molecular, and mass spectrometry, magnetic resonance spectrometry, chromatography and other methods of separation, electroanalytical methods, and thermal methods for chemical analysis									X	X	X	X								X	X	X		X
Apply theory and operational principles of analytical instruments									X	X	X	X			X	X				X	X	X		X
Utilize spectroscopic information from mass spectrometry, Infrared spectroscopy, ultraviolet spectroscopy, and nuclear magnetic resonance to identify the structures of organic and inorganic molecules.					X	X	X	X					X	X										
Use molecular spectroscopy to deduce chemical structure					X	X	X	X					X	X					X	X				
Write the structures of lipids, fatty acids, amino acids, nucleosides, nucleotides and nucleic acids, and recognize their chemical and physical properties.					X	X	X	X																X
Describe the features of carbohydrates		X																						X
Describe the features of lipids		X																						X
Describe the features of nucleic acids; DNA and RNA		X																						X
Classify compounds by structure, use the IUPAC nomenclature, and identify conformational effects.	X	X	X	X									X	X					X	X				
Prepare and characterize organic and inorganic substances using standard synthesis methods								x	x						x					x				
Prepare and characterize and moisture sensitive materials																				x				