

<p align="center">Organic Chemistry 112 A B C - Syllabus Addendum for Prospective Teachers</p> <p align="center">McMurry, J. (2004) <i>Organic Chemistry</i> 6th Edition</p>		
Chapter	Subject Matter Requirements for Prospective Teachers General Science	Academic content standards for kindergarten through grade twelve, adopted by the California State Board of Education
Ch 1-Structure and bonding	12.1p Explain the central role of carbon in living system chemistry	<i>Science Content Standards for California Public Schools, Grade 8:6a Students know that carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms; 6c Students know that living organisms have many different kinds of molecules, including small ones, such as water and salt, and very large ones, such as carbohydrates, fats, proteins, and DNA</i>
Ch 2-Polar covalent bonds: Acids and bases	12.1j Distinguish among acidic, basic, and neutral solutions by their observable properties	<i>Science Content Standards for California Public Schools, Grade 8:5e Students know how to determine whether a solution is acidic, basic, or neutral</i>
	12.1m Explain chemical reactivity using position on the periodic table	<i>Science Content Standards for California Public Schools, Grade 8: 7b Students know each element has a specific number of protons in the nucleus (the atomic number) and each isotope of the element has a different but specific number of neutrons in the nucleus.</i>
	12.1n Predict and explain chemical bonding using elements' positions in the periodic table	<i>Science Content Standards for California Public Schools, Grade 8: 7c Students know substances can be classified by their properties, including their melting temperature, density, hardness, and thermal and electrical conductivity.</i>
Ch 25-Biomolecules: Carbohydrates	12.1o Recognize that inorganic and organic compounds (e.g., water, salt, carbohydrates, lipids, proteins, nucleic acids) are essential to processes within	<i>Science Content Standards for California Public Schools, Grade 8:6a Students know that carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms</i>

	living systems	
Ch 26-Biomolecules: Amino Acids, peptides and proteins	12.1o Recognize that inorganic and organic compounds (e.g., water, salt, carbohydrates, lipids, proteins, nucleic acids) are essential to processes within living systems	<i>Science Content Standards for California Public Schools, Grade 8:6a Students know that carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms</i>
Ch 27-Biomolecules: Lipids	12.1o Recognize that inorganic and organic compounds (e.g., water, salt, carbohydrates, lipids, proteins, nucleic acids) are essential to processes within living systems	<i>Science Content Standards for California Public Schools, Grade 8:6a Students know that carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms</i>
Ch 28-Biomolecules: Heterocycles and nucleic acids	12.1o Recognize that inorganic and organic compounds (e.g., water, salt, carbohydrates, lipids, proteins, nucleic acids) are essential to processes within living systems	<i>Science Content Standards for California Public Schools, Grade 8:6a Students know that carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms</i>
Ch 29-The organic chemistry of metabolic pathways	12.1o Recognize that inorganic and organic compounds (e.g., water, salt, carbohydrates, lipids, proteins, nucleic acids) are essential to processes within living systems	<i>Science Content Standards for California Public Schools, Grade 8:6a Students know that carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms</i>
Ch 5-An overview of organic reactions	12.1h Explain that chemical changes in materials result in the formation of a new substance corresponding to the rearrangement of the atoms in molecules	<i>Science Content Standards for California Public Schools, Grade 8:5a Students know reactant atoms and molecules interact to form products with different chemical properties</i> <i>Science Content Standards for California Public Schools,</i>

		<i>Grades 9-12, Chemistry: 11c Students know some naturally occurring isotopes of elements are radioactive, as are isotopes formed in nuclear reactions</i>
Chapter	Chemistry Science Subject Matter Requirements	Academic content standards for kindergarten through grade twelve, adopted by the California State Board of Education
1 - Structure and bonding	1.3b <i>Draw Lewis dot structures for compounds and ions</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry:2e</u> <i>Students know how to draw Lewis dot structures</i>
	6.1a <i>Explain the bonding characteristics of carbon</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10b</u> <i>Students know the bonding characteristics of carbon that result in the formation of a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules</i>
2 - Polar covalent bonds; Acids and bases	1.3a <i>Compare types of molecular bonds including ionic, covalent and hydrogen bonds</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry:2a</u> <i>Students know atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds; 2b Students know chemical bonds between atoms in molecules such as H₂, CH₄, NH₃, H₂CCH₂, N₂, Cl₂, and many large biological molecules are covalent; 2c Students know salt crystals, such as NaCl, are repeating patterns of positive and negative ions held together by electrostatic attraction; 2d Students know the atoms and molecules in liquids move in a random pattern relative to one another because the intermolecular forces are too weak to hold the atoms or molecules in a solid form.</i>
3 - Organic compounds: Alkanes and Cycloalkanes	6.1b <i>Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</u> <i>Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids</i>

	<i>organic acids) and provide examples of reactions involving these groups</i>	
	<i>6.1c Inventory the ten simplest hydrocarbons that contain single bonds, multiple bonds, and benzene rings</i>	<i>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10d Students know the system for naming the ten simplest linear hydrocarbons and isomers that contain single bonds, simple hydrocarbons with double and triple bonds, and simple molecules that contain a benzene ring</i>
5 - An overview of organic reactions	<i>2.1c Distinguish reaction types, including single replacement, double replacement, synthesis, decomposition, and combustion</i>	<i>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 3a Students know how to describe chemical reactions by writing balanced equations; 3g Students know how to identify reactions that involve oxidation and reduction and how to balance oxidation-reduction reactions</i>
6 - Alkenes: Structure and reactivity	<i>6.1b Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	<i>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids</i>
	<i>6.1c Inventory the ten simplest hydrocarbons that contain single bonds, multiple bonds, and benzene rings</i>	<i>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10d Students know the system for naming the ten simplest linear hydrocarbons and isomers that contain single bonds, simple hydrocarbons with double and triple bonds, and simple molecules that contain a benzene ring</i>
7 - Alkenes: Reactions and synthesis	<i>6.1b Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines,</i>	<i>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and</i>

	<i>esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	organic acids
8 - Alkenes: An introduction to organic synthesis	<i>6.1b Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	<i>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</i> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids
	<i>6.1c Inventory the ten simplest hydrocarbons that contain single bonds, multiple bonds, and benzene rings</i>	<i>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10d</i> Students know the system for naming the ten simplest linear hydrocarbons and isomers that contain single bonds, simple hydrocarbons with double and triple bonds, and simple molecules that contain a benzene ring
9 - Stereochemistry	<i>6.1b Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	<i>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</i> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids
10-Alkyl halides	<i>6.1b Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	<i>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</i> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids
11-Reactions of alkyl halides: Nucleophilic substitutions and eliminations	<i>6.1b Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines,</i>	<i>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</i> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers,

	<i>esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	amines, esters, aldehydes, and organic acids
14-Conjugated dienes and ultraviolet spectroscopy	6.1b <i>Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</u> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids
15-Benzene and aromaticity	6.1b <i>Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</u> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids
	6.1c <i>Inventory the ten simplest hydrocarbons that contain single bonds, multiple bonds, and benzene rings</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10d</u> Students know the system for naming the ten simplest linear hydrocarbons and isomers that contain single bonds, simple hydrocarbons with double and triple bonds, and simple molecules that contain a benzene ring
16-Chemistry of benzene: Electrophilic aromatic substitution	6.1b <i>Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</u> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids
17-Alcohols and phenols	6.1b <i>Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines,</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</u> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers,

	<i>esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	amines, esters, aldehydes, and organic acids
18-Ethers and epoxides; Thiols and sulfides	6.1b <i>Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</u> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids
19-Aldehydes and ketones: Nucleophilic addition reactions	6.1b <i>Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</u> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids
20-Carboxylic acids and nitriles	6.1b <i>Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</u> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids
21-Carboxylic acid derivatives and nucleophilic acyl substitution reactions	6.1b <i>Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</u> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids

22-Carbonyl alpha-substitution reactions	6.1b <i>Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</u> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids
23-Carbonyl condensation reactions	6.1b <i>Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</u> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids
24-Amines	6.1b <i>Recognize the chemical structure of various organic functional groups (i.e., alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids) and provide examples of reactions involving these groups</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10e</u> Students know how to identify the functional groups that form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids
25-Biomolecules: Carbohydrates	6.1d <i>Understand the differences in structures and properties between amino acids and their polymers and between sugars and their polymers</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10c</u> Students know amino acids are the building blocks of proteins 10f Students know the R-group structure of amino acids and know how they combine to form the polypeptide backbone structure of proteins
26-Biomolecules: Amino acids, peptides and proteins	6.1d <i>Understand the differences in structures and properties between amino acids and their polymers and between sugars and their polymers</i>	<u>Science Content Standards for California Public Schools, Grades 9-12, Chemistry: 10c</u> Students know amino acids are the building blocks of proteins 10f Students know the R-group structure of amino acids and know how they combine to form the polypeptide backbone structure of proteins