Chemistry Assessment Plan
Rev. 12/16/2020

CHEMB1A - General Chemistry I

Chemistry	16-17	17-18	18-19	19-20	20-21	21-22
• Upon completion the student will be able to:Practice safe and effective general laboratory skills, including the ability to: a. Recognize the limitations of physical measurements and application of appropriate rules for significant figures. b. Complete measurements in an accurate and precise manner. c. Effectively work with peers in a collegial environment.			C			P
• Upon completion the student will be able to: Demonstrate proficiency in solving mathematical problems that require identifying key data (from lists, tables, experimental data, or graphs) and constructing correct formulas for unit conversions, ratios, and stoichiometry.			C	C		
• Upon completion the student will be able to: Use the atomic and kinetic theories of matter to explain macroscopic chemical and physical behavior.		C			P	
• Upon completion the student will be able to: Compare and contrast the details of ionic, covalent, and intermolecular bonding, and describe how energy changes are related to temperature, motion at the atomic level, and changes in chemical bonding.	C			C		
• Upon completion the student will be able to: Describe how energy changes are related to motion at the atomic level and the reorganization of matter found in chemical and physical changes.		C		C	P	
• Upon completion the student will be able to:Design experiments and interpret data according to the scientific method. This includes the ability to: a. Define and follow the general scientific method. b. Formulate questions in order to evaluate a hypothesis. c. Design and conduct experiments to answer questions. d. Record, manipulate and evaluate the experimental data to reach conclusions. e. Correlate experimental results with appropriate theory.		C				P

CHEMB1B - General Chemistry and Chemical Analysis

• 1. Upon successful completion of the course, the student will be able to: Practice safe and effective general laboratory skills.						P
• 2. Upon successful completion of the course, the student will be able to: Demonstrate proficiency in solving mathematical problems related to chemistry.						P
• 3. Upon successful completion of the course, the student will be able to: Apply the concepts of chemical equilibria to explain chemical phenomena (such as acid-base behavior, common ion effect and solubility product).					P	
• 4. Upon successful completion of the course, the student will be able to: Apply the concepts of thermodynamics to predict chemical phenomena.					P	
• 5. Upon successful completion of the course, the student will be able to: Apply the concepts of kinetics to chemical reactions.					P	
• 6. Upon successful completion of the course, the student will be able to: interpret experimental data according to the scientific method.				C		P

CHEMB2A - Introductory General Chemistry

• Upon completion the student will be able to:Understand and explain the atomic and molecular basis for the properties of everyday materials. Explain the periodicity of the various properties of the elements using the periodic table.	C					
• Upon completion the student will be able to: Understand the concept of oxidation-reduction and be able to apply the activity series to predict simple single displacement reactions.	C					
• Upon completion the student will be able to: Be able to recognize/identify chemistry happening in everyday life.	C					P
• Upon completion the student will be able to:. Determine the electronic structure of an atom and understand the theoretical basis for the arrangement of electrons and the basis for the types of formulas or compounds formed. Explain the formation of cations and anions from the electronic structure.	C					
• Upon completion the student will be able to: Determine the nature of chemical bonding of atoms in molecules and ions using the periodic table.	C					
• Upon completion the student will be able to: Relate the chemical and physical properties of substances to molecular structure, chemical bonding, and intermolecular interactions.	C					
• Upon completion the student will be able to: Understand and explain the states of matter and the transitions matter undergoes and determine energy required for a particular transition.	C					
• Upon completion the student will be able to:Understand reactions by identifying reactants and products, recognizing the type of reaction, balancing the equation for a reaction and making calculations from the equation for the purpose of identifying the limiting reactant, product produced or reactant required.	C					
• Upon completion the student will be able to: Understand the concept of equilibrium and how it is applied in a chemical reaction and in explaining pH or pOH.	C					
• Upon completion the student will be able to: Able to predict the formula of a simple inorganic compound and to identify the compound by name using either the Stock or Classical method. Determine the empirical formula using laboratory data.	C					
• Upon completion the student will be able to:Identify basic laboratory equipment and know it's function or use. State a solvable problem, state a hypothesis, and design an experiment to solve the problem.	C					

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CHEMB10 - Chemistry and Society						
• 1. Upon successful completion of the course, the student will be able to apply scientific reasoning in contexts involving chemistry and society.				C		
• 2. Upon successful completion of the course, the student will be able to use chemical theories, principles, and models, in conjunction with the scientific method, to analyze socio-cultural phenomena involving chemistry and society.						P
• 3. Upon successful completion of the course, the student will be able to critique the benefits and limitations of applying the scientific method to problems in the analysis of socio-cultural phenomena involving chemistry.						P
• 4. Upon successful completion of the course, the student will be able to explore independently contemporary topics in which chemistry has a significant role.						P
CHEMB11 - Introduction to General, Organic, and Biochemistry						
• Upon completion the student will be able to:Use dimensional (factor label) analysis as a problem solving tool.	C					
• Upon completion the student will be able to: Perform accurate observations of physical and chemical changes during lab experimentation.	C					
• Upon completion the student will be able to: Illustrate how matter and energy are related, in particular the role that energy plays changing the physical state of matter and chemical reactions.						P
• Upon completion the student will be able to: Describe the model of an atom and how atoms bond together to form larger structures such as molecules or crystal lattices. Based on periodic atomic properties, explain the relative macroscopic physical properties of matter.	C					
• Upon completion the student will be able to: Explain various observations on test, quizzes, and/or lab reports. Students should be able to assess their observations based on atomic/molecular structures and on the absorption or release of energy.		C				
• Upon completion the student will be able to: Identify and explain several common chemical systems and behaviors such as electrolytes, buffers, and osmosis.	C	C				
• Upon completion the student will be able to: Characterize and identify several chemical reactions that are frequently encountered in biochemistry and physiology, such as: 1. Oxidation/reduction reactions 2. Acid/base reactions 3. Dehydration reactions 4. Hydrolysis reactions 5. Addition reactions	C	C				
• Upon completion the student will be able to: Recognize from the name or structure organic functional groups and associate these groups with their chemical and physical properties.			C			
• Upon completion the student will be able to: Identify and name the chemical structure of lipids, carbohydrates, and proteins. Describe the functions of these classes of compounds and how these compounds are broken down in the processes of metabolism to produce energy in the body.			C			
CHEMB18 - Elementary Organic Chemistry						
• Upon completion the student will be able to:The student shall recognize organic compounds on the basis of the structural and functional groups present in a drawing or formula, and be able to list some properties which are characteristic of the members of each class.			C			
• Upon completion the student will be able to:Given the name of a typical organic substance, the student will be able to draw its structure using one of the standard formula types (e.g. Lewis structure, condensed structural formula, line formula).			C			
• Upon completion the student will be able to:The student shall correctly name organic compounds starting with drawings or descriptions, using both the IUPAC nomenclature and accepted common names.			C			
• Upon completion the student will be able to:The student shall identify common uses, sources, roles and values of organic compounds in industry, medicine, consumer use, nature and biology.			C			
• Upon completion the student will be able to:The student will be able to identify shape, (in)flexibility, and steric interactions in molecules, as well as some electronic and bonding features important to stability, reactivity, and other molecular properties. These latter should include resonance, polarity, acidity/basicity, and the concepts of nucleophilicity and electrophilicity.			C			
• Upon completion the student will be able to:The student shall identify and describe the chemical reactions typical for each major family of organic compounds. This will include writing an equation using standard examples, with symbols for reaction conditions and reagents.			C			
• Upon completion the student will be able to:The student shall be able to draw mechanisms of fundamental reaction types, and in uncomplicated cases explain how the mechanism and reaction conditions affect the outcome of a reaction. An example might be Walden inversion in an SN2 reaction, or the need and role of acid in the dehydration of alcohols.			C			
• Upon completion the student will be able to:The student shall distinguish between structural, conformational, and stereoisomers, including comparisons of structural formulas. Given a name, the student shall construct the structural formulas, and vice versa. The student shall exemplify the effects of stereoisomerism on the properties of compounds (e.g. biological).			C			
• Upon completion the student will be able to:Given any two of the following, the student shall predict the third: an organic reactant, a set of reaction conditions, the predominant organic product. The student shall predict the reagents, conditions, and intermediate products required for basic 1- and 2-step organic syntheses.			C			
• Upon completion the student will be able to:The student shall demonstrate basic use of common types of spectroscopy used to characterize and identify organic compounds (IR, 1H and 13C NMR). The student shall identify the characteristic spectral signatures of various organic structural and functional groups and use them to verify knowns and solve for unknowns in simple spectroscopy problems.			C			
• Upon completion the student will be able to:The student shall name each of the four major classes of biological compounds and describe the fundamental makeup, structural elements, physical and chemical properties, and common biological roles of each.			C			
• Upon completion the student will be able to:The student shall demonstrate the ability to perform common organic reaction procedures, including the following: • tests for characterizing substances (e.g. mp. bp, solubility, TLC characterizations, spectroscopic characterizations, and functional group tests) • separations of mixtures as are commonly found in a reaction procedure (e.g. extractions, distillations, recrystallizations, thin layer and column chromatographies, filtrations, etc.), and • properly following and recording experimental procedures with regard to amounts, conditions, observations, use of the aforementioned skills, performing calculations, and conclusions.			C			
• Upon completion the student will be able to:The student shall demonstrate safe practice in the chemical laboratory, including measures to prevent and control fire, explosion, contact with and intake of hazardous chemicals, spread of flammable and toxic vapors, and toxic spills and releases (including proper methods of toxic waste disposal).			C			

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CHEMB30A - Organic Chemistry for Science Majors, I						
• 1. Upon successful completion of the course, the student will be able to demonstrate the ability to identify the families of organic molecules (based both on their structures and nomenclature), and their respective chemical and physical characteristics.						P
• 2. Upon successful completion of the course, the student will be able to identify common uses, sources, and roles of organic compounds in industry, medicine, consumer use, nature and biology.					P	
• 3. Upon successful completion of the course, the student will be able to relate an understanding of bonds and bonding theory to a molecule's structural features, energy and stabilization, reactivity, and measurable properties.					P	
• 4. Upon successful completion of the course, the student will be able to apply the concepts of general acid-base chemistry to organic reactions.						P
• 5. Upon successful completion of the course, the student will be able to distinguish between structural (constitutional) isomers, conformational isomers, and the various 2D/3D stereoisomers.			C			
• 6. Upon successful completion of the course, the student will be able to describe and apply the mechanisms of and factors affecting reactions, including substitution, elimination, and electrophilic addition reactions, and carbocation rearrangements.						P
• 7. Upon successful completion of the course, the student will be able to identify, describe, and synthetically use typical chemical reactions for each organic family studied, including important regio- and stereochemical outcomes.						P
• 8. Upon successful completion of the course, the student will be able to perform basic interpretations of common types of spectroscopy (IR, MS, UV-Vis, H-1 and C-13 NMR) to characterize and identify organic compounds.			C			
• 9. Upon successful completion of the course, the student will be able to demonstrate the ability to safely perform the standard parts of common organic reaction procedures in the laboratory.						P
CHEMB30B - Organic Chemistry for Science Majors, II						
• 1. Upon successful completion of the course, the student will be able to identify the families of organic molecules encountered in this half of the course based both on their structures and nomenclature, and their respective chemical and physical characteristics.					P	
• 2. Upon successful completion of the course, the student will be able to express the understanding that our only way to molecular knowledge is through experimentation.						P
• 3. Upon successful completion of the course, the student will be able to identify, describe, and synthetically use typical chemical reactions for each organic family studied, including important regio- and stereochemical outcomes.					P	
• 4. Upon successful completion of the course, the student will be able to describe and apply the mechanisms of the various reactions studied, including tying the reaction pathway, rate, and outcome to reactant structure, reactive intermediate stability, and chosen reaction conditions.				C		
• 5. Upon successful completion of the course, the student will be able to describe each of the four major classes of biological compounds and common biological roles of each.				C		
• 6. Upon successful completion of the course, the student will be able to apply spectroscopic characterizations (such as advanced NMR techniques like COSY, DEPT, HETCOR) of materials found commonly in the second semester laboratory.			C			
• 7. Upon successful completion of the course, the student will be able to demonstrate the ability to safely perform common organic reactions of the main functional groups studied.						P