

Chemistry

State Standard Number	State Standard Area/Description	Unit Name	Course Topic Description
C	Chemistry		
0	The student will demonstrate an understanding of how scientific inquiry and technological design, including mathematical analysis, can be used appropriately to pose questions, seek answers, and develop solutions.		
C-1.1	Apply established rules for significant digits, both in reading a scientific instrument and in calculating a derived quantity from measurement.	Measurement	SI Units
			Significant Figures
		Gases	Pressure
C-1.2	Use appropriate laboratory apparatuses, technology, and techniques safely and accurately when conducting a scientific investigation.		
C-1.3	Use scientific instruments to record measurement data in appropriate metric units that reflect the precision and accuracy of each particular instrument.	Measurement	Uncertainty
			SI Units
		Gases	Lab: Accuracy and Uncertainty in measurements Pressure
C-1.4	Design a scientific investigation with appropriate methods of control to test a hypothesis (including independent and dependent variables), and evaluate the designs of sample investigations.	Measurement	Scientific Method
C-1.5	Organize and interpret the data from a controlled scientific investigation by using mathematics (including formulas, scientific notation, and dimensional analysis), graphs, models, and/or technology.	Gases	Temperature
C-1.6	Evaluate the results of a scientific investigation in terms of whether they verify or refute the hypothesis and what the possible sources of error are.	Solutions	Lab: make solution of kool-aid
		Measurement	Scientific Method
			Uncertainty
C-1.7	Evaluate a technological design or product on the basis of designated criteria.		
C-1.8	Use appropriate safety procedures when conducting investigations.		
0	Content		
C-2	Students will demonstrate an understanding of atomic structure and nuclear processes.		
C-2.1	Illustrate electron configurations by using orbital notation for representative elements.	Atoms	Electrons in Atoms

Chemistry

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C-2.2	Summarize atomic properties (including electron configuration, ionization energy, electron affinity, atomic size, and ionic size).	Nuclear Chemistry	Inside the Atom
C-2.3	Summarize the periodic table's property trends (including electron configuration, ionization energy, electron affinity, atomic size, ionic size, and reactivity).	Atoms	The Periodic Table
			Valence Electrons
			Regions of the Periodic Table
			Lab: Periodic Table (P/P only)
			Trends in the Periodic Table
C-2.4	Compare the nuclear reactions of fission and fusion to chemical reactions (including the parts of the atom involved and the relative amounts of energy released).	Matter	Classifying Chemical Reactions
		Nuclear Chemistry	Fission and Fusion
C-2.5	Compare alpha, beta, and gamma radiation in terms of mass, charge, penetrating power, and the release of these particles from the nucleus.	Nuclear Chemistry	Radioactive Decay
C-2.6	Explain the concept of half-life, its use in determining the age of materials, and its significance to nuclear waste disposal.	Nuclear Chemistry	Radioactive Decay
C-2.7	Apply the predictable rate of nuclear decay (half-life) to determine the age of materials.	Equilibrium	Le Chatelier's Principle
C-2.8	Analyze a decay series chart to determine the products of successive nuclear reactions and write nuclear equations for disintegration of specified nuclides.	Nuclear Chemistry	Radioactive Decay Lab: Construct a Bohr Model of C-13 atom
C-2.9	Use the equation $E = mc^2$ to determine the amount of energy released during nuclear reactions.	Nuclear Chemistry	Fission and Fusion
C-3	The student will demonstrate an understanding of the structures and classifications of chemical compounds.		
C-3.1	Predict the type of bonding (ionic or covalent) and the shape of simple compounds by using Lewis dot structures and oxidation numbers.	Bonding	Lab: Bonding (P/P only)
			Ionic Bonding
			Covalent Bonding
			Lewis Dot Structures
C-3.2	Interpret the names and formulas for ionic and covalent compounds.	Bonding	Covalent Bonding
C-3.3	Explain how the types of intermolecular forces present in a compound affect the physical properties of compounds (including polarity and molecular shape).	Bonding	Ionic Bonding
			States of Matter
		Solutions	Lab: make solution of kool-aid

Chemistry

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C-3.4	Explain the unique bonding characteristics of carbon that have resulted in the formation of a large variety of organic structures.	Organic Chemistry	Polymers
C-3.5	Illustrate the structural formulas and names of simple hydrocarbons (including alkanes and their isomers and benzene rings).		
C-3.6	Identify the basic structure of common polymers (including proteins, nucleic acids, plastics, and starches).	Organic Chemistry	Bonding Lab: Make Slime (polymers) Polymers
C-3.7	Classify organic compounds in terms of their functional group.		
C-3.8	Explain the effect of electronegativity and ionization energy on the type of bonding in a molecule.	Bonding	Lab: Bonding (P/P only)
C-3.9	Classify polymerization reactions as addition or condensation.	Matter Organic Chemistry Thermodynamics	Classifying Chemical Reactions Lab: Make Slime (polymers) Polymers Bonding Heat Flow and Physical Changes
C-3.10	Classify organic reactions as addition, elimination, or condensation.	Thermodynamics Matter	Heat Flow and Physical Changes Classifying Chemical Reactions
C-4	The student will demonstrate an understanding of the types, the causes, and the effects of chemical reactions.		
C-4.1	Analyze and balance equations for simple synthesis, decomposition, single replacement, double replacement, and combustion reactions.	Matter	Equation Balancing Classifying Chemical Reactions
C-4.2	Predict the products of acid-base neutralization and combustion reactions.	Matter	Classifying Chemical Reactions
C-4.3	Analyze the energy changes (endothermic or exothermic) associated with chemical reactions.	Thermodynamics Equilibrium	Chemical Processes Temperature
C-4.4	Apply the concept of moles to determine the number of particles of a substance in a chemical reaction, the percent composition of a representative compound, the mass proportions, and the molemass relationships.	Matter Solutions	The Mole Concentration
C-4.5	Predict the percent yield, the mass of excess, and the limiting reagent in	Matter	Atoms, Molecules, and Moles Stoichiometry

Chemistry

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	chemical reactions.		Lab: Conservation of mass (P/P only) Molar Mass
		Equilibrium	Le Chatelier's Principle
C-4.6	Explain the role of activation energy and the effects of temperature, particle size, stirring, concentration, and catalysts in reaction rates.	Rates	Definition of Reaction Rates Catalyst Concentration Lab: Factors affecting Rate of Reaction Temperature Pressure
		Equilibrium	Concentration Temperature Definition of Chemical Equilibrium Pressure Le Chatelier's Principle Lab: Le Chatelier's Principle (P/P only)
		Solutions	Lab: make solution of kool-aid
		Thermodynamics	Heat Flow
C-4.7	Summarize the oxidation and reduction processes (including oxidizing and reducing agents).		
C-4.8	Illustrate the uses of electrochemistry (including electrolytic cells, voltaic cells, and the production of metals from ore by electrolysis).		
C-4.9	Summarize the concept of chemical equilibrium and Le Châtelier's principle.	Equilibrium	Le Chatelier's Principle Temperature Pressure Lab: Le Chatelier's Principle (P/P only)
C-4.10	Explain the role of collision frequency, the energy of collisions, and the orientation of molecules in reaction rates.	Rates	Pressure Definition of Reaction Rates Catalyst Concentration Lab: Factors affecting Rate of Reaction Temperature

Chemistry

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		Equilibrium	Le Chatelier's Principle Lab: Le Chatelier's Principle (P/P only) Concentration Temperature Definition of Chemical Equilibrium Pressure
C-5	The student will demonstrate an understanding of the structure and behavior of the different phases of matter.		
C-5.1	Explain the effects of the intermolecular forces on the different phases of matter.	Bonding	States of Matter
C-5.2	Explain the behaviors of gas; the relationship among pressure, volume, and temperature; and the significance of the Kelvin (absolute temperature) scale, using the kinetic-molecular theory as a model.	Gases	Pressure
		Thermodynamics	Heat Flow
		Rates	Temperature
C-5.3	Apply the gas laws to problems concerning changes in pressure, volume, or temperature (including Charles's law, Boyle's law, and the combined gas law).	Gases	Gas Laws Lab: Observe gas laws by changing P, V, T Pressure
		Thermodynamics	Heat Flow
		Rates	Temperature
C-5.4	Illustrate and interpret heating and cooling curves (including how boiling and melting points can be identified and how boiling points vary with changes in pressure).	Thermodynamics	Heat Flow and Physical Changes Lab: Calc heat of fusion using calorimeter Heat Flow
C-5.5	Analyze the energy changes involved in calorimetry by using the law of conservation of energy as it applies to temperature, heat, and phase changes (including the use of the formulas $q = mc \Delta T$ [temperature change] and $q = mL_v$ and $q = mL_f$ [phase change] to solve calorimetry problems).	Rates	Temperature
		Thermodynamics	Heat Flow Heat Flow and Physical Changes Lab: Calc heat of fusion using calorimeter
C-5.6	Use density to determine the mass, volume, or number of particles of a gas in a chemical reaction.	Matter	Classifying Chemical Reactions
C-5.7	Apply the ideal gas law ($pV = nRT$) to solve problems.	Gases	Lab: Observe gas laws by changing P, V, T Gas Laws
C-5.8	Analyze a product for purity by following the appropriate assay procedures.		

Chemistry

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C-5.9	Analyze a chemical process to account for the weight of all reagents and solvents by following the appropriate material balance procedures.	Matter	Classifying Chemical Reactions
		Solutions	Definitions
			The Dissolution Process
			Factors that Affect the Dissolution Process
C-6	The student will demonstrate an understanding of the nature and properties of various types of chemical solutions.		
C-6.1	Summarize the process by which solutes dissolve in solvents, the dynamic equilibrium that occurs in saturated solutions, and the effects of varying pressure and temperature on solubility.	Solutions	The Dissolution Process
			Factors that Affect the Dissolution Process
			Solubility
			Definitions
		Rates	Temperature
		Thermodynamics	Heat Flow
C-6.2	Compare solubility of various substances in different solvents (including polar and nonpolar solvents and organic and inorganic substances).	Solutions	The Dissolution Process
			Factors that Affect the Dissolution Process
			Solubility
			Definitions
C-6.3	Illustrate the colligative properties of solutions (including freezing point depression and boiling point elevation and their practical uses).		
C-6.4	Carry out calculations to find the concentration of solutions in terms of molarity and percent weight (mass).	Equilibrium	Concentration
		Solutions	Concentration
			Lab: make solution of kool-aid
C-6.5	Summarize the properties of salts, acids, and bases.	Acids & Bases	Acid and Base Strength
			The pH Scale
			Properties of Acids and Bases
			Lab: Test household acids/bases
			Definition of Acids and Bases
C-6.6	Distinguish between strong and weak common acids and bases.	Acids & Bases	Properties of Acids and Bases
			Lab: Test household acids/bases
			Definition of Acids and Bases
			Acid and Base Strength
			The pH Scale
C-6.7	Represent common acids and bases by	Acids & Bases	Properties of Acids and Bases

Chemistry

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	their names and formulas.		Lab: Test household acids/bases Definition of Acids and Bases Acid and Base Strength The pH Scale
C-6.8	Use the hydronium or hydroxide ion concentration to determine the pH and pOH of aqueous solutions.	Equilibrium Acids & Bases Solutions	Concentration The pH Scale Lab: Test household acids/bases Lab: make solution of kool-aid
C-6.9	Explain how the use of a titration can determine the concentration of acid and base solutions	Acids & Bases Equilibrium Solutions	Acid and Base Strength The pH Scale Properties of Acids and Bases Lab: Test household acids/bases Definition of Acids and Bases Concentration Lab: make solution of kool-aid
C-6.10	Interpret solubility curves to determine saturation at different temperatures.	Solutions	Solubility
C-6.11	Use a variety of procedures for separating mixtures (including distillation, crystallization filtration, paper chromatography, and centrifuge).		
C-6.12	Use solubility rules to write net ionic equations for precipitation reactions in aqueous solution.	Solutions	Solubility Definitions Concentration The Dissolution Process Lab: make solution of kool-aid Factors that Affect the Dissolution Process
C-6.13	Use the calculated molality of a solution to calculate the freezing point depression and the boiling point elevation of a solution.		
C-6.14	Represent neutralization reactions and reactions between common acids and metals by using chemical equations.	Matter Acids & Bases	Equation Balancing Classifying Chemical Reactions Acid and Base Strength The pH Scale Properties of Acids and Bases Lab: Test household acids/bases Definition of Acids and Bases



Chemistry

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		Bonding	Metallic Bonding
C-6.15	Analyze the composition of a chemical sample by using gas chromatography.		