

## Chemistry

SC.O.C.1.1	formulate scientific explanations based on historical observations and experimental evidence, accounting for variability in experimental results.	
SC.O.C.1.2	demonstrate how a testable methodology is employed to seek solutions for personal and societal issues (e.g., “scientific method”).	
SC.O.C.1.3	relate societal, cultural and economic issues to key scientific innovations.	
SC.O.C.1.4	conduct and conduct and/or design investigations that incorporate the skills and attitudes and/or values of scientific inquiry (e.g., established research protocol, accurate record keeping, replication of results and peer review, objectivity, openness, skepticism, fairness, or creativity and logic).	
SC.O.C.1.5	implement safe procedures and practices when manipulating equipment, materials, organisms, and models.	
SC.O.C.1.6	use appropriate technology solutions within a problem solving setting to measure and collect data, interpret data, analyze and/or report data, interact with simulations, conduct research, and present and communicate conclusions.	
SC.O.C.1.7	design, conduct, evaluate and revise experiments (e.g., compose a question to be investigated, design a controlled investigation that produces numeric data, evaluate the data in the context of scientific laws and principles, construct a conclusion based on findings, or propose revisions to investigations based on manipulation of variables and/or analysis of error; communicate and defend the results and conclusions).	
SC.O.C.1.8	draw conclusions from a variety of data sources to analyze and interpret systems and models (e.g., use graphs and equations to measure and apply variables such as rate and scale, evaluate changes in trends and cycles, predict the influence of external variances such as potential sources of error, or interpret maps).	
1.1-1.8	<ul style="list-style-type: none"> <li>Hypothesize about the results of scientific experiments</li> </ul>	Level 2
	<ul style="list-style-type: none"> <li>Safely perform scientific experiments</li> </ul>	Level 2
	<ul style="list-style-type: none"> <li>Record scientific experiments using the proper scientific method</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>Analyze data using analog and technological sources</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>Use analog and technological sources to present experimental data</li> </ul>	Level 4
	<ul style="list-style-type: none"> <li>Draw conclusions using experimental data</li> </ul>	Level 4
SC.O.C.2.1	classify pure substances by their chemical and physical properties.	
	<ul style="list-style-type: none"> <li>Classify substances by their chemical properties</li> </ul>	Level 1
	<ul style="list-style-type: none"> <li>Classify substances by their physical properties</li> </ul>	Level 1
SC.O.C.2.2	research and evaluate the contributions of Dalton, Bohr, Heisenberg, and Schrödinger to the evolution of the atomic theory.	
	<ul style="list-style-type: none"> <li>Research contributions of Dalton</li> </ul>	Level 1

	<ul style="list-style-type: none"> <li>Research contributions of Bohr</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>Research contributions of Heisenberg</li> </ul>	Level 1
	<ul style="list-style-type: none"> <li>Research contributions of Schrödinger</li> </ul>	Level 3
SC.O.C.2.3	determine the proper set of quantum numbers ( $n$ , $l$ , $m_l$ , and $m_s$ ) for any electron in any given element.	
		Level 2
SC.O.C.2.4	produce electron configurations and orbital diagrams for any element on the periodic table and predict the chemical properties of the element from the electron configuration.	
	Produce electron configurations and orbital diagrams	Level 2
	Predict the chemical properties of the element from the electron configuration	Level 3
SC.O.C.2.5	illustrate Lewis' dot structures for representative (main group) elements.	
SC.O.C.2.6	generate the correct formula and/or name for ionic and molecular compounds.	
	<ul style="list-style-type: none"> <li>generate the correct formula for ionic compounds</li> </ul>	Level 2
	<ul style="list-style-type: none"> <li>generate the correct formula for molecular compounds</li> </ul>	Level 2
SC.O.C.2.7	analyze periodic trends in atomic size, ionic size, electronegativity, ionization energy and electron affinity.	
	<ul style="list-style-type: none"> <li>analyze periodic trends in atomic size</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>analyze periodic trends in ionic size</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>analyze periodic trends in electronegativity</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>analyze periodic trends in ionization energy and electron affinity</li> </ul>	Level 3
SC.O.C.2.8	predict the type of bonding that occurs between atoms and characterize the properties of the ionic, covalent or metallic substances.	
	<ul style="list-style-type: none"> <li>predict the type of bonding that occurs between atoms</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>characterize the properties of the ionic, covalent or metallic substances.</li> </ul>	Level 3
SC.O.C.2.9	construct models to explain the structure and geometry of organic and inorganic molecules.	
	<ul style="list-style-type: none"> <li>construct models to explain the structure and geometry of organic molecules.</li> </ul>	
	<ul style="list-style-type: none"> <li>construct models to explain the structure and geometry of inorganic molecules.</li> </ul>	
SC.O.C.2.10	given the reactants, anticipate the products and create balanced	

	equations for the five general types of chemical reactions (e.g., synthesis or combination, decomposition, single replacement, or double replacement and combustion).	
	<ul style="list-style-type: none"> <li>Identify reactants of chemical reactions</li> </ul>	Level 1
	<ul style="list-style-type: none"> <li>Predict the products of a reaction</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>Balance chemical equations</li> </ul>	Level 2
	<ul style="list-style-type: none"> <li>Identify the five types of chemical equations</li> </ul>	Level 1
SC.O.C.2.11	determine experimentally the effects of temperature and concentration on solution properties (e.g., solubility, conductivity, density and colligative properties).	
	<ul style="list-style-type: none"> <li>Determine the effects of temperature on solubility of a solution</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>Determine the effects of concentration on density</li> </ul>	Level 3
SC.O.C.2.12	classify reactions as exothermic and endothermic reactions by the direction of heat flow in a chemical reaction.	
	<ul style="list-style-type: none"> <li>Classify reactions as exothermic or endothermic</li> </ul>	Level 1
	<ul style="list-style-type: none"> <li>Calculate the change in heat resulting in a chemical reaction</li> </ul>	Level 3
SC.O.C.2.13	generate mole conversions that demonstrate the ability to convert from one type of quantity to another (e.g., mass to number of particles, number of particles to volume, or volume to mass).	
	<ul style="list-style-type: none"> <li>Convert from number of particles to moles</li> </ul>	Level 2
	<ul style="list-style-type: none"> <li>Define Avogadro's constant</li> </ul>	Level 2
	<ul style="list-style-type: none"> <li>Convert from moles to grams</li> </ul>	Level 2
	<ul style="list-style-type: none"> <li>Convert from grams to moles</li> </ul>	Level 2
SC.O.C.2.14	perform calculations using the combined gas laws.	
	<ul style="list-style-type: none"> <li>Find absolute zero using Boyle's law</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>Find the relationship between pressure and temperature in an enclosed gas system</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>Find the relationship between pressure and volume in an enclosed gas system</li> </ul>	Level 3
SC.O.C.2.15	perform the following "mole" calculations: molarity, percentage composition, empirical and molecular formula, formulas of hydrates and theoretical yield.	
	<ul style="list-style-type: none"> <li>Calculate the molarity of a solution based upon the amount of solute and solution</li> </ul>	Level 2
	<ul style="list-style-type: none"> <li>Calculate the percent composition based on mass of solute and solvent</li> </ul>	Level 2
	<ul style="list-style-type: none"> <li>Calculate the empirical formula of a compound based on percent composition</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>Calculate the percent of water in a hydrated compound</li> </ul>	Level 3
SC.O.C.2.16	compare and contrast the Arrhenius and Bronsted-Lowry definitions of acids and bases.	
	<ul style="list-style-type: none"> <li>Define an Arrhenius acid and base</li> </ul>	Level 2

	<ul style="list-style-type: none"> <li>Define a Bronste-Lowery acid and base</li> </ul>	Level 2
	<ul style="list-style-type: none"> <li>Define a strong acid</li> </ul>	Level 1
	<ul style="list-style-type: none"> <li>Define a strong base</li> </ul>	Level 1
SC.O.C.2.17	compare methods of measuring pH (e.g., indicators, indicator papers, or pH meters).	
	<ul style="list-style-type: none"> <li>Use <math>K_a</math> constant to calculate the molarity of a weak acid or base</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>Use the molarity of a solution to calculate the pH</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>Titrate an unknown acid or base using a pH indicator</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>Calculate the pH of an unknown acid or base using the data from a titration</li> </ul>	Level 4
	<ul style="list-style-type: none"> <li>Calibrate a pH meter using standardized acid and base</li> </ul>	Level 4
SC.O.C.2.18	predict the product of an acid-base reaction.	Level 2
SC.O.C.2.19	investigate and explain water's role as a solvent based upon principles of polarity of substances.	
	<ul style="list-style-type: none"> <li>Use molecular geometry and electronic activity to show water as a polar molecule</li> </ul>	Level 3
	<ul style="list-style-type: none"> <li>Show the insolubility of a polar and nonpolar substance</li> </ul>	Level 2
	<ul style="list-style-type: none"> <li>Show the use of emulsifying agents to combine polar and non polar substance</li> </ul>	Level 2
SC.O.C.3.1	synthesize concepts across various science disciplines to better understand the natural world (e.g., form and function, or systems and change over time).	Level 3
SC.O.C.3.2	investigate, compare and design scientific and technological solutions to address personal and societal problems.	
SC.O.C.3.3	communicate experimental designs, results and conclusions using advanced technology tools.	Level 4
SC.O.C.3.4	collaborate to research present current environmental and technological issues and predict possible solutions.	
	<ul style="list-style-type: none"> <li>Create a website to highlight an environmental issue</li> </ul>	Level 4
	<ul style="list-style-type: none"> <li>Create links to other sites concerning the specific issue</li> </ul>	Level 4
	<ul style="list-style-type: none"> <li>Start an online blog to discuss the issue in question</li> </ul>	Level 4
SC.O.C.3.5	explore occupational opportunities in science, engineering and technology and evaluate the required academic preparation.	
	Explore different careers in chemistry	Level 1
	Explore the academic requirements to reach each chemistry career	Level 1
SC.O.C.3.6	given a current science-technology-societal issue, construct and defend potential solutions.	Level 3