Chemistry Standards

Chemistry Teaching & Learning Framework					
Unit 1 **3 weeks BL/6 weeks YR**	**Unit 2** **3 weeks BL/6 weeks YR**	**Unit 3** **3 weeks BL/6 weeks YR**	**Unit 4** **3 weeks BL/6 weeks YR**	**Unit 5** **3 weeks BL/6 weeks YR**	**Unit 6** **3 weeks BL/6 weeks YR**
Atomic Structure (SC1)	**Bonding and Compounds (SC2)**	**Reactions (SC3)**	**Reaction Rates and Equilibrium (SC4)**	**Thermochemistry and Gas Laws (SC5)**	**Solutions and Acids and Bases (SC6)**
SC1. **Obtain, evaluate, and communicate information about the use of the modern atomic theory and periodic law to explain the characteristics of atoms and elements.** a. Evaluate merits and limitations of different models of the atom in relation to relative size, charge, and position of protons, neutrons, and electrons in the atom. b. Construct an argument to support the claim that the proton (and not the neutron or electron) defines the element's identity. c. Construct an explanation based on scientific evidence of the production of elements heavier than hydrogen by nuclear fusion. d. Construct an explanation that relates the relative abundance of isotopes of a particular element to the atomic mass of the element. e. Construct an explanation of light emission and the movement of electrons to identify elements. f. Use the periodic table as a model to predict the relative properties of elements based on the patterns of	**SC2.** **Obtain, evaluate, and communicate information about the chemical and physical properties of matter resulting from the ability of atoms to form bonds.** a. Plan and carry out an investigation to gather evidence to compare the physical and chemical properties at the macroscopic scale to infer the strength of intermolecular and intramolecular forces. b. Construct an argument by applying principles of inter- and intra- molecular forces to identify substances based on chemical and physical properties. c. Construct an explanation about the importance of molecular-level structure in the functioning of designed materials. d. Develop and use models to evaluate bonding configurations from nonpolar covalent to ionic bonding. (*Clarification statement:* VSEPR theory is not addressed in this element.)	**SC3.** **Obtain, evaluate, and communicate information about how the Law of Conservation of Matter is used to determine chemical composition in compounds and chemical reactions.** a. Use mathematics and computational thinking to balance chemical reactions (i.e., synthesis, decomposition, single replacement, double replacement, and combustion) and construct an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. b. Plan and carry out an investigation to determine that a new chemical has been formed by identifying indicators of a chemical reaction (e.g., precipitate formation, gas evolution, color change, water production, and changes in energy to the system). c. Use mathematics and computational thinking to apply concepts of the mole and Avogadro's number to conceptualize and calculate • percent composition • empirical/molecular formulas • mass, moles, and molecules relationships • molar volumes of gases d. Use mathematics and computational thinking to identify and solve different types	**SC4.** **Obtain, evaluate, and communicate information about how to refine the design of a chemical system by applying engineering principles to manipulate the factors that affect a chemical reaction.** a. Plan and carry out an investigation to provide evidence of the effects of changing concentration, temperature, and pressure on chemical reactions. b. Construct an argument using collision theory and transition state theory to explain the role of activation energy in chemical reactions. c. Construct an explanation of the effects of a catalyst on chemical reactions and apply it to everyday examples. d. Refine the design of a chemical system by altering the conditions that would change forward and amount of products at equilibrium.	**SC5. Obtain, evaluate, and communicate information about the Kinetic Molecular Theory to model atomic and molecular motion in chemical and physical processes.** a. Plan and carry out an investigation to calculate the amount of heat absorbed or released by chemical or physical processes. b. Construct an explanation using a heating curve as evidence of the effects of energy and intermolecular forces on phase changes. c. Develop and use models to quantitatively, conceptually, and graphically represent the relationships between pressure, volume, temperature, and number of moles of a gas.	**SC6.** **Obtain, evaluate, and communicate information about the properties that describe solutions and the nature of acids and bases.** a. Develop a model to illustrate the process of dissolving in terms of solvation versus dissociation. b. Plan and carry out an investigation to evaluate the factors that affect the rate at which a solute dissolves in a specific solvent. c. Use mathematics and computational thinking to evaluate commercial products in terms of their concentrations (i.e., molarity and percent by mass). d. Communicate scientific and technical information on how to prepare and properly label solutions of specified molar concentration. e. Develop and use a model to explain the effects of a solute on boiling point and freezing point. f. Use mathematics and computational thinking to compare, contrast, and evaluate the nature of acids and bases in terms of percent dissociation, hydronium ion concentration, and pH. g. Ask questions to evaluate

electrons in the outermost energy level of atoms (i.e. including atomic radii, ionization energy, and electronegativity). g. Develop and use models, including electron configuration of atoms and ions, to predict an element's chemical properties.	e. Ask questions about chemical names to identify patterns in IUPAC nomenclature in order to predict chemical names for ionic (binary and ternary), acidic, and inorganic covalent compounds.	of reaction stoichiometry problems (i.e., mass to moles, mass to mass, moles to moles, and percent yield) using significant figures. e. Plan and carry out an investigation to demonstrate the conceptual principle of limiting reactants.			merits and limitations of the Arrhenius and Bronsted-Lowry models of acid and bases. h. Plan and carry out an investigation to explore acid-base neutralization.