SCIENCE HS CHEMISTRY	**YEAR AT A GLANCE** **Student Learning Outcomes by Marking Period** **2016-2017**

FIRST TERM	**Overarching/general themes:** Matter; atomic structure; atomic theory, elements; compounds; periodic table; electron configuration; bonding.	
Dates	**Textual References** **Living by Chemistry, 1st ed.**	**To Demonstrate Proficiency by the End of the Quarter Students Will:**
Marking Period Starts: Sept. 8, 2015 Suggested Completion Date: Nov. 13, 2015 1st Predictive Assessment: Sept. TBD Close Reading: *The surprisingly scientific flash behind the fireworks: How pyrotechnicians use physics and chemistry with flair.* (David Ropeik) First Marking Period Ends: Nov. 6, 2015	**Unit 1: Alchemy; Matter, Atomic Structure, and Bonding** Sec. I: Defining Matter Sec. II: Basic Building Materials Sec. III: A World of Particles Sec. IV: Moving Electrons Sec. V: Building With Matter	• Participate in laboratory activities safely and explain how to use equipment correctly. • Define matter and its properties by sorting items & identify properties common to those considered matter (1.1). • Determine mass and volume of matter using scientific equipment (1.1). • Calculate density by solving density problems (NGSS). • Decipher chemical names and symbols by determining patterns in the names and symbols. • Describe basic chemical equations and conservation of matter, describing how copper is taken through various chemical reactions & recovered (4.1, 5.1). • Explain the organization of the periodic table and its patterns (3.1, 3.2, 3.3). • Describe basic atomic structure by examining various models and relating this to the periodic table (2.1, 2.2). • Compare and contrast different atoms structurally and describe what changes are needed to change one element into another by exploring isotopes, nucleosynthesis, and radioactivity, and by examining reactions resulting in new elements (2.5, 2.7). • Provide evidence that compounds are made up of elements by conducting flame tests (1.1). • Draw shell models and determine electron configurations using the periodic table (2.4). • Describe ionic bonding patterns (4.1). • Write names and chemical formulas for compounds containing polyatomic ions (4.6). • Explore the transition metals in making paint pigments. • Explain types of bonding by examining 4 models and the properties associated with each (4.1). • Explain the relationship between an element's location on the periodic table and its bonding patterns (3.1, 3.3, 3.4). • Explore electroplating by extracting metal ions from ionic compounds (8.4).

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SECOND TERM	**Overarching/general themes:** Molecular structure and properties; molecular formula; Lewis dot structure; chemical reaction; balancing equations; stoichiometry; acid-base chemistry; precipitation reactions; energy thermodynamics; chemical and physical change and energy; laws of thermodynamics; combustion; bond energies; heats of reaction; oxidation-reduction, and electrochemistry. (Note: Parts of the Fire unit are covered in Term 2 and others in Term 4)	
Dates	**Textual References** **Living by Chemistry, 1st ed.**	**To Demonstrate Proficiency by the End of the Quarter Students Will:**
Marking Period Starts: Nov. 9, 2015 Suggested Completion Date: Dec. 13, 2015 for Unit 2 Close Reading: *Smells: Why a Molecule's Shape Matters*	**Unit 2: Smells; Molecular Structure and Properties** Sec. I: Speaking of Molecules Sec. II: Building Molecules Sec. III: Molecules in Action Sec. IV: Molecules in the Body	• Analyze molecular properties and behavior by drawing on personal experience with scents (1.1, 1.2, 1.3, 6.1, 6.3, 6.5). • Describe the difference between molecular structures and molecular formulas by examining structures and writing formulas (4.2, 4.6). • Explain and use the HONC 1234 rule to create structural formulas from molecular formulas (4.1, 4.2). • Identify isomers by discussing isomers and visualizing different orientations. • Use Lewis-dot symbols to create structural formulas and predict molecular bonding and structure using Lewis-dot symbols and the octet rule (4.1, 4.2). • Use structural formula cards as a model to Identify and name functional groups within molecules and relate these to certain smells (4.6). • Synthesize an ester from an alcohol and an organic acid (NGSS HS-PS1-4). • Study the role of electron pairs and molecular shape by working with ball-and-stick models (4.4). • Generate links between molecular shape and smell using space-filling models (4.4). • Explore receptor site theory and how the nose works by modeling this. • Describe behavior of polar molecules through observation (4.3, 4.5). • Describe different bond types based on electronegativity (4.3). • Use electro-negativity values to compare atoms and bonds and direction of bond dipoles and molecule as a whole (4.3). • Predict whether a substance will have a smell based on its composition, bonding, phase, size, and polarity. • Identify mirror-image isomers. • Build models to see how amino acids link and fold to build proteins. • Predict the smell of a compound and test the accuracy of this prediction.
Suggested Start Date: January 5, 2016 for Unit 3 Suggested Completion Date: Jan. 15, 2016 for Unit 3 Close Reading: *Sugar: An Unusual Explosive*	**Unit 3: Toxins; Stoichiometry, Solution Chemistry, & Acids and Bases** Sec. I: Toxic Change	• Interpret chemical equations, predict products of reactions, and test predictions (4.1, 5.1). • Define chemical and physical change and classify chemical equations as such (1.1, 1.3, 2.3, 5.2). • Provide evidence that mass is conserved during chemical change through experimentation (2.3, 5.1). • Balance chemical equations (5.1). • Classify the types of chemical reactions according to change that takes place (5.2).

SECOND TERM	Overarching/general themes: Molecular structure and properties; molecular formula; Lewis dot structure; chemical reaction; balancing equations; stoichiometry; acid-base chemistry; precipitation reactions; energy thermodynamics; chemical and physical change and energy; laws of thermodynamics; combustion; bond energies; heats of reaction; oxidation-reduction, and electrochemistry. (Note: Parts of the Fire unit are covered in Term 2 and others in Term 4)	
Dates	**Textual References** **Living by Chemistry, 1st ed.**	**To Demonstrate Proficiency by the End of the Quarter Students Will:**
Second Term continued Suggested Start Date: Jan. 19, 2016 for Unit 4 2nd Predictive Assessment: TBD Suggested Completion Date for Unit 4 and Second Marking Period Ends: Jan. 29, 2016	**Unit 4: Fire; Energy, Thermodynamics, and Oxidation-Reduction (Fire Supplement 1)** Sec. II: Measuring Energy Lesson 7 You're Fired! Sec. I: Observing Energy Lesson 1 Fired Up! Lesson 2 Not So Hot Lesson 3 Point of View Sec. III: Understanding Energy Lesson 13 Speed Things Up Sec. IV: Controlling Energy Lesson 15 Metal Magic Lesson 17 Electron Cravings	• Identify substances that combust (1.1, 4.1, 5.2, 6.4, 8.4). • Review chemical literature for examples of oxygen reacting with other substances (1.1, 3.3, 4.1, 4.2, 4.6, 5.1, 5.2, 6.2, 7.5, 8.4). • Provide examples of oxidation that occurs in tandem with reduction (8.4). • Predict chemical reactions that will release energy (exothermic reactions) (6.4). • Describe chemical reactions that may release energy (exothermic reactions) or require energy to proceed (endothermic reactions) (6.4). • Find popular representations demonstrating that energy can neither be created nor destroyed and that the universe tends to disorder (6.3, 6.4, 6.5). • Change the conditions for chemical reactions that increase or slow the rate of reaction (7.5, 7.6). • Use the model of oxidation and reduction to more deeply describe chemical reactions in terms of electron transfer; especially combustion reactions and reactions of transition metals with oxygen, sulfur and solutions of salts of other transition metals. (8.4, 7.7.5, 7.6, 3.4, NGSS)

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THIRD TERM	**Overarching/general themes** Stoichiometry; solution chemistry, acids and bases; qualitative and quantitative aspects of chemical reactions; atomic theory and molecular structure; gas laws; phase changes; temperature scales; mole; solutions and dilutions; weather in terms of gas laws.	
Dates	**Textual References** **Living by Chemistry, 1st ed.**	**To Demonstrate Proficiency by the End of the Quarter Students Will:**
Marking Period Starts Feb. 1, 2016: and Suggested Start Date: Feb. 8, 2016 for Unit 5 2nd Predictive Assessment: TBD Suggested Completion Date: Mar. 24, 2016 for Unit 5	**Unit 5: Toxins; Stoichiometry, Solution Chemistry, and Acids and Bases** Sec. II: Measuring Toxins Sec. III: Toxins in Solution Sec. IV: Acidic Toxins Sec. V: Toxic Cleanup	• Calculate toxic dose substances given LD_{50} • Weigh out a mole of different substances to understand Avogadro's number and how it translates in scientific notation and grams. • Calculate molar mass of compounds and use molar mass to complete mass-mole calculations (5.3). • Calculate LD_{50}, molar mass, grams, and moles for fructose & aspartame • Considering pros and cons of additives. • Determine molarity of solutions (7.2). • Define solution, saturated solution, solute, and solvent. • Calculate # moles or grams in a solution sample (7.2). • Make solutions with different concentrations (7.2). • Classify substances as acids and bases and how indicators determine if something is an acid or a base (8.1). • Examine particle models of acids and bases to create definitions of Arrhenius and Bronsted-Lowry acids and bases (8.1). • Define pH and explain the connection to –OH and H+ concentrations (8.2). • Complete a serial dilution of a solution and its effects on the acidity or basicity of a solution (7.2, 8.2). • Mix chemicals to determine if a chemical reaction has occurred. • Write chemical equations including that for a neutralization reaction (5.1, 5.2). • Perform a titration and determine the molarity of a solution with an unknown concentration • Mix solutions to determine in a precipitate is formed (7.3, 7.5). • Solve limiting reactant problems (7.3, 7.5). • Complete gram-mole-gram conversions (5.5). • Calculate percent yield for reaction (5.6)
Suggested Start Date: March 28, 2016 for Unit 6 Close Reading: *The Chemistry Of Popcorn: It's All About 'Pop-Ability'.* Science Daily (2005, April 15, 2013)	**Unit 6: Weather; Phase Changes & Behavior of Gases** Sec. I: Physically Changing Matter Sec. II: Pressing Matter Sec. III: Concentrating Matter	• Interpret basic weather maps • Determine the proportional relationship between volume and height for measuring rainfall • Calculate density and explain how it is affected by phase changes (1.1, 1.3, 4.5, 6.1, 6.3, 6.5, 7.1). • Examine changes in phase, volume, and density in response to changes in temperature (6.1, 6.3, 6.5). • Create liquid and gas thermometers to explain how they work and temperature scales • Convert between degree Celsius and degree Fahrenheit and Celsius and Kelvin • Observe the motion of gas molecules (kinetic theory of gases) via computer simulation. Describe. • Solve simple gas law problems using Charles's law relating volume and temperature of a gas (6.1) • Explain role of temperature and density in the movement of cold and warm air masses (6.1).

THIRD TERM	Overarching/general themes Stoichiometry; solution chemistry, acids and bases; qualitative and quantitative aspects of chemical reactions; atomic theory and molecular structure; gas laws; phase changes; temperature scales; mole; solutions and dilutions; weather in terms of gas laws.	
Dates	**Textual References** **Living by Chemistry, 1st ed.**	**To Demonstrate Proficiency by the End of the Quarter Students Will:**
Third Term continued Third Marking Period Ends: April 15, 2016 Suggested Completion Date for Unit 6 Apr. 29, 2016	**Unit 6: Weather (continued)**	• Define gas pressure • Explain the inversely proportional relationship between pressure and volume of a gas (Boyle's law) (6.1). • Observe Gay-Lussac's Law and solve problems involving this law (6.1). • Define and use the combined gas law involving all three variables (pressure, volume, and temperature) (6.1). • Apply understanding of gas behavior to weather (1.1, 1.2, 1.3, 2.3, 4.5, 6.1, 6.3, 6.4, 6.5, 7.1, 7.6, 8.3). • Explore pressure and temperature variations in the atmosphere (1.1, 1.2, 1.3, 2.3, 4.5, 6.1, 6.3, 6.4, 6.5, 7.1, 7.6, 8.3). • Explain the relationship between number of particles and volume, temperature, and pressure of gas (6.1). • Define a mole in terms of number of particles (6.2). • Define STP and relate it to Avogadro's law (6.2). • Calculate the number of gas molecules in a given volume using the ideal gas law (6.2) • Investigate humidity to explain fog, dew, rain, and snow (1.1, 1.2, 1.3, 2.3, 4.5, 6.1, 6.3, 6.4, 6.5, 7.1, 7.6, 8.3). • Investigate extreme weather such as hurricanes including the role of phase change, air pressure, and temperature (1.1, 1.2, 1.3, 2.3, 4.5, 6.1, 6.3, 6.4, 6.5, 7.1, 7.6, 8.3).

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FOURTH TERM	**Overarching/general themes** Energy thermodynamics; connection between chemical and physical change and energy; laws of thermodynamics; combustion; bond energies; heats of reaction; oxidation-reduction; electrochemistry; reversible reactions and chemical equilibrium. (Note: Parts of the Fire unit are covered in Terms 2 and 3)	
Dates	**Textual References** **Living by Chemistry, 1st ed.**	**To Demonstrate Proficiency by the End of the Quarter Students Will:**
Marking Period Starts Apr. 25, 2016: Suggested Start Date: May 2, 2016 for Unit 7 Suggested Completion Date: May 13, 2016 for Unit 7	**Unit 7: Fire; Energy, Thermodynamics, and Oxidation-Reduction (Fire Supplement 2)** Sec. II: Measuring Energy Lesson 10 Fuelish Choices Sec. III: Understanding Energy Lesson 11 Make It or Break It Lesson 12 Over the Hill Lesson 14 Make It Work Sec. IV: Controlling Energy Lesson 15 Metal Magic Lesson 16 Pumping Iron Lesson 17 Electron Cravings Lesson 18 The Active Life Lesson 19 Current Events	• Analyze the calorimetric results of fuel combustion for differences in heats of combustion (6.4). • Use models to represent bond breaking and bond making in combustion reactions (6.4). • Graphically represent the energy of a chemical reaction (6.4, 7.5). • Research information on the steam engine and the internal combustion engine to associate chemical reactions with work (6.1). • Create a table of heats of formation for metals oxidizing (8.3). • Argue for the claim that electrons move from a pure metal to the oxygen in a redox reaction (4.1, 8.3). • Organize a demonstration that dramatizes the different activities of metals. • Diagram/model a piston and its movement and calculate the work that must be expended for it to rotate against air pressure of one Torr. • Construct a Daniell cell, predict the voltage from a theoretical Table of Reduction Potentials, then using the actual voltage in the cell, make a comparison between the two voltages, theoretical and actual. Document the procedure used and the calculations and measurements made.
Suggested Start Date: May 16, 2016 for Unit 8 Suggested Completion Date: May 27, 2016 for Unit 8 MCAS: June 1-2, 2016 End of Course Assessment: June 3-20, 2016 Completion of Extended Projects and Feedback and Fourth Marking Period Ends: June 22, 2016	**Unit 8: Showtime; Reversible Reactions and Chemical Equilibrium** Sec. I: Chemical Equilibrium Lesson 1 How Awesome Lesson 2 How Backward Lesson 3 How Dynamic Lesson 4 How Favorable Lesson 5 How Balanced Sec. II: Changing Conditions at Equilibrium Lesson 6 How Pushy Lesson 7 How Colorful	• Demonstrate that a solution is different from a pure solvent using a pH indicator, densitometer, or colligative properties (1.1, 4.5, 7.4, 8.2). • Use a Cobalt Chloride solution or a saturated Potassium Nitrate solution to demonstrate the reversibility of a reaction by changing the temperature of the solution (6.4, 7.1, 7.6). • Make predictions about the distribution of particles (marbles, water) and about room humidity under specific conditions and relate them to equilibrium. Identify factors that could influence humidity (7.6) (6.5). • Explain how an antacid works in the stomach (8.3).