2019-2020 Chemistry Annual Overview – Semester 1

	Topic *= Benchmark Assessed on Common Final Exam	Learning Targets	Suggested Pacing
	This course has a cumulative year-long Common Final Exam		
Unit 1 – Intro to Chemistry	**T1- Data Collection & Analysis (N.1.1, N.1.6, N.2.3, MACC.912.N-Q.1.1, MACC.912.N-Q.1.3, MACC.912.F-IF.3.7)** • Choosing & Interpreting Units & Labels • Precision vs. Accuracy • Significant Figures • Percent Error • Dimensional Analysis • Creating & Interpreting Graphs • Characteristics of Science & Methods	• ***Define*** a problem based on chemistry and ***design*** an experiment to investigate, collect and analyze data, and pose explanations supported by data collected. (N.1.1) ○ ***Collect Data/Evidence*** use tables/graphs to draw conclusions, and make inferences based on patterns or trends in the data. (N.1.6) ○ ***Determine*** the number of significant figures in measurements and calculations. ***Explain*** the difference between precision and accuracy. ***Calculate and explain*** the concept of percent error. (N-Q.1.3) ○ ***Recognize*** the importance of using units and labels while showing work. ***Identify*** the steps taken during multi-step problems by showing work during dimensional analysis. ***Create*** the appropriate type of graph to represent and plot data. (N-Q.1.1) ○ ***Create and interpret*** the key features of various types of graphs (as available technology permits). (F-IF.3.7) • ***Differentiate*** between what is science and what is not science (religion, opinion or belief). *(N.2.3) Honors* • ***Identify*** the strict standards of science and explain how pseudoscience does not adhere to those standards. *(N.2.3) Honors*	**6 Days** **3 Blocks** Aug 19th – Aug 26th *Unit 1 Quiz Aug 26th*
Unit 2 – Forms of Matter	**T1 – Matter & Change (*P.8.1, *P.8.2)** • Particles and four states of Matter • Physical vs. Chemical Properties	• ***Identify and describe*** the four states of matter (solid, liquid, gas, plasma) in terms of energy, phase transitions, arrangement, and movement of particles. (*P.8.1) • ***Differentiate*** between physical and chemical properties of matter (volume, compressibility, density, conductivity, malleability, reactivity, molecular composition, freezing point, melting points, boiling point). (*P.8.2) • ***Distinguish*** between an element, a compound, and a mixture. (*P.8.2)	**4 Days** **2 Blocks** Aug 27th – Aug 30th
	T2 – Methods & Experiments (*P.8.2) • Physical vs. Chemical Changes • Mixture Types & Separation Techniques	• ***Identify*** physical and chemical changes in matter. (*P.8.2) • ***Differentiate*** between heterogeneous and homogenous mixtures. (*P.8.2) • ***Describe*** how to separate various types of mixtures using simple laboratory techniques (filtration, distillation, chromatography, evaporation) based on physical properties. (*P.8.2)	**6 Days** **3 Blocks** Sept 3rd – Sept 10th *Unit 2 Test Sept 11th*

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Unit 3- Structure of Matter	**T1 – Atom (*P.8.4, *P.8.3, N.3.5, N.1.2, N.1.5, N.2.4, N.2.5, N.3.1, N.3.3, N.3.2)** • Modern Atomic Theory • Development of the Atomic Model due to Experimental Evidence • Consensus in the Development of a Theory • Contributions to Science	•***Compare & contrast*** the proton, neutron, and electron based on mass, electrical charge, and location in the atom. (*P.8.4) •***Explain*** the existence of neutrons and how they affect an element's mass (isotopes). (*P.8.4) •***Calculate*** the relative atomic mass of an element. (*P.8.4) •***Explain*** the order in which the proton, neutron, and electron were discovered. (*P.8.3) •***Identify*** changes in the atomic model from ancient to modern times. (*P.8.3, N.3.5) •***Describe*** the following scientists and experiments and their importance to the development of modern atomic theory: Dalton, Rutherford's Gold-foil, Thompson's cathode ray tube, Bohr's planetary model, *Millikan's oil drop experiment*. ***Recognize*** the various backgrounds of each scientist influence the explanations they made towards modern atomic theory. (*P.8.3, N.2.5, N.3.5) •***Describe*** criteria for science (testable, can be verified, derived from experimentation and observations, systematic, seeks to falsify claims through testing, relies on empirical evidence). (N.1.2) •***Describe*** science as both durable (long-lasting), robust (strongly supported by data from repeated experimentation) and yet open to change. (N.2.4) •***Explain*** the difference between scientific theories and scientific laws. ***Describe*** the role consensus plays in the development of a theory. (N.3.3, N. 3.2) •***Recognize*** that contributions to science can be made and have been made by many people from all over the world. (N.1.5) •***Differentiate*** between a hypothesis and a theory. *(N.3.1) Honors* •***Recognize*** that theories evolve over time based on new information and technology. *(N.3.1) Honors*	**4 Days** **2 Block** Sept 12th – Sept 17th
	T2 – Electromagnetism (*P.10.18) • Wavelength vs. Frequency • Energy Levels in the EMS Spectrum	•***Explain*** the inverse relationship between wavelength and frequency. (*P.10.18) •***Compare & contrast*** the different parts of the EM spectrum (radio, micro, infrared, visible light, UV, X-rays, gamma) in terms of energy. (*P.10.18) •***Explain*** what happens to an electron when it absorbs or releases energy. (*P.10.18) •***Perform*** calculations to determine the wavelength or frequency given the speed of light. (P.10.18)	**4 Days** **2 Blocks** Sept 18th – Sept 23rd
	T3 – Quantum Theory (*P.10.9) • Quantization of Energy at Atomic Level • Energy Levels, Sublevels & Orbitals	•***Explain*** the relationship between an electron's distance from the nucleus and its (absorbing or emitting) energy using the Bohr model. (*P.10.9) •***Compare & contrast*** energy levels, sublevels, and orbitals. (*P.10.9)	**2 Days** **1 Blocks** Sept 24th – Sept 25th *Unit 3 Test Sept 26th*

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Unit 4 – Periodic Table	**T1 – Introduction & Layout (*P.8.5, N.1.4)** • Groups & Periods • Octet Rule • Electron Configuration • Aufbau, Pauli & Hund Concepts • Reliable Sources	•***Explain*** the arrangement of elements on the periodic table according to periodic law and the octet rule. (*P.8.5) •***Identify*** the following groups on the periodic table: Alkali metals, Alkali Earth metals, Transition metals, Inner Transition metals, Metalloids, Halogens (halides), and Noble gases. (*P.8.5) •***Apply*** the concepts of Aufbau, Pauli, and Hund to determine the location of an electron in the atom. (*P.8.5) •***Identify and write*** the electron configurations for elements 1-36 in multiple ways. (*P.8.5) •***Determine*** an atom's location on the periodic table based on its electron configuration (and vice versa). (*P.8.5) •***Research*** elements on the periodic table using reliable sources of information that follow the strict standards of science. (N.1.4)	**6 Days** **3 Blocks** Sept 27th – Oct 4th
	T2 – Periodic Trends (*P.8.5) • Reactivity, Radius, Electronegativity & Ionization Energy	•***Explain*** what happens to an atom's radius, electronegativity, and ionization energy as you go across a period or down a group of the periodic table based on nuclear charge and shielding electrons. (*P.8.5) •***Compare*** an ion's radius to its atom's radius. (*P.8.5) •***Compare*** different elements' reactivity based on positioning on the periodic table. (*P.8.5)	**4 Days** **2 Blocks** Oct 7th – Oct 10th *Unit 4 Test* *Oct 11th*
End of Quarter 1			

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Unit 5 - Compounds	**T1- Bonding (*P.8.6, P.8.12)** • Ionic vs. Covalent Bond Characteristics • Lewis Structures • Metallic Bond • Bonding Characteristics of Carbon (H)	•***Explain*** the properties and differences between ionic, covalent, and hydrogen bonding. (*P.8.6) •***Predict*** the type of bond in a binary compound based on the position of its elements on the periodic table. (*P.8.6) •***Predict*** bonding polarity based on electronegativity differences. (*P.8.6) •***Determine*** Lewis structures containing single or multiple bonds. (*P.8.6) •***Discuss*** the repeating arrangement of ions in crystals. (P.8.6) •***Explain*** the electron sea model of metallic bonding and relate it to the properties of metals. (P.8.6) •***Explain*** how carbon's atomic structure allows it to bond in multiple ways to other carbon atoms, to functional groups, and in polymers. *(P.8.12) Honors*	**6 Days** **3 Blocks** Oct 15th – Oct 22nd

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	T2 – Naming (*P.8.7, P.8.13) • Ionic Compounds • Binary Molecular Compounds • Functional Groups (H)	•***Identify*** the names of ionic compounds when given the chemical formula. (*P.8.7) •***Name*** the chemical formulas for binary molecular compounds. (*P.8.7) •***Identify*** the functional groups sugars, proteins, nucleotides, amino acids, hydroxyl groups which form alcohols, carbonyl groups which form aldehydes/ketones, carboxyl groups which form carboxylic acids, and **identify** their properties when added to a hydrocarbon. *(P.8.13) Honors*	**6 Days** **3 Blocks** Oct 23rd – Oct 30th
	T3 – Formula Writing (*P.8.7) • Binary & Tertiary Ionic Compounds • Binary Molecular Compounds	•***Determine*** the formula for binary and tertiary ionic compounds when given the name. (*P.8.7) •***Determine*** the formula for binary molecular compounds when given the name. (*P.8.7)	**6 Days** **3 Blocks** Oct 31st – Nov 7th *Unit 5 Test* *Nov 8th*
Unit 6 – Chemical Reactions	**T1 – Chemical Equations (*P.8.8, *P.8.9, P.8.10, P.10.2)** • Reaction Types • Oxidation-Reduction Reactions in Living and Non-living Systems (H) • Balance Chemical Equations • Conservation of Energy (H)	•***Determine*** the type of chemical reaction given the chemical equation (redox, acid-base, synthesis, decomposition, single-replacement, double-replacement, combustion). (*P.8.8) •***Balance*** a chemical equation. (*P.8.9) •***Relate*** the law of conservation of mass to balancing a chemical equation. (*P.8.9) •***Describe*** what happens during oxidation and reduction in terms of: loss or gain of electrons, increase or decrease of oxidation numbers, loss or gain of oxygen, and loss or gain of hydrogen. *(P.8.10) Honors* •***Assign*** oxidation numbers and classify half reactions as either oxidation or reduction. *(P.8.10) Honors* •***Write*** a chemical reaction that depicts energy as a product or reactant. *(P.10.2) Honors* •***Define*** enthalpy. *(P.10.2) Honors* •***Calculate*** the enthalpy change for a reaction using experimental data on temperature changes, quantities of reactants, and mass of water. *(P.10.2) Honors*	**10 Days** **5 Blocks** Nov 11th – Nov 22nd *Unit 6 Quiz* *Nov 22nd*
	Thanksgiving Break (November 23rd – December 1st)		
	T2 – Mole Concept (*P.8.9) • Convert between Moles, Particles, Mass & Volume	•***Define*** a "mole" as a unit used for counting atoms, molecules, and formula units. (*P.8.9) •***Convert*** between moles, particles, mass, and volume in a sample of substance. (*P.8.9)	**6 Days** **3 Blocks** Dec 2nd – Dec 9th
Exam Review **December 10th – December 16th**			
Teacher-Generated Semester Exam **December 17th – 20th**			

	2019-2020 Chemistry Annual Overview - Semester 2		
	Topic ***= Benchmark Assessed on Common Final Exam**	**Learning Targets**	**Suggested Pacing**
	This course has a cumulative year-long Common Final Exam		
Unit 7 – Stoichiometry	**T1 – Stoichiometry (*P.8.9, N.1.7)** • Calculate Quantities of Chemicals in Reactions • Limiting Reagents • Calculate Percent Yield • Critical & Analytical Thinking	•***Perform*** calculations involving moles, mass, volume, and representative particle conversion factors in any combination using the principles of stoichiometry. (*P.8.9) •***Calculate*** the amount of product formed in a limiting reagent problem, given the quantity of two reactants. (*P.8.9) •***Calculate*** percent yield of a reaction based on the relationship between theoretical yield (from stoichiometry) and experimental yield. (*P.8.9) •***Work*** through difficult problems using critical and analytical thinking in problem solving. (N.1.7)	**17 Days** **8.5 Blocks** Jan 7th – Jan 30th *Unit 7 Test Jan 31st*
Unit 8 – Fluids	**T1 – Behavior of Gases (*P.12.10)** • Kinetic Molecular Theory • Gas Laws (Boyle's, Charles', Gay-Lussac's, Avogadro's Hypothesis)	•***Explain*** the Kinetic Molecular Theory. (*P.12.10) •***Describe*** elastic collisions. (*P.12.10) •***Identify*** factors that affect the behavior of gases. (*P.12.10) •***Identify and apply*** the relationships between temperature, pressure, volume, and moles using the gas laws (Boyle's, Charles', Gay-Lussac's, Avogadro's Hypothesis). (*P.12.10) •***Interpret*** the graphical representation of the relationships between T, P, V, and n. (*P.12.10) •***Explain*** the conditions under which a real gas deviates from an ideal gas. (*P.12.10)	**10 Days** **5 Blocks** Feb 3rd – Feb 14th
	T2 – Phase Transitions (*P.12.11, P.10.5) • Particle Motion • Heating Curve/Phase Diagram • Kinetic Molecular Theory • Relate Temperature to Kinetic Energy	•***Describe*** phase transitions in terms of the Kinetic Molecular Theory. (*P.12.11) •***Determine*** the phase of a substance using a heating curve (time vs. temp) or a phase diagram. (*P.12.11) •***Identify*** conditions under which phase changes occur. (*P.12.11) •***Compare*** the motion of particles in different phases. (*P.12.11) •***Define*** the relationship between the temperature in Kelvin and the average kinetic energy of particles. (P.10.5)	**10 Days** **5 Blocks** Feb 18th – March 2nd
	T3 – Intra & Intermolecular Forces (*P.8.6, L.18.12) • Intramolecular vs. Intermolecular Force • Water Soluble Substances • Cause & Effect of Properties of Water	•***Predict*** charge distribution based on electronegativity values and location of element on the periodic table. (*P.8.6) •***Compare*** the strengths of intermolecular attractions with the strengths of ionic and covalent bonds. (*P.8.6) •***Explain*** the difference between intermolecular and intramolecular forces. (*P.8.6) •***Explain*** how the interactions between water molecules accounts for the unique properties of water. (L.18.12) •***Relate*** the different properties of water with their importance to life on Earth. (L.18.12) •***Identify*** the types of substances that will dissolve in water. (L.18.12)	**8 Days** **4 Blocks** March 3rd – March 12th *Unit 8 Test March 13th*
Spring Break (March 14th – March 22nd)			

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Unit 9 – Acids, Basis & pH	**T1 – Acid Base Theory (*P.8.11, N.1.2, N.2.2)** • Bronsted-Lowry & Arrhenius • Experimentation	• ***Define*** acids and bases using the Bronsted-Lowry, and Arrhenius definitions. (*P.8.11) • ***Use*** experimental data to illustrate and explain the pH scale, to characterize acid-base solutions. ***Use*** the criteria for science (testable, can be verified, derived from experimentation and observations, systematic, seeks to falsify claims through testing, relies on empirical evidence) when conducting experimentation. (N.1.2) ***Recognize*** which questions can be answered through science and which questions are outside the boundaries of scientific investigation. ***Recognize*** scientific questions that can be disproved by experimentation/testing. (N.2.2)	**2 Days** **1 Block** March 24th – March 25th
	T2 – Ion Concentration & pH (*P.8.11) • Dissociation • pH Scale • Strength & Concentration	• ***Define*** pH. (*P.8.11) • ***Differentiate*** between acids and bases and ***classify*** a substance as acidic, basic, or neutral based on its pH, $[H^+]$, or $[OH^-]$. (*P.8.11) • ***Distinguish*** between strong and weak acids/bases based upon extent of dissociation. (P.8.11) • ***Recognize*** the difference between strength of acids/bases and concentration of acids/bases. (P.8.11)	**10 Days** **5 Blocks** March 26th – April 8th *Unit 9 Test April 9th*
Unit 10 - Thermochemistry	**T1 – Forms and Transformations of Energy (P.10.1, N.4.1)** • Potential & Kinetic • Examples of Energy Transformations	• ***Recognize*** that energy cannot be created or destroyed, only transformed. (P.10.1) • ***Differentiate*** between kinetic and potential energy. (P.10.1) • ***Identify*** various examples of the transformation of energy (heat to light, light to heat, electrical to sound, sound to electrical, electrical to chemical, chemical to electrical, mechanical to electrical, nuclear to heat, etc.). (P.10.1) • ***Explain*** how scientific knowledge and reasoning provide an empirically-based perspective to inform various consumer choices involving energy efficiency. (N.4.1)	**2 Days** **1 Block** April 13th – April 14th
	T2 – Exothermic & Endothermic Reactions (*P.10.6, *P.10.7, N.1.6, P.10.8) • Potential Energy Diagrams • Entropy (H) • Inferences from data	• ***Draw, label, and interpret*** endothermic and exothermic energy diagrams. (*P.10.6) • ***Identify*** the amount of activation energy needed based on a potential energy diagram. (*P.10.6) • ***Explain*** the difference between endothermic and exothermic reactions. (*P.10.7) • ***Classify*** chemical reactions and phase changes as exothermic or endothermic. (*P.10.7) • ***Define*** heat as the energy transferred between matter due to a difference in temperature. (P.10.7) • ***Collect Data/Evidence*** on endothermic and exothermic reactions, use tables/graphs to draw conclusions, and make inferences based on patterns or trends in the data. (N.1.6) • ***Predict*** entropy changes and spontaneity of chemical reactions. *(P.10.8) Honors*	**5 Days** **2.5 Blocks** April 15th – April 21st *Unit 10 Test April 22nd*

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Unit 11 – Rates & Equilibrium	**T1 – Factors that Affect Rates (*P.12.12)** • Surface Area, Concentration, Temperature & Catalyst • Collision Theory	•***Describe*** how a catalyst speeds up a reaction. (*P.12.12) •Using collision theory, ***predict*** the effect on the rate of a reaction when altering the concentration, temperature, pressure, surface area, and presence of a catalyst. (*P.12.12)	**4 Days** **2 Blocks** April 23rd – April 28th
	T2 – Concepts of Equilibrium (*P.12.13) • Dynamic Equilibrium • LeChatelier's Principle	•***Identify and explain*** the factors that affect the rate of dissolving (temperature, concentration, surface area, pressure, mixing). (*P.12.13) •***Apply*** LeChatelier's principle to ***predict*** the direction of equilibrium shift when an external stress is applied. (*P.12.13) •***Describe*** reversible reactions in terms of dynamic equilibrium. (*P.12.13) •***Recognize*** characteristics of a reaction that has reached dynamic equilibrium. (*P.12.13)	**6 Days** **3 Blocks** April 29th – May 6th
Unit 12 – Nuclear Processes	**T1 – Nuclear Reactions (*P.10.12, P.10.11, P.10.10, N.4.2, L.17.15, L17.19)** • Chemical vs. Nuclear Reactions • Radioactive Decay (alpha, beta, gamma), Fission, Fusion (H) • Half-Life Calculations (H) • Real world examples of Chemical & Nuclear Reactions • Cost & Benefits to Society & Environment (H)	• ***Identify*** and ***explain*** the differences between chemical and nuclear reactions. (*P.10.12) • ***Distinguish*** between the different types of radiation (alpha, beta, and gamma). (P.10.11) • ***Explain*** the differences between nuclear fission and fusion, and understand that there is a difference between light vs. heavy. *(P.10.11) Honors* • ***Predict*** the type of nuclear decay based upon its neutron to proton ratio. *(P.10.11) Honors* • ***Calculate*** the amount of radioactive substance remaining after an integral number of half-lives have passed. *(P.10.11) Honors* • ***Explain*** both the benefits and hazards associated with the different types of nuclear energy. *(L.17.19) Honors* • ***Describe*** the potential environmental hazards of nuclear energy. *(L.17.15) Honors* • ***Evaluate*** the viability of nuclear energy by comparing it to the availabilities and consequences of use of nonrenewable natural resources. *(L.17.15) Honors* • ***Provide*** examples of alternative forms of renewable energy, their effects on the environment and the viability of the uses on a large scale. *(L.17.15) Honors* • ***Compare & contrast*** the different forms of energy in relation to their costs vs. their benefit. *(L.17.15) Honors*	**6 Days** **3 Blocks** May 7th – May 14th *Unit 11 & 12 Test May 15th*
Exam Review **May 18th – May 21st**			
Common Final Exam (cumulative of year-long content) **May 22nd – May 28th**			