Academy Park Chemistry	
Unit 1	The Importance of Matter
Unit 2	The Composition of Matter
Unit 3	Electrons
Unit 4	The Periodic Table
Unit 5	Bonding
Unit 6	Chemical Reactions
Unit 7	The Mole and Stoichiometry

Unit 1: The Importance of Matter **Topic**: Matter	**Subject/Course**: C.P. Chemistry **Grade**: 10 – 12 K. Greto
Keystone Assessment Anchors and NGSS	
CHEM.A.1.1.1: Classify physical or chemical changes within a system in terms of matter and/or energy.	
CHEM.A.1.1.2: Classify observations as qualitative and/or quantitative.	
CHEM.A.1.1.3: Utilize significant figures to communicate the uncertainty in a quantitative observation.	
CHEM.A.1.2.2: Differentiate between homogeneous and heterogeneous mixtures (e.g., how such mixtures can be separated).	
CHEM.B.1.1.1: Apply the mole concept to representative particles (e.g., counting, determining mass of atoms, ions, molecules, and/or formula units).	
CHEM.B.1.2.2: Apply the law of definite proportions to the classification of elements and compounds as pure substances.	
HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.	
HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	
*HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.**	
HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).	

Unwrapping the Standards	
Big Ideas	**Essential Questions**
Definition of Chemistry	**Why is Chemistry considered 'The Central Science'**
Branches of Chemistry	*What defines the various branches of chemistry?*
Matter, Mass, and Volume	What can and cannot be considered Matter?
Mass versus Weight	How do mass and weight compare and contrast?
Chemical versus Physical Change	**How are chemical and physical changes different on the microscopic level?**
Indicators of a Chemical Reaction	**How can you tell that a chemical change has taken place? How does the law of conservation of mass apply to chemical reactions?**
Interactions between any two objects can cause changes in one or both of them	How can one explain and predict interactions between objects within systems?
The Scientific Method	Are the steps in the Scientific Method interchangeable?
Scientific Hypothesis, Theory, and Law	What is the difference between a theory and a scientific law?
Quantitative versus Qualitative Observations	**What are the similarities and differences between qualitative data and quantitative data?**
Observations versus Inferences	Why is it important for scientists to focus on recording observations and not inferences when gathering data?
Homogeneous versus Heterogenous Mixtures	How does a mixture differ from a compound?
Significant Figures	**"When error is unavoidable in measurement, what margins of error are tolerable?" - UBD 2nd edition**
Accuracy versus Precision	How can the accuracy of experimental data be described using error and percent error?

Unit 2: The Composition of Matter **Topic:** Atoms, Nuclear Change	**Subject/Course:** C.P. Chemistry **Grade:** 10 – 12 K. Greto
Keystone Assessment Anchors and NGSS	
CHEM.A.1.1.4: Relate the physical properties of matter to its atomic or molecular structure.	
CHEM.A.1.2.2: Differentiate between homogeneous and heterogeneous mixtures (e.g., how such mixtures can be separated).	
CHEM.A.1.2.4: Describe various ways that concentration can be expressed and calculated (e.g., molarity, percent by mass, percent by volume).	
CHEM.A.2.1.1: Describe the evolution of atomic theory leading to the current model of the atom based on the works of Dalton, Thomson, Rutherford, and Bohr.	
CHEM.A.2.1.2: Differentiate between the mass number of an isotope and the average atomic mass of an element.	
CHEM.B.1.1.1: Apply the mole concept to representative particles (e.g., counting, determining mass of atoms, ions, molecules, and/or formula units).	
CHEM.B.1.2.2: Apply the law of definite proportions to the classification of elements and compounds as pure substances.	
CHEM.B.1.4.1: Recognize and describe different types of models that can be used to illustrate the bonds that hold atoms together in a compound (e.g., computer models, ball-and-stick models, graphical models, solid-sphere models, structural formulas, skeletal formulas, Lewis dot structures).	
HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	
HS-PS1-8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.	
*HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.**	
HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).	

Unwrapping the Standards	
Big Ideas	**Essential Questions**
States of Matter	**How do the properties of the physical states of matter differ? (Including plasma)**
Elements versus Compounds	What distinguishes elements from compounds?
Molecular Compounds can combine in more than one way	*How can there be a law of definite proportions and a law of multiple proportions?*
Atomic Number	*How is the periodic table organized?*
Early ideas about Atoms	**What are the similarities and differences of the atomic models of Democritus, Aristotle, and Dalton?**
Law of Conservation of Mass	How does Dalton's atomic theory explain the conservation of mass?
Cathode Ray Tube and Gold Foil Experiment	**Why was Dalton and Thompson's model inadequate? What evidence led to the newer models of the atom?**
The Parts of an Atom	**What are the differences between the subatomic particles when it comes to charge and mass?**
	What are the locations of the subatomic particles within the structure of an atom?
	Why is the location of the subatomic particles important to their function in creating a stable atom with set chemical and physical properties?
Isotopes	Do isotopes of the same element have different chemical properties?
Average Atomic Mass	*Why are atomic masses not whole numbers?*
How the subatomic particles are dependent on one another	**Given the mass number and atomic number, how are the number of electrons, protons, and neutrons in an atom calculated?**
Radioactive Decay	**What is the relationship between unstable nuclei and radioactive decay?**
Types of Nuclear Radiation	*How are alpha, beta, and gamma radiation characterized in terms of mass and charge?*

Unit 3: Electrons **Topic:** Electron Configuration	**Subject/Course:** C.P. Chemistry **Grade:** 10 – 12 K. Greto

Keystone Assessment Anchors and NGSS

CHEM.A.1.1.4: Relate the physical properties of matter to its atomic or molecular structure.
CHEM.A.2.1.1: Describe the evolution of atomic theory leading to the current model of the atom based on the works of Dalton, Thomson, Rutherford, and Bohr.
CHEM.A.2.2.1: Predict the ground state electronic configuration and/or orbital diagram for a given atom or ion.
CHEM.A.2.2.2: Predict characteristics of an atom or an ion based on its location on the periodic table (e.g., number of valence electrons, potential types of bonds, reactivity).
CHEM.A.2.2.3: Explain the relationship between the electron configuration and the atomic structure of a given atom or ion (e.g., energy levels and/or orbitals with electrons, distribution of electrons in orbitals, shapes of orbitals).
CHEM.A.2.2.4: Relate the existence of quantized energy levels to atomic emission spectra.
CHEM.B.1.4.1: Recognize and describe different types of models that can be used to illustrate the bonds that hold atoms together in a compound (e.g., computer models, ball-and-stick models, graphical models, solid-sphere models, structural formulas, skeletal formulas, Lewis dot structures).
HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.*
HS-PS3-5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
HS-PS4-3. Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.
HS-PS4-4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.
HS-PS4-5. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.*

Unwrapping the Standards	
Big Ideas	**Essential Questions**
Electrons and Light as Waves versus Particles	How do the wave and particle natures of light compare?
Atomic Emission Spectra	How do continuous electromagnetic spectra and atomic emission spectra compare and contrast?
Bohr and Quantum Mechanical Models of the atom	How do the Bohr and quantum mechanical model of the atom compare?
Dual-Wave and Particle Behavior of Electrons	What is the impact of de Broglie's wave-particle duality and the Heisenberg uncertainty principle on the current view of electrons in atoms?
Electron Configuration	How are the Pauli exclusion principle, the aufbau principle, and Hund's rule used to write electron configurations with orbital diagrams and electron configuration notation? How can you use electron configuration to build a model of an atom?
Orbital Filling Diagrams	
Valence Electrons	What are valence electrons, and how do electron-dot structures represent an atom's valence electrons? Why do elements with similar valence electrons have similar chemical properties?
Electron-Dot Structures	
Purpose of Electrons	How does the electrons location affect its function in an atom?

Unit 4: The Periodic Table **Topic:** Development and Uses	**Subject/Course:** C.P. Chemistry **Grade:** 10 – 12 K. Greto

Keystone Assessment Anchors and NGSS
CHEM.A.1.1.4: Relate the physical properties of matter to its atomic or molecular structure.
CHEM.A.1.2.3: Describe how factors (e.g., temperature, concentration, surface area) can affect solubility.
CHEM.A.2.2.2: Predict characteristics of an atom or an ion based on its location on the periodic table (e.g., number of valence electrons, potential types of bonds, reactivity).
CHEM.A.2.3.1: Explain how the periodicity of chemical properties led to the arrangement of elements on the periodic table.
CHEM.A.2.3.2: Compare and/or predict the properties (e.g., electron affinity, ionization energy, chemical reactivity, electronegativity, atomic radius) of selected elements by using their locations on the periodic table and known trends.
CHEM.B.1.1.1: Apply the mole concept to representative particles (e.g., counting, determining mass of atoms, ions, molecules, and/or formula units).
HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.*

Unwrapping the Standards	
Big Ideas	**Essential Questions**
Metals, Nonmetals, Metalloids	How do metals, nonmetals, and metalloids differ?
Lavoisier to Democritus	How was the periodic table developed?
Structure of the Periodic Table	What are the key features of the periodic table?
Valence Electrons	Why do elements in the same group have similar properties?
Groups of Atoms	Based on their electron configurations, what are the four blocks of the periodic table?
	What are the key features of the various groups/families in the periodic table?
The Noble Gases	What can we learn from the electron configurations of the Noble Gases?
Trends in the Periodic Table	What are the period and group trends of different properties?
Atomic Radius as a Starting Point	How are the period and group trends in atomic radii related to electron configuration?

Unit 5: Bonding **Topic:** Ionic, Covalent, Metallic	**Subject/Course:** C.P. Chemistry **Grade:** 10 – 12 K. Greto

Keystone Assessment Anchors and NGSS
CHEM.A.1.1.4: Relate the physical properties of matter to its atomic or molecular structure.
CHEM.A.1.1.5: Apply a systematic set of rules (IUPAC) for naming compounds and writing chemical formulas (e.g., binary covalent, binary ionic, ionic compounds containing polyatomic ions).
CHEM.A.1.2.1: Compare properties of solutions containing ionic or molecular solutes (e.g., dissolving, dissociating).
CHEM.A.2.2.2: Predict characteristics of an atom or an ion based on its location on the periodic table (e.g., number of valence electrons, potential types of bonds, reactivity).
CHEM.A.2.3.2: Compare and/or predict the properties (e.g., electron affinity, ionization energy, chemical reactivity, electronegativity, atomic radius) of selected elements by using their locations on the periodic table and known trends.
CHEM.B.1.1.1: Apply the mole concept to representative particles (e.g., counting, determining mass of atoms, ions, molecules, and/or formula units).
CHEM.B.1.2.1: Determine the empirical and molecular formulas of compounds.
CHEM.B.1.3.1: Explain how atoms combine to form compounds through ionic and covalent bonding.
CHEM.B.1.3.2: Classify a bond as being polar covalent, non-polar covalent, or ionic.
CHEM.B.1.4.1: Recognize and describe different types of models that can be used to illustrate the bonds that hold atoms together in a compound (e.g., computer models, ball-and-stick models, graphical models, solid-sphere models, structural formulas, skeletal formulas, Lewis dot structures).
CHEM.B.1.4.2: Utilize Lewis dot structures to predict the structure and bonding in simple compounds.
HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.*
HS-PS3-5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

Unwrapping the Standards	
Big Ideas	**Essential Questions**
The Different Types of Bonds	What holds atoms together in a chemical bond?
Ion Formation	How do positive and negative ions form? How does ion formation relate to electron configuration?
Ionic Bonds and their properties	How do ionic bonds form and how are ions

	arranged in an ionic compound?
	What can you conclude about the strength of ionic compounds based on the physical properties of ionic compounds?
	Is ioninc bond formation exothermic or endothermic?
Converting between formula units and IUPAC names	What is a formula unit and how does it relate to an ionic compound's composition?
	How do you write the formula for compounds formed from different ions and oxyanions (polyatomic ions)?
	What are the naming conventions for ionic compounds and oxyanions (polyatomic ions)?
Metallic Bonds	What are the characteristics of a metallic bond? How are they similar and different from Ionic compounds?
	How does the electron sea model account for the physical properties of metals?
Alloys	What are alloys, and how can they be categorized?
Covalent Bonds and Molecular Compounds Properties	How does the octet rule apply to atoms to form covalent bonds? Why do atoms form single, double, and triple covalent bonds.
	How are the strength of a covalent bond, its bond length, and its bond dissociation energy related, including how they relate to endothermic and exothermic reactions?
	Are electrons really shared in covalent compounds or is there more of a level of competition? Do the electrons stay in the middle fo the two atoms?
Converting between names and formulas for Covalent compounds	What rules do you follow to name a binary molecular compound from its molecular formula?
	How are the naming rules similar and different from naming ionic compounds?
	How are acidic solutions named?
Lewis Dot Structures for Compounds	What are the basic steps to draw Lewis Structures?
	How is electronegativity used to determine bond type?
Electronegativity and Polarity	How do polar and nonpolar covalent bonds and polar and nonpolar molecules compare and contrast? How does polarity play a key role in the blood-brain barrier?

Unit 6: Chemical Reactions **Topic:** Chemical Reactions	**Subject/Course:** C.P. Chemistry **Grade:** 10 – 12 K. Greto

Keystone Assessment Anchors and NGSS

CHEM.A.1.1.1: Classify physical or chemical changes within a system in terms of matter and/or energy.
CHEM.A.1.1.5: Apply a systematic set of rules (IUPAC) for naming compounds and writing chemical formulas (e.g., binary covalent, binary ionic, ionic compounds containing polyatomic ions).
CHEM.A.1.2.3: Describe how factors (e.g., temperature, concentration, surface area) can affect solubility.
CHEM.A.1.2.5: Describe how chemical bonding can affect whether a substance dissolves in a given liquid.
CHEM.B.1.1.1: Apply the mole concept to representative particles (e.g., counting, determining mass of atoms, ions, molecules, and/or formula units).
CHEM.B.1.4.1: Recognize and describe different types of models that can be used to illustrate the bonds that hold atoms together in a compound (e.g., computer models, ball-and-stick models, graphical models, solid-sphere models, structural formulas, skeletal formulas, Lewis dot structures).
CHEM.B.2.1.1: Describe the roles of limiting and excess reactants in chemical reactions.
CHEM.B.2.1.3: Classify reactions as synthesis, decomposition, single replacement, double replacement, or combustion.
CHEM.B.2.1.4: Predict products of simple chemical reactions (e.g., synthesis, decomposition, single replacement, double replacement, combustion).
CHEM.B.2.1.5: Balance chemical equations by applying the Law of Conservation of Matter.
HS-PS1-2. Construct and revise 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.
HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Unwrapping the Standards	
Big Ideas	**Essential Questions**
Indicators of a Reaction	What is evidence of chemical change?
Word and Skeleton Equations	What are some of the different ways that a chemical reaction can be represented?
Balancing Equations	What does it mean for a chemical equation to be balanced? How is this accomplished?
Classifying Reactions	How are chemical reactions classified? What is the benefit of classifying reactions?
Predicting Products	What are the characteristics of different classes of chemical reactions?
	Do reactions always occur? What are some limiting factors?
Parts of a Reaction	What is a catalyst? What are aqueous solutions? How do you represent the need for light in photosynthesis when it is technically not a reactant or product?

Unit 7: The Mole and Stoichiometry **Topic:** Stoichiometry, the Mole, Molar Mass, and Molar Volume	**Subject/Course:** C.P. Chemistry **Grade:** 10 – 12 K. Greto

Keystone Assessment Anchors and NGSS
CHEM.A.1.1.3: Utilize significant figures to communicate the uncertainty in a quantitative observation.
CHEM.A.1.1.5: Apply a systematic set of rules (IUPAC) for naming compounds and writing chemical formulas (e.g., binary covalent, binary ionic, ionic compounds containing polyatomic ions).
CHEM.B.1.1.1: Apply the mole concept to representative particles (e.g., counting, determining mass of atoms, ions, molecules, and/or formula units).
CHEM.B.2.1.1: Describe the roles of limiting and excess reactants in chemical reactions.
CHEM.B.2.1.2: Use stoichiometric relationships to calculate the amounts of reactants and products involved in a chemical reaction.
CHEM.B.2.1.5: Balance chemical equations by applying the Law of Conservation of Matter.
CHEM.B.2.2.2: Predict the amounts of reactants and products involved in a chemical reaction using molar volume of a gas at STP.
HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Unwrapping the Standards	
Big Ideas	**Essential Questions**
Moles to Particles	How can moles be converted to number of representative particles and vice versa?
Molar Mass versus Atomic Mass	Why can the mass of an atom be related to the mass of a mole of atoms?
Moles to Mass	How can the number of moles be converted to the mass of a substance and vice versa?
Percent Composition	What is meant by percent composition of a compound?
Empirical and Molecular Formula	How can the empirical and molecular formulas for a compound be determined from mass percent and actual mass data?
Mole to Mole Conversions	What relationships can be derived from a balanced chemical equation?
Stoichiometry Process	What is the sequence of steps used in solving stoichiometric problems?
Limiting and Excess Reactants	In a chemical reaction, how can you determine which reactant is the limiting one? The excess one?

Theoretical and Percent Yield	What is the theoretical yield of a chemical reaction? How do you calculate the percent yield for a chemical reactions?