Options EHS Chemistry A-OR	Scope and Sequence
Unit **Lesson**	**Objectives**
Atoms and the Periodic Table	
The Historical Development of Atomic Theory	
	Describe early atomic models including Dalton's postulates.
	Describe how Thomson's and Millikan's research led to the understanding of the electron in the early atomic model.
	Describe how Rutherford's gold foil experiment led to Rutherford's nuclear model of the atom.
	Science Practice: Describe, in writing, how a scientist's creativity resulted in changes in atomic theory.
The Modern Atomic Theory	
	Describe the experimental basis for Einstein's explanation of the photoelectric effect.
	Explain Bohr's model of the atom and how it accounts for the existence of spectral lines.
	Describe the modern (electron cloud) model of the atom.
	Science Practice: Compare Dalton's atomic model with the current quantum model of the atom.
The Structure of the Atom	
	Describe the structure of atoms, and discriminate between the relative sizes and electrical charges of protons, neutrons, and electrons.
	Explain that protons and neutrons have substructures and consist of particles called quarks.
	Identify an element based on the number of protons in an atom.
	Explain the relationship between the number of neutrons in an atom of an element, its mass number, and its isotopes.
	Science Practice: Use math to calculate the average atomic mass of an element from its isotopic composition.
Elements, Compounds, and Mixtures	
	Describe elements as pure substances.
	Describe compounds as pure substances.

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		Describe mixtures.
		Science Practice: Classify matter as pure substances or mixtures by studying their properties.
	Atomic Numbers and Electron Configurations	
		Identify electron configurations as a scientific model, and explain its usefulness and limitations.
		Express the arrangement of electrons of atoms using electron configurations.
		Use atomic orbitals to write quantum numbers for electrons.
		Science Practice: Use specific symbols to represent the arrangement of electrons in atoms.
	The History and Arrangement of the Periodic Table	
		Outline the historical development of the periodic table.
		Describe the arrangement of the periodic table and relate the properties of atoms to their position in the periodic table.
		Use the periodic table to classify elements.
		Science Practice: Predict the properties of elements based on their position on the periodic table.
	Electrons and the Periodic Table	
		Relate the position of an element in the periodic table to its electron configuration.
		Use the periodic table to determine the number of valence electrons available for bonding.
		Science Practice: Analyze the relationship between electron configurations and the structure of the periodic table.
	Periodic Trends	
		Use the periodic table to predict trends in atomic radii and ionic radii.
		Use the periodic table to identify and explain periodic trends in ionization energy.
		Use the periodic table to identify trends in electronegativity and electron affinity.
		Science Practice: Given two elements, make predictions that compare their radii, ionization energy, electronegativity,

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		and/or electron affinity.
	Unit Test	
Properties and Changes of Matter		
	Gases	
		Describe the postulates of kinetic-molecular theory.
		Interpret the behavior of ideal gases in terms of kinetic-molecular theory, including diffusion and effusion.
		Describe how kinetic-molecular theory explains the properties of gases, including temperature, pressure, compressibility, and volume.
		Science Practice: Identify the limitations of kinetic-molecular theory.
	Liquids	
		Describe how the postulates of kinetic-molecular theory apply to liquids.
		Describe how kinetic-molecular theory explains the properties of liquids, including compressibility and shape.
		Science Practice: Use the kinetic-molecular theory model to explain the behavior of liquids.
	Solids and Plasmas	
		Use kinetic-molecular theory to compare and contrast atomic or molecular motion in solids and plasmas.
		Describe how kinetic-molecular theory explains the properties of solids, including compressibility, shape, and volume.
		Describe how kinetic-molecular theory explains the properties of plasmas.
		Science Practice: Give examples of plasmas in nature and technology.
	Phase Changes	
		Describe phase changes in terms of kinetic-molecular theory.
		Describe the energy changes that happen during changes of state.
		Science Practice: Make and interpret graphs of temperature vs. time for changes of state.
	Changes in Matter	

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		Differentiate between physical properties and chemical properties of matter.
		Differentiate between extensive and intensive properties of matter, and give examples of each.
		Differentiate between physical changes and chemical changes of matter.
		Science Practice: Identify substances based on their chemical and physical properties.
	Gas Laws	
		State Boyle's law, Charles's law, and Gay-Lussac's law, and apply these laws to calculate the relationships among volume, temperature, and pressure.
		Derive the combined gas law from Boyle's law, Charles's law, and Gay-Lussac's law.
		Define partial pressure.
		Apply Dalton's law of partial pressures to describe the composition of gases.
		Science Practice: Make a table to compare the various gas laws.
	Lab: Physical and Chemical Changes	
		Distinguish between chemical changes and physical changes.
		Describe indicators of chemical change.
		Conduct systematic observations during an experiment.
		Science Practice: Write a clear, coherent laboratory report that describes methods used and conclusions made.
	Ionic Bonding	
		Explain how ionic bonds form.
		Explain that ionic compounds form crystal lattices.
		Describe how polyatomic ions form ionic bonds with other ions.
		Explain how ionic bonds affect the properties of ionic compounds.
		Science Practice: Explain the process by which ionic bonds form.

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	Covalent Bonding	
		Use the periodic table to determine the number of electrons available for bonding.
		Use the octet rule to predict covalent compounds.
		Construct electron-dot structures (i.e., Lewis structures) to illustrate the arrangement of electrons in covalent structures.
		Explain how covalent bonds affect the properties of covalent compounds.
		Science Practice: Develop and use electron-dot models, and explain their usefulness and limitations.
	Lab: Ionic and Covalent Bonds	
		Design and conduct an experiment to test the properties of substances.
		Draw conclusions about the type of bond in a substance based on the tested properties of that substance.
		Science Practice: Compare your conclusions about the identity of the bonds in substances to published information about those substances.
	Unit Test	
Chemical Reactions and Stoichiometry		
	Percent Composition and Molecular Formula	
		Solve problems to calculate percent composition.
		Determine the empirical formula and the molecular formula of a substance through calculations.
		Explain the relationship between the empirical formula and the molecular formula of a compound.
		Science Practice: Use math to solve percent composition problems and to determine empirical and molecular formulas.
	Writing and Balancing Chemical Equations	
		Describe chemical reactions by writing word equations and formula equations.
		Use the law of conservation of mass to balance chemical equations.
		Science Practice: Identify and use special symbols properly in chemical equations.

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	Types of Reactions	
		Identify and characterize the types of reactions, including synthesis, decomposition, combustion, single replacement, and double replacement.
		Classify a reaction as synthesis, decomposition, single replacement, double replacement, or combustion.
		Use the activity series to determine whether a single replacement reaction will occur.
		Science Practice: Predict the products of a reaction using the activity series.
	Lab: Types of Reactions	
		Identify the reactants and products of a reaction performed in alaboratory setting.
		Write balanced equations for a reaction performed in a laboratory setting.
		Science Practice: Use experimental data to classify a reaction.
	Molar Masses	
		Define a mole and explain its role in the measurement of matter.
		Explain the relationship between the mole and Avogadro’s number.
		Determine the molar mass of a molecule from its chemical formula.
		Science Practice: Perform math calculations to determine the number of particles in a given sample of a substance.
	Introduction to Stoichiometry	
		Use a balanced equation to write mole ratios correctly to use in stoichiometry problems.
		Perform stoichiometric calculations to determine the mole-to-mole relationships between reactants and products of a reaction.
		Science Practice: Use mathematical procedures, including dimensional analysis and significant figures, when solving mole-to-mole stoichiometry problems.
	Stoichiometric Calculations	
		Use molar mass to write conversion factors that convert between mass and moles.
		Identify and solve stoichiometric problems that relate mass to moles and mass to mass.

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		Perform stoichiometric calculations to determine mass relationships between reactants and products of a reaction.
		Science Practice: Use mathematical procedures, including dimensional analysis and significant figures, when solving mole-to-mass, mass-to-mole, and mass-to-mass stoichiometric problems.
	Unit Test	
Reaction Rate and Equilibrium		
	Reaction Rate	
		Explain the concept of reaction rate.
		Describe collision theory and how it is related to reactions.
		Explain how various factors, including concentration, temperature, and pressure, affect the rate of a chemical reaction.
		Science Practice: Use the collision theory model to explain how reactions happen.
	Reversible Reactions and Equilibrium	
		Explain dynamic equilibrium.
		Write equilibrium expressions, and use them to calculate the equilibrium constant for reactions.
		Science Practice: Use scientific notation when solving problems to find the equilibrium constant for a reaction.
	Shifts in Equilibrium	
		Use Le Chatelier’s principle to predict shifts in equilibrium caused by changes in pressure, concentration, and temperature.
		Use Le Chatelier’s principle to predict shifts in equilibrium caused by the addition of a common ion to the system.
		Science Practice: Translate technical information expressed in words about Le Chatelier’s principle into a chart.
	Unit Test	
Cumulative Exam		
	Cumulative Exam Review	
	Cumulative Exam	