Chemistry I Honors Curriculum Maps

Unit 1: What is Chemistry?
Unit 2: Matter and Energy
Unit 3: Atoms and Moles
Unit 4: The Periodic Table
Unit 5: Ions and Ionic Compounds
Unit 6: Covalent Compounds
Unit 7: The Mole and Chemical Composition
Unit 8: Chemical Equations and Reactions
Unit 9: Stoichiometry
Unit 10: Gases
Unit 11: Solutions
Unit 12: Chemical Equilibrium
Unit 13: Acids and Bases

Grade: 10 - 12 **Subject:** Chemistry I Honors	**Unit 1: What is Chemistry?**
Big Idea/Rationale	This unit will introduce students to the study of chemistry. They will learn about the three states of matter. They will also learn about physical and chemical properties and changes in matter. The SI system of measurement is introduced along with conversion factors to convert from one unit of measure to another. The concept of density is also presented. Finally, the classification of matter introduces the concepts of atoms, elements, molecules, compounds, and mixtures.
Enduring Understanding (Mastery Objective)	• Summarize the similarities and differences for the three states of matter • Distinguish between physical and chemical properties. • Apply the SI system of measurement. • Classify substances as elements, compounds, or mixtures.
Essential Questions (Instructional Objective)	• Describe ways in which chemistry is part of your daily life. • Describe the characteristics of three common states of matter. • Describe physical and chemical changes, and give examples of each. • Identify the reactants and products in a chemical reaction. • List four observations that suggest a chemical change has occurred. • Distinguish between different characteristics of matter, including mass, volume, and weight. • Identify and use SI Chapters in measurements and calculations. • Identify and describe physical properties, including density • Identify chemical properties • Distinguish between elements and compounds. • Distinguish between pure substances and mixtures • Classify mixtures as homogeneous or heterogeneous. • Explain the difference between mixtures and compounds.
Content (Subject Matter)	• Chemicals • Chemical reactions • States of matter • Reactants and products • Mass, volume, weight • Conversion factors • Physical and chemical properties • Density • Classification of matter • Pure substances and mixtures • Elements and compounds • Atoms and molecules • Heterogeneous and homogeneous

	• Separation of mixtures
Skills/ Benchmarks (CCSS Standards)	• 5.2.12.A.2: Account for the differences in the physical properties of solids, liquids, and gases. • 5.2.12.C.1: Use the kinetic molecular theory to describe and explain the properties of solids, liquids, and gases. • 5.2.12.A.1: Use atomic models to predict the behaviors of atoms in interactions. • 5.1.12.D.3: Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare. • 5.1.12.D.1: Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. • 5.1.12.B.1: Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data.

Materials and Resources	**Lab: Thickness of Aluminum Foil**
	• **Equipment**:
	  ○ Balance
	  ○ Overflow cans
	  ○ 100 ml Graduated cylinders
	  ○ Rulers
	• **Materials**
	  ○ Foil
	  ○ Aluminum weights
	
	Lab: Density of Pennies
	• **Equipment**:
	  ○ Balance
	  ○ 50 ml Graduated cylinder
	• **Materials**
	  ○ pennies (20 pre 1983, 20 post 1983)
	
	Lab: Physical and Chemical Changes
	• **Equipment**:
	  ○ graduated cylinders
	  ○ beakers
	  ○ droppers
	  ○ scoops
	  ○ weighing trays
	  ○ stirring rods
	  ○ pipettes
	  ○ test tubes
	  ○ bunsen burner

	• **Materials**
	  ○ MgSO4
	  ○ AgNO 3
	  ○ Cooper (II) sulfate crystals
	  ○ sucrose
	  ○ diapers
	  ○ aluminum foil
	  ○ magnesium ribbon
	  ○ HCl
	  ○ CuCl2
	
	Lab: Separation of a Mixture
	• **Equipment**:
	  ○ Magnet
	  ○ Filter paper
	  ○ Funnel
	  ○ Hot plates
	  ○ Three beakers (250 ml)
	  ○ Balance
	  ○ Stirring rods
	  ○ Grease markers
	  ○ baggies
	• **Materials**
	  ○ mixture (salt, sand, iron)

Notes	

Grade: 10 - 12 **Subject:** Chemistry I Honors	**Unit 2: Matter and Energy**
Big Idea/Rationale	Students will learn that all changes in matter involve a change of energy but that the amount of energy in a system is conserved during any chemical or physical change. The difference between heat and temperature is also explained. Students are introduced to accuracy, precision, significant figures, and scientific notation.
Enduring Understanding (Mastery Objective)	• Summarize how energy change in a system is conserved • Use accuracy, precision, and significant figures to solve mathematical calculations.
Essential Questions (Instructional Objective)	• Explain that physical and chemical changes in matter involve transfers of energy • Apply the law of conservation of energy to analyze changes in matter. • Distinguish between heat and temperature • Convert between the Celsius and Kelvin temperature scales. • Distinguish between accuracy and precision in measurements • Determine the number of significant figures in a measurement • Calculate changes in energy using the equation of specific heat and round the results to the correct number of significant figures • Write very large and very small numbers in scientific notation • Perform calculations using scientific notation. • Significant figures and scientific notation.
Content (Subject Matter)	• Energy • Physical and chemical changes • States of matter • Endothermic vs exothermic • Conservation of energy • Heat vs temperature • Kinetic energy • Conservation of mass • Accuracy vs precision • Significant figures • Scientific notation
Skills/ Benchmarks (CCSS Standards)	• 5.1.12.A.1: Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. • 5.1.12.A.2: Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories. • 5.1.12.A.3 Use scientific principles and theories to build and refine

	standards for data collection, posing controls, and presenting evidence. • 5.1.12.B.1: Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. • 5.1.12.B.2: Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. • 5.1.12.B.3: Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories. • 5.1.12.B.4: Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations. • 5.1.12.C.1: Reflect on and revise understandings as new evidence emerges. • 5.1.12.C.2: Use data representations and new models to revise predictions and explanations. • 5.1.12.C.3: Consider alternative theories to interpret and evaluate evidence-based arguments. • 5.1.12.D.1: Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. • 5.1.12.D.3: Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare. • 5.2.12.C.1: Use the kinetic molecular theory to describe and explain the properties of solids, liquids, and gases. • 5.2.12.C.2: Account for any trends in the melting points and boiling points of various compounds. • 5.2.12.D.2: Describe the potential commercial applications of exothermic and endothermic reactions.

Materials and Resources	**Lab: Conservation of Mass**
	• **Equipment**:
	  ○ 50 ml Graduated cylinders
	  ○ 2 ziploc baggies
	  ○ balance
	  ○ scoop
	• **Materials**
	  ○ Alka seltzer
	  ○ CaCl2
	  ○ Baking soda
	
	Lab: Measurement
	• **Equipment/Materials**:
	  ○ Rulers

	○ Thermometer ○ Graduated cylinder 100 ml ○ Hot plates ○ Large test tube ○ 100 mL beaker
Notes	

Grade: 10 - 12 **Subject:** Chemistry I Honors	**Unit 3: Atoms and Moles**
Big Idea/Rationale	Students will learn about the historical evidence for the existence of the atom and Dalton's model for the structure of the atom. The unit continues with descriptions of the Rutherford experiment, Thomson, and Bohr. These and other scientists revised and refined the model of the atom to the quantum model of today. The unclear structure of the atom is also explained in the chapter and students will be introduced to the mole as a way of counting particles.
Enduring Understanding (Mastery Objective)	• Summarize previous atomic experiments to understand the history and structure of the atom. • Summarize the nuclear structure of the atom and how electrons fit into orbitals.
Essential Questions (Instructional Objective)	• State the three laws that support the existence of atoms • List the five principles of John Dalton's atomic theory • Describe the evidence for the existence of electrons, protons, and neutrons, and describe the properties of these subatomic particles • Discuss atoms of different elements in terms of their numbers of electrons, protons, and neutrons, and define the terms atomic number and mass number • Define isotope, and determine the number of particles in the nucleus of an isotope • Calculate atomic masses using the weighted averages of isotopes • Compare the quantities and units for atomic mass with those for molar mass • Define mole, and explain why this unit is used to count atoms • Calculate either mass with molar mass or number with Avogadro's number given an amount in moles.
Content (Subject Matter)	• Law of definite proportions • Atomic theory • Law of conservation of mass • Law of multiple proportions • Subatomic particles • Electrons, protons, neutrons • Rutherford experiment • Isotopes
Skills/ Benchmarks (CCSS Standards)	• 5.1.12.A.1: Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. • 5.1.12.A.2: Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories.

	• 5.1.12.A.3 Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence. • 5.1.12.B.1: Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. • 5.1.12.B.2: Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. • 5.1.12.B.3: Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories. • 5.1.12.B.4: Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations. • 5.1.12.C.1: Reflect on and revise understandings as new evidence emerges. • 5.1.12.C.2: Use data representations and new models to revise predictions and explanations. • 5.1.12.C.3: Consider alternative theories to interpret and evaluate evidence-based arguments. • 5.1.12.D.1: Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. • 5.1.12.D.3: Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare. • 5.2.12.A.1: Use atomic models to predict the behaviors of atoms in interactions. • 5.2.12.A.4: Explain how the properties of isotopes, including half-lives, decay modes, and nuclear resonances, lead to useful applications of isotopes.

Materials and Resources	**Lab: Conservation of Mass**
	• **Equipment**:
	  ○ 50 ml Graduated cylinders
	  ○ 2 ziploc baggies
	  ○ balance
	  ○ scoop
	• **Materials**
	  ○ Alka seltzer
	  ○ CaCl2
	  ○ Baking Soda
	
	Lab: Flame Tests
	• **Equipment**:
	  ○ Wood stirrers
	  ○ Incandescent light

	○ Spectroscopes ○ Gas tubes ○ Beaker 100ml ○ Distilled water ○ Well plates ○ Bunsen burner • **Materials** ○ Calcium Chloride ○ Lithium Chloride ○ Strontium Chloride ○ Potassium Chloride ○ Copper Chloride ○ Unknown
Notes	

Grade: 10 - 12 **Subject:** Chemistry I Honors	**Unit 4: The Periodic Table**
Big Idea/Rationale	• To understand how the periodic table is arranged. • To understand and identify the various families/groups of elements. • To identify the various trends within the periodic table.
Enduring Understanding (Mastery Objective)	• Describe the organization of the modern periodic table according to the periodic law. • Locate the different families of the representative elements and describe their characteristic properties. • Locate metals, nonmetals and metalloids on the periodic table. • Describe the periodic trends in ionization energy, atomic radius, electronegativity, ionic size, and electron affinity.
Essential Questions (Instructional Objective)	• What patterns did the historical figures in chemistry notice in regards to elemental properties? • How did they organize the elements? • What are the different families of the representative elements (main group elements) on the periodic table? • What are the characteristic properties of the metals? How do they relate to their electron configurations? • What is ionization energy and its periodic trend? How does it relate to atomic structures of the elements? • What are the periodic trends of atomic radii? How do they relate to the atomic structures of the elements? • What are the periodic trends in electronegativity? How do they relate to the atomic structures of the elements?
Content (Subject Matter)	• John Newland, Dmitri Mendeleev, and Henry Moseley contributed to the development of the periodic table. • The periodic law states that the properties of elements are periodic tunctions of the elements' atomic numbers. • In the periodic table, elements are ordered by atomic number. They are placed in to groups and periods. • Elements in the same period have the same number of occupied energy levels and valence electrons. • The main-group elements are Group 1 (alkali metals), Group 2 (alkaline-earth metals), Group 13-16, Group 17 (Halogens), Group 18 (Noble Gases). • Hydrogen is in a class by itself. • Most elements are metals. • Transition metals, including the lanthanides and actinides, occupy the center of the periodic table. • Periodic trends are related to the atomic structure of the elements.

	• Ionization energy, electronegativity, and electron affinity generally increase across the period and increase as you move down a group.
Skills/ Benchmarks (CCSS Standards)	• 5.1.12.B.4 – Scientific reasoning used to evaluate and interpret data patterns and scientific conclusions. • 5.1.12.C.3 – consider alternative theories to interpret and evaluate evidence-based arguments. • 5.1.12.D.1 – Engage in multiple forms of discussion n order to process, make sense of, and learn from others' ideas, observations, and experiences. • 5.2.12.A.3 – Predict the placement of unknown elements on the Periodic Table based on their physical and chemical properties. • 5.2.12.B.1 – Model how the outermost electrons determine the reactivity of elements and the nature of they tend to form
Materials and Resources	○ Textbook ○ Calculator ○ Pen or pencil ○ Notebook ○ Lab notebook
Notes	

Grade: 10 – 12 **Subject:** Chemistry I Honors	**Unit 5: Ions and Ionic Compounds**
Big Idea/Rationale	• To understand simple ions. • To understand and identify ionic bonding and salts. • To name ionic compounds, and write their chemical formulas.
Enduring Understanding (Mastery Objective)	• Relate the electron configuration of an atom to its chemical reactivity. • Determine an atom's number and valence electrons. Use the octet rule to predict what stable ions are like to form. • Explain why the properties of ions differ from those of their parent atoms • Describe the process of forming an ionic bond • Explain how the properties of ionic compounds depend on the nature of ionic bonds. • Names of cations, anions, and ionic compounds. • Write the chemical formulas for ionic compounds.
Essential Questions (Instructional Objective)	• How does electron configuration relate to the atom's chemical reactivity? • How does one determine the valence electrons and draw their electron dot structure? • How would one describe the formation of cations from metals and the anions from nonmetals? • What are the characteristics of an ionic bond and an ionic compound?
Content (Subject Matter)	• Atoms may gain or lose electrons to achieve an electron configuration identical to that of a noble gas. • Alkali metals and halogens are very reactive when donating and accepting electrons from one another. • Electrons in the outermost energy level are known as valence electrons. • Ions are electrically charged particles that have different chemical properties than their parent atoms. • The opposite charges of cations and anions attract to form a tightly packed substance of bonded ions call a crystal lattice. • Salts have high melting points and do not conduct electric current in the solid state, but they do conduct electric current when metlted or when dissolved in water. • Ionic compounds are named by joining the cation and anion names. • Formulas for ionic compounds are written to show their balance of overall charge. • A polyatomic ion is a group of two or more atoms bonded together that functions as a single unit. • Parentheses are used to group polyatomic ions in a chemical formula with a subscript.

Skills/ Benchmarks (CCSS Standards)	• 5.1.12.D.1 – Engage in multiple forms of discussion n order to process, make sense of, and learn from others' ideas, observations, and experiences. • 5.1.12.D.2 – Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams. • 5.2.12.A.1 – Use atomic models to predict the behaviors of atoms in interactions. • 5.2.12.B.1 – Model how the outermost electrons determine the reactivity of elements and the nature of they tend to form • 5.2.12.C.2 – Account for any trends in the melting points of various compounds
Materials and Resources	**Lab: Test for Fe II and Fe III** • **Equipment**: o Gloves o Pipettes o Well plates • **Materials** o 0.1M FeCl3 (4.1g in 150 ml) o 0.2M Fe(NH4)2(SO4)2 (11.8g)heavy cream o 0.1M K3Fe(CN)6 (4.9g)extracts o 0.1M K4Fe(CN)6 (6.3g) o 0.2M KSCN (2.9g) o two unknowns **Lab: Bond Type** o **Equipment**: o Well plates o Conductivity tester o 1 M HCl o Hot plates o Stirring rod o Pipettes o **Materials**: o CaCl2 o Iron powder o ethanol o phenyl salicylate o Calcium metal o NaCl o Distilled water o Sucrose
Notes	

Grade: 10 - 12 **Subject:** Chemistry I Honors	**Unit 6: Covalent Compounds**
Big Idea/Rationale	Students will learn about covalent compounds. They will learn how covalent bonds form, how ionic and covalent substances differ, how to draw and name covalent compounds, and how the shape of a molecule affects its properties.
Enduring Understanding (Mastery Objective)	• Compare and contrast: ionic and covalent bonding. • Write the chemical formulas and names for ionic and covalent compounds. • Draw ionic and covalent structures based upon current theory. • Apply bonding theory to determine properties of molecules and compounds.
Essential Questions (Instructional Objective)	• Explain the role and location of electrons in covalent bonds. • Explain differences in bond energies and lengths • Describe the change in energy and stability that takes place as a covalent bond forms. • Distinguish between nonpolar and polar covalent bonds based on electronegativity • Compare the physical properties of substances that have different bond types, and relate bond types to electronegativity differences. • Draw Lewis structures to show the arrangement of valence electrons among atoms in molecules and polyatomic ions. • Explain the differences between single, double, and triple covalent bonds. • Draw resonance structures for simple molecules and polyatomic ions, and recognize when they are required. • Name binary inorganic covalent compounds by using prefixes, roots, and suffixes. • Predict the shape of a molecule using VSEPR theory. • Associate the polarity of molecules with the shapes of molecules, and relate the polarity and shape of molecules to the properties of a substance.
Content (Subject Matter)	• Covalent bonds • Potential energy of bonds • Electronegativity differences • Lewis structures • Multiple bonds • Resonance structures • Nomenclature • VSEPR • Polarity

Skills/ Benchmarks (CCSS Standards)	• 5.1.12.A.1: Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. • 5.1.12.A.2: Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories. • 5.1.12.A.3 Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence. • 5.1.12.B.1: Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. • 5.1.12.B.2: Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. • 5.1.12.B.3: Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories. • 5.1.12.B.4: Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations. • 5.1.12.C.1: Reflect on and revise understandings as new evidence emerges. • 5.1.12.C.2: Use data representations and new models to revise predictions and explanations. • 5.1.12.C.3: Consider alternative theories to interpret and evaluate evidence-based arguments. • 5.1.12.D.1: Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. • 5.1.12.D.3: Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare. • 5.2.12.A.1: Use atomic models to predict the behaviors of atoms in interactions. • 5.2.12.A.4: Explain how the properties of isotopes, including half-lives, decay modes, and nuclear resonances, lead to useful applications of isotopes.

Materials and Resources	**Lab: Chemical Bonds**
	• **Equipment**:
	  ○ Well plates
	  ○ Conductivity tester
	  ○ Hot Plates
	  ○ Foil
	  ○ Pipettes
	• **Materials**
	  ○ CaCl2
	  ○ Citric Acide
	  ○ Ethanol

	○ phenyl salicylate ○ KI ○ NaCl ○ Distilled water ○ Sucrose
Notes	

Grade: 10 - 12 **Subject:** Chemistry I Honors	**Unit 7: The Mole and Chemical Composition**
Big Idea/Rationale	Students will learn about the Mole and Avogadro's number and how to convert between the amount in moles and the number of particles. They will solve problems using moles, particles, and molar mass. They will relate moles to chemical formulas and determining molar mass. Empirical and molecular formulas are also determined from percentage composition and formula mass, and percentage composition is derived from empirical and molecular formulas.
Enduring Understanding (Mastery Objective)	• Calculate chemical formulas from experimental data. • Mathematically convert moles to other equivalent units
Essential Questions (Instructional Objective)	• Identify the mole as the unit used to count particles, whether atoms, ions, or molecules. • Use Avogadro's number to convert between amount in moles and number of particles. • Solve problems converting between mass, amount in moles, and number of particles using Avogadro's number and molar mass. • Use molar volume to convert between moles of a substance and volume. • Use a periodic table or isotopic composition data to determine the average atomic masses of elements. • Infer information about a compound from its chemical formula • Determine the molar mass of a compound from its formula. • Determine a compound's empirical formula from its percentage composition. • Determine the molecular formula or formula unit of a compound from its empirical formula and its formula mass. • Calculate percentage composition of a compound from its molecular formula or formula unit.
Content (Subject Matter)	• Avogadro's number • Molar conversions • Percentage composition • Empirical and molecular formulas
Skills/ Benchmarks (CCSS Standards)	• 5.1.12.A.1: Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. • 5.1.12.A.2: Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories. • 5.1.12.A.3 Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence. • 5.1.12.B.1: Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies,

	causal/correlational relationships, and anomalous data. • 5.1.12.B.2: Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. • 5.1.12.B.3: Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories. • 5.1.12.B.4: Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations. • 5.1.12.C.1: Reflect on and revise understandings as new evidence emerges. • 5.1.12.C.2: Use data representations and new models to revise predictions and explanations. • 5.1.12.C.3: Consider alternative theories to interpret and evaluate evidence-based arguments. • 5.1.12.D.1: Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. • 5.1.12.D.3: Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare. • 5.2.12.A.1: Use atomic models to predict the behaviors of atoms in interactions. • 5.2.12.A.4: Explain how the properties of isotopes, including half-lives, decay modes, and nuclear resonances, lead to useful applications of isotopes.

Materials and Resources	**Lab: Hydrates**
	• **Equipment**:
	  ○ Bunsen burner
	  ○ Ring stand/ring
	  ○ Evaporating dish
	  ○ Stirring rod
	  ○ Balance
	• **Materials**
	  ○ CuSO4
	
	Lab: Synthesis of MgO
	• **Equipment**:
	  ○ Crucible/lid
	  ○ Bunsen burner
	  ○ Ring stand
	  ○ Triangle/ring
	  ○ Balance
	• **Materials**
	  ○ Mg strips

Notes	

Grade: 10 - 12 **Subject:** Chemistry I Honors	**Unit 8: Chemical Equations and Reactions**
Big Idea/Rationale	Students will learn about the different types of evidence of chemical reactions. They will describe chemical reactions by using word equations and unbalanced and balanced formula equations. They will learn how mass is conserved in chemical reactions and how to relate conservation of mass to a balanced equation. Different types of chemical reactions are described, and students learn to predict products for each type. They will also learn to distinguish between and write total and net ionic equations.
Enduring Understanding (Mastery Objective)	• Predict products from in chemical reactions. • Apply the concept of conservation of mass to chemical reactions.
Essential Questions (Instructional Objective)	• List evidence that suggests that a chemical reaction has occurred and evidence that proves that a chemical reaction has occurred. • Describe a chemical reaction by using a word equation and formula equation. • Interpret notations in formula equations, such as those relating to states of matter or reaction conditions. • Relate the conservation of mass to the rearrangement of atoms in a chemical reaction. • Write and interpret a balanced chemical equation for a reaction, and relate conservation of mass to the balanced equation. • Identify combustion reactions, and write chemical equations that predict the products. • Identify synthesis reactions, and write chemical equations that predict the products. • Identify decomposition reactions, and write chemical equations that predict the products. • Identify displacement reactions, and use the activity series to write chemical equations that predict the products. • Identify double-displacement reactions, and write chemical equations that predict the products. • Write total ionic equations for reactions in aqueous solutions. • Identify spectator ions and write net ionic equations for reactions in aqueous solutions. • Explain how concentration, pressure, and temperature may affect the rate of a reaction. • Explain why, for surface reactions, the surface area is an important factor.
Content (Subject Matter)	• Chemical reactions

	• States of matter • Balancing equations • Classifying reactions • Predicting products • Net ionic equations
Skills/ Benchmarks (CCSS Standards)	• 5.1.12.A.1: Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. • 5.1.12.A.2: Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories. • 5.1.12.A.3 Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence. • 5.1.12.B.1: Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. • 5.1.12.B.2: Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. • 5.1.12.B.3: Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories. • 5.1.12.B.4: Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations. • 5.1.12.C.1: Reflect on and revise understandings as new evidence emerges. • 5.1.12.C.2: Use data representations and new models to revise predictions and explanations. • 5.1.12.C.3: Consider alternative theories to interpret and evaluate evidence-based arguments. • 5.1.12.D.1: Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. • 5.1.12.D.3: Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare. • 5.2.12.A.1: Use atomic models to predict the behaviors of atoms in interactions. • 5.2.12.A.4: Explain how the properties of isotopes, including half-lives, decay modes, and nuclear resonances, lead to useful applications of isotopes.

Materials and Resources	**Lab: Evidence of a Chemical Change**
	• **Equipment**:
	  ○ Beaker 100mL
	  ○ Bunsen burner
	  ○ Stirring rod

	- Gloves - Ring stand/ring/mesh - Marker - Ruler - Test tubes/rack **Materials** - Aluminum wire - Cu(NO3)2, 1M - HCl, 1M - NaOH, ~3M - copper wire - Note: double the amount of HCl **Lab: Progressive Precipitation** **Equipment**: - Test tubes - Beaker - Stirring rod - Stoppers **Materials** - silver nitrate sol'n - sodium sulfate sol'n - potassium dichormate sol'n - distilled water - Sodium chloride sol'n - Sodium sulfide sol'n **Lab: Simple Qualitative Analysis** **Equipment**: - Beakers, 50 mL - Bunsen burner - Wood stirrers - Filter paper strips - Red litmus paper - Well plates **Materials** - Na2CO3 1M HCl 0.1M KMnO4 1M NaOH - Na2SO3 - NH4Cl
Notes	

Grade: 10 - 12 **Subject:** Chemistry I Honors	**Unit 9: Stoichiometry**
Big Idea/Rationale	Students will learn about the use of a balanced chemical equation to determine quantities of one or more substances involved in a reaction. Mole ratios from the balanced equation are the basis for all of these stoichiometry problems. Stoichiometry problems can involve amount in moles, number of particles, volume, and mass. Other concepts presented include finding limiting reactants, theoretical yield, and percentage yield. The last section of the chapter applies stoichiometric concepts to cars, and pollution in general.
Enduring Understanding (Mastery Objective)	• Apply chemical reactions and mole conversions to identify limiting reagents.
Essential Questions (Instructional Objective)	• Use Proportional reasoning to determine mole ratios from a balanced chemical equation. • Explain why mole ratios are central to solving stoichiometry problems. • Solve stoichiometry problems involving mass by using molar mass. • Solve stoichiometry problems involving volume by using density. • Solve stoichiometry problems involving gases at STP • Solve stoichiometry problems involving the number of particles of a substance by using Avogadro's number. • Identify the limiting reactant for a reaction and use it to calculate theoretical yield. • Perform calculations involving percentage yield. • Relate volume calculations in stoichiometry to the inflation of automobile safety air bags. • Use the concept of limiting reactants to explain why fuel-air ratios affect engine performance. • Compare the efficiency of pollution-control mechanisms in cars using percentage yield.
Content (Subject Matter)	• Stoichiometry • Limiting reactants • Percent yield
Skills/ Benchmarks (CCSS Standards)	• 5.1.12.A.1: Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. • 5.1.12.A.2: Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories. • 5.1.12.A.3 Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence. • 5.1.12.B.1: Design investigations, collect evidence, analyze data, and

	evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. • 5.1.12.B.2: Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. • 5.1.12.B.3: Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories. • 5.1.12.B.4: Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations. • 5.1.12.C.1: Reflect on and revise understandings as new evidence emerges. • 5.1.12.C.2: Use data representations and new models to revise predictions and explanations. • 5.1.12.C.3: Consider alternative theories to interpret and evaluate evidence-based arguments. • 5.1.12.D.1: Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. • 5.1.12.D.3: Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare. • 5.2.12.A.1: Use atomic models to predict the behaviors of atoms in interactions. • 5.2.12.A.4: Explain how the properties of isotopes, including half-lives, decay modes, and nuclear resonances, lead to useful applications of isotopes.

Materials and Resources	**Lab: Micro Mole Rockets**
	• **Equipment**:
	  ○ 250 mL beaker
	  ○ 10 mL Grad. Cylinder
	  ○ marker
	  ○ one hole stoppers
	  ○ paper towels
	  ○ pipets, beral type
	  ○ scissors
	  ○ test tubes/rack
	  ○ wood splint
	  ○ matches
	  ○ launcher
	• **Materials**
	  ○ 3M HCl
	  ○ H2O2, 3%
	  ○ yeast
	  ○ zinc, mossy

	Lab: Stoichiometry
	• **Equipment**:
	  ○ 150 mL beaker, 2
	  ○ balance
	  ○ hot plate
	  ○ stirring rod
	• **Materials**
	  ○ Iron filings
	  ○ CuSO4

Notes	

Grade: 10 - 12 **Subject:** Chemistry I Honors	**Unit 10: Gases**
Big Idea/Rationale	Students will learn about gases. They will become familiar with the characteristics of gases such as compressibility and density. The concept of pressure is explained, as well as standard conditions. The kinetic-molecular theory is introduced. They will investigate the relationships between pressure, volume, temperature and amount of gas by means of the gas laws. The final portion of the chapter develops molar relationships for gases, among them the ideal gas law and stoichiometry.
Enduring Understanding (Mastery Objective)	• Summarize the Kinetic Molecular Theory • Compare and Contrast Simple Gas Laws from the Ideal Gas Law. • Summarize the concepts of pressure and standard conditions
Essential Questions (Instructional Objective)	• Describe the general properties of gases. • Define pressure, give the SI Unit for pressure, and convert between standard Units of pressure. • Relate the kinetic-molecular theory to the properties of an ideal gas. • State Boyle's law, and use it to solve problems involving pressure and volume. • State Charles's law, and use it to solve problems involving volume and temperature. • State Gay-Lussac's law and use it to solve problems involving pressure and temperature. • State Avogadro's law, and explain its importance in determining the formulas of chemical compounds. • Solve problems using the ideal gas law. • Describe the relationships between gas behavior and chemical formulas, such as those expressed by Graham's low of diffusion, Gay-Lussac's law of combining volumes, and Dalton's law of partial pressures including problem solving. • Apply your knowledge of reaction stoichiometry to solve gas stoichiometry problems.
Content (Subject Matter)	• Properties of gases • Kinetic-molecular theory • Boyle's Law • Charles' Law • Gay-Lussac's Law • Avogadro's Law • Ideal Gas Law • Graham's Law of Diffusion

	• Dalton's Law
Skills/ Benchmarks (CCSS Standards)	5.1.12.A.1: Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. 5.1.12.A.2: Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories. 5.1.12.A.3 Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence. 5.1.12.B.1: Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. 5.1.12.B.2: Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. 5.1.12.B.3: Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories. 5.1.12.B.4: Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations. 5.1.12.C.1: Reflect on and revise understandings as new evidence emerges. 5.1.12.C.2: Use data representations and new models to revise predictions and explanations. 5.1.12.C.3: Consider alternative theories to interpret and evaluate evidence-based arguments. 5.1.12.D.1: Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. 5.1.12.D.3: Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare. 5.2.12.A.1: Use atomic models to predict the behaviors of atoms in interactions. 5.2.12.A.4: Explain how the properties of isotopes, including half-lives, decay modes, and nuclear resonances, lead to useful applications of isotopes.

Materials and Resources	**Lab: Molar Mass of Butane**
	• **Equipment**:
	  ○ Lighters
	  ○ 50 mL grad cylinder
	  ○ bin
	  ○ balance
	  ○ thermometer
	  ○ barometer (online)
	  ○ vapor pressure table (book)

Notes	

Grade: 10 - 12 **Subject:** Chemistry I Honors	**Unit 11: Solutions**
Big Idea/Rationale	Students will learn about mixtures and solutions. Molarity is defined as the most commonly used measure of concentration. They will learn how to calculate molarity and learn how to use it to solve stoichiometry problems. Factors that affect solubility and the dissolving process are described, and the concept of saturation is explained. Finally, properties of solutions such as conductivity and colligative properties are described and explained.
Enduring Understanding (Mastery Objective)	• Describe the components of a solution. • Summarize the factors that affect the rate of dissolving. • Distinguish between colligative properties and their importance
Essential Questions (Instructional Objective)	• Distinguish between solutions, suspensions, and colloids. • Describe some techniques chemists use to separate mixtures. • Calculate concentration using common units. • Define molarity, and calculate the molarity of a solution. • Describe the procedure for preparing a solution of a certain molarity. • Use the dilution equation, M1V1=M2V2 to prepare a solution. • Use molarity in stoichiometric calculations. • Identify applications of solubility principles, and relate them to polarity and intermolecular forces. • Explain what happens at the particle level when a solid compound dissolves in a liquid. • Predict the solubility of an ionic compound by using a solubility table. • Describe solutions in terms of their degree of saturation. • Describe factors involved in the solubility of gases in liquids – Henry's Law. • Distinguish between non-electrolytes, weak electrolytes, and strong electrolytes. • Describe how a solute affects the freezing point and boiling point of a solution. • Explain how a surfactant stabilized oil-in-water emulsions.
Content (Subject Matter)	• Solutions • Concentration • Molarity • Molality • Solubility • Surfactants • Colligative properties

Skills/ Benchmarks (CCSS Standards)	• 5.1.12.A.1: Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. • 5.1.12.A.2: Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories. • 5.1.12.A.3 Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence. • 5.1.12.B.1: Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. • 5.1.12.B.2: Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. • 5.1.12.B.3: Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories. • 5.1.12.B.4: Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations. • 5.1.12.C.1: Reflect on and revise understandings as new evidence emerges. • 5.1.12.C.2: Use data representations and new models to revise predictions and explanations. • 5.1.12.C.3: Consider alternative theories to interpret and evaluate evidence-based arguments. • 5.1.12.D.1: Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. • 5.1.12.D.3: Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare. • 5.2.12.A.1: Use atomic models to predict the behaviors of atoms in interactions. • 5.2.12.A.4: Explain how the properties of isotopes, including half-lives, decay modes, and nuclear resonances, lead to useful applications of isotopes.

Materials and Resources	• **Lab: Surfactants**
	• **Equipment**:
	  ○ 2 150 mL beakers
	  ○ 25 mL grad cylinder
	  ○ hot plate
	  ○ stirring rod
	  ○ funnel
	  ○ filter paper
	  ○ test tubes 2/rack
	  ○ pH paper
	• **Materials**

	○ Vegetable oil ○ ethanol ○ 30% NaOH sol'n ○ saturated NaCl sol'n ○ saturated CaCl2 sol'n ○ distilled water **Lab: Ice Cream** • **Equipment**: ○ Small baggie ○ Large baggie ○ Measuring cups ○ Spoons ○ salt ○ ice ○ tape • **Materials** ○ sugar ○ milk ○ heavy cream ○ vanilla ○ extracts ○ chocolate chips/syrup ○ food coloring
Notes	

Grade: 10 - 12 **Subject:** Chemistry I Honors	**Unit 12: Chemical Equilibrium**
Big Idea/Rationale	Students will learn about chemical equilibrium. They will learn that chemical equilibrium is dynamic and involves processes that proceed in opposite directions at the same rate. They will also learn how stress on a system in equilibrium causes the system to adjust to establish a new equilibrium that relieves the stress.
Enduring Understanding (Mastery Objective)	• Distinguish between stresses that are applied to a chemical reaction. • Apply chemical calculations to forward and reverse reactions.
Essential Questions (Instructional Objective)	• Contrast reactions that go to completion with reversible ones • Describe chemical equilibrium • Give examples of chemical equilibria that involve complex ions • Write K_{eq}expressions for reactions in equilibrium, and perform calculations with them • Write K_{sp} expressions for the solubility of slightly soluble salts, and perform calculations with them • State LeChatelier's principle • Apply LeChatelier's principle to determine whether the forward or reverse reaction is favored when a stress such as concentration, temperature, or pressure is applied to an equilibrium system • Discuss the common ion effect in the context of LeChatelier's principle • Discuss the practical uses of LeChatelier's principle
Content (Subject Matter)	• Reversible reaction • Dynamic equilibrium • Complex ions • Equilibrium constants • Le Chateliers principle • Common-ion effect
Skills/ Benchmarks (CCSS Standards)	• 5.1.12.A.1: Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. • 5.1.12.A.2: Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories. • 5.1.12.A.3 Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence. • 5.1.12.B.1: Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data.

	• 5.1.12.B.2: Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. • 5.1.12.B.3: Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories. • 5.1.12.B.4: Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations. • 5.1.12.C.1: Reflect on and revise understandings as new evidence emerges. • 5.1.12.C.2: Use data representations and new models to revise predictions and explanations. • 5.1.12.C.3: Consider alternative theories to interpret and evaluate evidence-based arguments. • 5.1.12.D.1: Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. • 5.1.12.D.3: Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare. • 5.2.12.A.1: Use atomic models to predict the behaviors of atoms in interactions. • 5.2.12.A.4: Explain how the properties of isotopes, including half-lives, decay modes, and nuclear resonances, lead to useful applications of isotopes.

Materials and Resources	**Lab: Equilibrium**
	• **Equipment:**
	  ○ Beaker 50ml
	  ○ Beaker, 250 ml, 2
	  ○ Pipets, 4
	  ○ Spatula
	  ○ Stirring rod
	  ○ Test tubes, small, 6
	  ○ Test tube rack
	  ○ Thermometer
	  ○ Hot plate
	  ○ Marking pen
	• **Materials**
	  ○ CoCl2*6H2O, 1% sol'n in alcohol, 20 ml
	  ○ Acetone, 1ml
	  ○ CaCl2, 2 pellets
	  ○ HCl, 12M, 3 drops
	  ○ AgNO3, 0.1M, 1ml
	  ○ distilled water
	  ○ ice

Notes	

Grade: 10 - 12 **Subject:** Chemistry I Honors	**Unit 13: Acids and Bases**
Big Idea/Rationale	Students will define acids and bases according to the Arrhenius and Bronsted-Lowry definitions. They will understand the meaning of neutralization, learn how to carry out a titration, and make calculations based on titration data. The acid-ionization constant and buffer solutions will be introduced.
Enduring Understanding (Mastery Objective)	• Compare and Contrast Acid/Base Theories. • Apply pH to common household substances.
Essential Questions (Instructional Objective)	• Describe the distinctive properties of strong and weak acids and relate their properties to the Arrhenius definition of an acid. • Describe the distinctive properties of strong and weak bases, and relate their properties to the Arrhenius definition of a base. • Compare the Bronsted-Lowry definitions of acids and bases with the Arrhenius definition of a base. • Identify conjugate acid-base pairs. • Write chemical equations that show how an amphoteric species can behave as either an acid or a base. • Use K_w in calculations. • Explain the relationship between pH and H_3O^+ concentration. • Perform calculations using pH, $[H_3O^+]$, and K_w. • Describe two methods of measuring pH. • Predict the product of an acid-base reaction. • Describe the conditions at the equivalence point in a titration. • Explain how you would select an indicator for an acid-base titration. • Describe the procedure for caring out a titration to determine the concentration of an acid or base solution.
Content (Subject Matter)	• Acid base definitions • pH and pOH • neutralization reactions • titration • indicator • ionization constants
Skills/ Benchmarks (CCSS Standards)	• 5.1.12.A.1: Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. • 5.1.12.A.2: Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories. • 5.1.12.A.3 Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence.

	• 5.1.12.B.1: Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. • 5.1.12.B.2: Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. • 5.1.12.B.3: Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories. • 5.1.12.B.4: Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations. • 5.1.12.C.1: Reflect on and revise understandings as new evidence emerges. • 5.1.12.C.2: Use data representations and new models to revise predictions and explanations. • 5.1.12.C.3: Consider alternative theories to interpret and evaluate evidence-based arguments. • 5.1.12.D.1: Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. • 5.1.12.D.3: Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare. • 5.2.12.A.1: Use atomic models to predict the behaviors of atoms in interactions. • 5.2.12.A.4: Explain how the properties of isotopes, including half-lives, decay modes, and nuclear resonances, lead to useful applications of isotopes.

Materials and Resources	**Lab: Acids and Bases**
	• **Equipment**:
	  ○ Burets, 2
	  ○ Clamps
	  ○ Ring stand
	  ○ Pipettes
	  ○ Test tubes/rack
	  ○ Beakers
	• **Materials**
	  ○ 0.1M H2SO4
	  ○ 0.1M HCl
	  ○ 0.3M NaOH
	  ○ phenolphthalein indicator

Notes	