Honors Chemistry I with Lab

This course is designed to prepare students for the challenges of a college level chemistry course. It is recommended for those students planning to major in the sciences, mathematics or engineering and who is currently performing above average in math and science. The topics covered include: matter, energy, measurements, problem solving, thermochemistry, atomic theory, quantum mechanics, periodic law, ionic and covalent bonding, chemical nomenclature, chemical reactions, solids, liquids, gases, acids and bases, and equilibrium. Learning is accomplished through lectures, laboratory work and demonstrations, and the presentation of scientific data.

Due to this course's heavy math component, students are expected to excel in algebra and mathematic problem solving. Exams will reflect more depth and rigor than general chemistry exams. Weekly laboratory experiments and activities complement theory while emphasizing safety and science writing skills. Students successfully completing this course will be endowed with an exceptional understanding of the fundamentals of chemistry and achieve proficiency in solving chemical problems. This course will contribute to the development of each student's ability to think critically and to express his/her ideas, in both oral and written fashion, with clarity and logic. Students must be disciplined and self-motivated.

The students will also be expected to do projects one during the fall semester and one during the spring semester. A summer assignment will also be required.

Course Information:

Frequency & Duration: Daily for 42 minutes; 6 periods per week (includes 1 lab period)
Text: Raymond E. Davis, Mickey Sarquis, Regina Frey and Jerry L. Sarquis. *Modern Chemistry*. Austin: Holt, Rinehart and Winston, 2006. Print.

Content: The Nature of Science **Duration:** Aug/Sept (2.5 weeks)

Essential Question:	What is the nature of science?
Skills:	• Identify properties of matter that depend on sample size (mass, volume, weight, etc…). • Utilize significant figures to communicate the uncertainty in a quantitative observation. • Classify observations as qualitative or quantitative. • Demonstrate an understanding of quantitative measurement and analysis of data. • Calculate uncertainty in a measurement using percent error and average deviation calculations. • Be able to express measurements in different units. • Be able to express measurements in both a standard and scientific notation forms.
Instructional/Engagement Activities	
Assessment:	• For given samples of matter, students will be able to identify the properties depending on each samples size. • Students will be able to utilize significant figures to communicate the uncertainty in a quantitative observation. • Students will be able to classify observations as qualitative or quantitative. • Students will be able to calculate uncertainty in a measurement using percent error and average deviation calculations.
Resources / Activities:	Modern Chemistry (p.6-7) and (p.28-58) Introduction to Equipment Lab (Safety) Measurement Lab Scientific Method Lab Density Lab
Standards:	3.2.10. A1. Identify properties of matter that depend on sample size. CHEM.A.1.1.3 Utilize significant figures to communicate the uncertainty in a quantitative observation. CHEM.A.1.1.2 Classify observations as qualitative or quantitative.
Vocabulary:	**Dimensional Analysis (Factor Label)-** the analysis of the relationships between different physical quantities by identifying their fundamental dimensions (such as length, mass, and time) and units of measure (such as miles vs. kilometers, or pounds vs. kilograms vs. grams) and tracking these dimensions as calculations or comparisons are performed; **Scientific Notation** A method for expressing a given quantity as a number having significant digits necessary for a specified degree of accuracy, multiplied by 10 to the appropriate power, as 1385.62 written as 1.386×10^3; **Significant Figures**- A prescribed decimal place that determines the amount of rounding off to be done based on the precision of the measurement; **SI**

System (or Metric System)- the decimal measuring system based on the meter, liter, and gram as units of length, capacity, and weight or mass; **Qualitative Observations**- use your senses to observe the results. (Sight, smell, touch, taste and hear.); **Quantitative Observations**- made with instruments such as rulers, balances, graduated cylinders, beakers, and thermometers. These results are measurable

Comments: Students will have to memorize the formulas to calculate, percent error, and average deviation.
Consideration may be given to discussing significant figures at a later time.

Content: Matter and Energy

Duration: Sept./ Oct. (6 weeks)

Essential Question:

How is matter characterized and quantified?

Skills:

- Describe the three normal states of matter (energy, particles in motion, phase transitions) according to the kinetic molecular theory.
- Differentiate between pure substances and mixtures, and between heterogeneous and homogeneous mixtures.
- Differentiate between physical and chemical properties and predict how combinations of substances can result in physical and/or chemical changes.
- Explain the difference between endothermic and exothermic reactions and processes.
- Describe the relationship between average kinetic molecular energy, temperature, and phase changes.

Instructional/Engagement Activities

Assessment:

- Students will be able to describe the three normal states of matter (in terms of energy, particle motion, and phase transitions) according to the kinetic molecular theory.
- Given various samples of matter, students will be able to differentiate between pure substances and mixtures, as well as between heterogeneous and homogeneous among the mixtures.
- Given various properties of matter, students will be able to differentiate between chemical and physical properties and predict how combinations of substances can result in physical and/or chemical changes.
- Students will be able to explain the difference between endothermic and exothermic reactions.
- Students will be able to describe the relationship between the average kinetic molecular energy, temperature, and phase changes.

Resources / Activities:

Modern Chemistry (p7-14 and 342-346)

Separations of Mixtures Lab
Entropy and Enthalpy Lab

Standards:	3.2. C.A3. Describe the three normal states of matter in terms of energy, particle motion, and phase transitions. 3.2.10. A3. Describe phases of matter according to the **kinetic molecular theory**. 3.2. C.A1. Differentiate between pure substances and mixtures; differentiate between heterogeneous and homogeneous mixtures. Differentiate between physical properties and chemical properties. 3.2. C.A4.Predict how combinations of substances can result in physical and/or chemical changes. CHEM.A.1.1.1 Classify physical or chemical changes within a system in terms of matter and/or energy 3.2.10. A4. Explain the difference between **endothermic** and **exothermic** reactions. Identify the factors that affect the rates of reactions. 3.2. C.B3. Explain the difference between an **endothermic** process and an **exothermic** process. Describe the law of conservation of energy 3.2.12. B3. Describe the relationship between the average kinetic **molecular** energy, temperature, and phase changes. 3.2.C.B2 Explore the natural tendency for systems to move in a direction of disorder or randomness (entropy).
Vocabulary:	**Matter**- Anything that has mass and takes up space and may be classified as either a pure substance or a mixture; **Pure Substance**-something that consists of one type of matter (an element or a compound; **Mixture** - a blend of two or more kinds of matter each of which retains its own identity and properties; **Heterogeneous Mixture** – a mixture that consists of visibly distinguishable parts; **Homogeneous Mixture** – a mixture that has uniform composition and no visibly distinguishable parts; **Chemical Property**- A property of matter that describes a substance's ability to participate in a chemical reaction; (can't be measured or observed without changing the identity of the substance); **Physical Property** – a characteristic that can be measured or observed without changing the identity of the substance; **Endothermic Reaction**- Describe a process in which heat is absorbed from the environment; **Exothermic Reaction**- Describe a process in which a system releases heat into the environment; **Kinetic Molecular Theory**- Explains the behavior of physical systems, depends on the combined actions of the molecules constituting the system; **Phase transition (phase change)**- The transitions between the solid, liquid, and gaseous phases of a single component, due to the effects of temperature and/or pressure.
Comments:	

Content: Atoms **Duration:** Oct./ Nov. (3 weeks)

Essential Question:	Why does the atomic theory serve as the basis for the study of matter?
Skills:	• Describe the evolution of atomic theory of the atom and how it contributed to the modern model of the atom. • Differentiate between the mass number of an isotope and an average atomic mass of an element and distinguish among the isotopic forms of elements. • Recognize discoveries from Daltons atomic theory, Thomson's (the electron), Rutherford (the nucleus), and Bohr (the planetary model of atom). • Describe Rutherford's gold foil experiment that led to the discovery of the atomic nucleus. • Explain the law of definite proportions to classify elements and compounds as pure substances. • Explain why compounds are composed of integer ratios of elements. • Interpret the law of conservation of energy, law of conservation of mass, the laws of definite proportions, and multiple proportions. • Recognize the contributions of Robert Millikan to the early atomic model. • Calculate percent abundance of an isotope of a particular element.
Instructional/Engagement Activities	
Assessment:	• Students will be able to describe how the discoveries of Dalton, Thomson, Millikan, Rutherford, and Bohr lead to our current model of the atom. • Student will be able to explain the difference between an isotope's mass number and the average atomic mass of the same element. • Students will distinguish among the isotopic forms of elements. • Students will be able to explain how the law of definite proportions is used to classify elements and compounds as pure substances. • Students will be able to interpret and apply the law of conservation of energy, laws of conservation of mass, the laws of definite proportions and multiple proportions. • Students will be able to calculate percent abundance of an isotope of a particular element.
Resources / Activities:	Modern Chemistry (p.73, 97-103) Isotope Lab TBA Lab
Standards:	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. 3.2.12.A2 Distinguish among the isotopic forms of elements. 3.2.10.A5.MODELS Describe the historical development of models of the atom and

	how they contributed to modern atomic theory. 3.2.C.A5.MODELS Recognize discoveries from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus), and Bohr (planetary model of atom), and understand how each discovery leads to modern theory. Describe Rutherford's "gold foil" experiment that led to the discovery of the nuclear atom. Identify the major components (protons, neutrons, electrons) of the nuclear atom and explain how they interact. CHEM.B.1.2.2- Apply the Law of definite proportions to the classification of elements and compounds as pure substances. 3.2. C.A4. Interpret and apply the laws of conservation of mass, constant composition (definite proportions), and multiple proportions. 3.2.12.A2 Explain why compounds are composed of integer ratios of elements.
Vocabulary:	**Dalton's Atomic Theory**-the first theory of structure of matter supported by experimentation; **Isotope**- An atom that has the same number of protons as other atoms of the same element do but that has different number of neutrons in the nucleus **Average Atomic Mass**- the average mass of an atom of an element calculated using relative abundance of isotopes in naturally occurring element; **Law of Conservation of Mass**- Atoms cannot be created or destroyed in ordinary chemical and physical changes; **Law of Definite Proportions (Constant Composition)**- A chemical compound always contains the same elements in exactly the same proportions by weight and mass; **Rutherford's Atomic Model**- First modern concept of atomic structure; all of the positive charge and most of the mass of the atom are contained in a compact nucleus; a number of electrons (equal to the atomic number) occupy the rest of the volume of the atom and neutralize the positive charge); **Thomson's Atomic Model**-also known as the plum pudding model which describes the atom as a positively charged particle with electrons embedded into it like plums embedded into pudding. The plum pudding model was abandoned after discovery of the atomic nucleus; **Bohr Model**- The simplest modern picture of the structure of the atom, according to which electrons move in orbits around the nucleus; **Electromagnetic Radiation**- All of the frequencies or wavelengths of electromagnetic radiation; **Average Atomic Mass-** the weighted average of the masses of all the naturally occurring isotopes of an element; **Mass Number –** the total number of protons and neutrons in the nucleus of an isotope; **Atomic Number**- the number of protons in the nucleus of an element;;**Robert Millikan –** oil drop experiment
Comments:	

Content: Electron Configuration **Duration:** Nov./ Dec. (3 weeks)

Essential Question:	What is the behavior of the electrons in matter?
Skills:	• Compare the electron configurations for the first twenty elements of the periodic table. and relate the position of an element on the periodic table to its electron configuration and reactity. • Explain how light is absorbed or emitted by electron orbital transitions. • Predict properties of elements using trends of the periodic table. • Calculate wavelength and frequency of light. • Calculate the wavelength of light emitted or absorbed during electron transitions in the Bohr Model of the atom. • Compare and contrast the Bohr Model of the atom with quantum mechanical view. • Determine the set of quantum numbers (n, l, m_l, m_s) for any electron in an atom.
Instructional/Engagement Activities	
Assessment:	• Students will be able to compare the electron configurations for the first twenty elements of the periodic table and relate the position of an element on the periodic table to its electron configuration and compare its reactivity to the reactivity of other elements in the table. • Students will be able to explain how light is absorbed or emitted by electron orbital transitions. • Students will be able to predict properties of elements using trends of the periodic table. • Students will be able to calculate wavelength and frequency of light. • Students will be able to calculate the wavelength of light emitted or absorbed during electron transitions in the Bohr Model of the atom. • Students will be able to compare and contrast the Bohr Model of the atom with quantum mechanical view. • Students will be able to determine the set of quantum numbers (n, l, m_l, m_s) for any electron in an atom.
Resources / Activities:	Modern Chemistry (p.90 → 117) Flame Test Lab Quantum Leap Lab Lab
Standards:	3.2.C.A2 Compare the electron configurations for the first twenty elements of the periodic table. Relate the position of an element on the periodic table to its electron configuration and compare its reactivity to the reactivity of other element in the table. 3.2.12.A2 Explain how light is absorbed or emitted by electron orbital transitions. 3.2.10.A1 Predict properties of elements using trends of the periodic table.

Vocabulary:	**Bohr Model**- The simplest modern picture of the structure of the atom, according to which electrons move in orbits around the nucleus; **Electromagnetic Spectrum-** All of the frequencies or wavelengths of electromagnetic radiation; **Electron Configuration**- The arrangement of electrons in an atom; **Orbital Notation, Spectroscopic Notation, Nobel Gas Notation**- are ways of showing the electron configuration; **Quantum Numbers**-the numbers that specifies the properties of atomic orbitals and the properties of electrons in orbitals.

Comments: Students will have to memorize the formulas for wavelength and frequency.

Content: Periodicity **Duration:** December (2 weeks)

Essential Question:	How is the periodic table a template of organization for the material world?
Skills:	• Relate an element's position on the periodic table to its electron configuration. • Compare an element's reactivity to that of other elements. • Describe chemical reactions in terms of atomic rearrangement and /or electron configuration. • Explain how the periodicity of chemical properties led to the arrangement of elements in the periodic table. • Compare and/or predict the properties (e.g., electron affinity, ionization energy, chemical reactivity, electronegativity, atomic radius) of selected elements by using their locations in the periodic table and known trends. • Predict characteristics of an atom or ion based on its location in the periodic table (e.g., number of valence electrons, potential types of bonds, reactivity).
Instructional/Engagement Activities	
Assessment:	• Students will be able to relate an element's position in the periodic table to its electron configuration. • Students will be able to compare the element's reactivity to that of other elements. • Students will be able to describe chemical reactions in terms of atomic rearrangement and /or electron transfer. • Students will be able to explain how the periodicity of chemical properties led to the arrangement of elements in the periodic table. • Students will be able to compare and/or predict the properties (e.g., electron affinity, ionization energy, chemical reactivity, electronegativity, atomic radius) of selected elements by using their locations in the periodic table and known trends. • Students will be able to predict characteristics of an atom or ion based on its location in the periodic table (e.g., number of valence electrons, potential types of bonds, reactivity).
Resources / Activities:	Modern Chemistry (p.132 → 169) Periodicity Lab- graphing trends lab Reactivity of Alkaline Earth Metals Lab
Standards:	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. 3.2.10.A1 Predict the properties of elements using the trends of the periodic table. CHEM.A.2.2.2Predict characteristics of an atom or ion based on its location on the periodic table (e.g., number of valence electrons, potential types of bonds, reactivity).
Vocabulary:	**Atomic Radius**- Measure of the size of atoms; **Electron Affinity**- The energy change that occurs when an electron is acquired by a neutral atom; **Electronegativity**- A measure of the ability of an atom in a chemical compound to attract electrons; **Ionization Energy -** **d**escribes the amount of energy required to remove an electron from the atom or molecule in the gaseous state; **Ionic Radius**- The radius exhibited by an ion in an ionic crystal where the ions are packed together to a point where their outermost electronic orbitals are in contact with each other**; Periodicity**- the variations in properties of **chemical** elements as depending on by their position in the periodic table;

Comments:

Content: Chemical Bonding **Duration:** Dec/Jan (2 weeks)

Essential Question:	How does the study of valence electrons help to explain most chemical phenomena?
Skills:	• Use electronegativity to explain the difference between polar and non-polar covalent bonds. • Use electronegativities and molecular geometry to predict the polarity of a molecule • Utilize Lewis dot Structures to predict the structure and bonding in simple compounds and draw the Lewis dot structure for simple molecules and ionic compounds. • Compare and contrast different bond types that result in the formation of molecules and compounds and explain how atoms combine to form compounds through both ionic and covalent bonding. • Predict chemical formulas based on the number of valence electrons. • Use VSEPR theory to predict the molecular geometry of simple molecules. • Explain the unique properties of water (polarity, high boiling point, forms of hydrogen bonds, high specific heat) that support life on Earth.
Instructional/Engagement Activities	
Assessment:	• Students will be able to use electronegativity to explain the difference between polar and non-polar covalent bonds. • Students will be able to use electronegativities and molecular geometry to predict the polarity of a molecule • Students will be able to utilize Lewis dot Structures to predict the structure and bonding in simple molecules and ionic compounds. • Students will be able to compare and contrast different bond types that result in the formation of molecules and compounds and explain how atoms combine to form compounds through both ionic and covalent bonding. • Students will be able to predict chemical formulas based on the number of valence electrons. • Students will be able to use VSEPR theory to predict the molecular geometry of simple molecules. • Students will be able to explain the unique properties of water (polarity, high boiling point, forms of hydrogen bonds, high specific heat) that support life on Earth.
Resources / Activities:	Modern Chemistry (p.175-179) Lewis Structures and Molecular Geometry Lab Intermolecular Forces LAb
Standards:	3.2.C.A1 Use electronegativity to explain the difference between polar and non-polar covalent bonds. CHEM.B.1.3.3 Use illustrations to predict the polarity of a molecule. CHEM.B.1.4.2 Utilize Lewis dot Structures to predict the structure and bonding in simple compounds. 3.2.10.A.2 Compare and contrast different bond types that result in the formation of molecules and compounds.

	3.2.C.A2 Explain how atoms combine to form compounds through both ionic and covalent bonding. Predict chemical formulas based on the number of valence electrons. Draw Lewis dot Structures for simple molecules and ionic compounds. CHEM.B.1.3.1 Explain how atoms combine to form compounds through ionic and covalent bonding. CHEM.B.1.4.2 Utilize Lewis dot structures to predict the structure and bonding in simple compounds. 3.2.12.A5 MODELS/ PATTERNS USE VSEPR theory to predict the molecular geometry of simple molecules. 3.2.10.A1 Explain the unique properties of water (polarity, high boiling point, forms of hydrogen bonds, high specific heat) that support life on Earth.
Vocabulary:	**Covalent Bonds**- A bond formed when atoms share one or more pairs of electrons; **Intermolecular Forces-** The forces of attraction between molecules; **Ionic Bonds**- A chemical bond formed between two ions with opposite charges; **Ions**- An atom or molecule that has gained or lost one or more electrons and has a negative or positive charge; **Lewis Structure**- structural representation of a molecule where dots are used to show valence electron position around the atoms and lines or dot pairs represent covalent bonds between atoms; **Octet Rule-** A concept of chemical bonding theory that is based on the assumption that atoms tend to have either empty valence shells or full valance shells of eight electrons; **Polyatomic Ions**- An ion made of two or more atoms; **VSEPR Theory (Molecular Geometry)-** Theory that predicts some molecular shapes based on the idea that pairs of valence electrons surrounding an atom repel each other

Comments: Students will have to memorize various VSEPR structures. This may be decided on a per teacher basis.

Content: Naming Chemical Compounds **Duration:** January (1 week)

Essential Question:

How does chemical naming exhibit organizational patterns?

Skills:

- Predict chemical formulas for simple ionic and molecular compounds.
- Apply a systematic set of rules (IUPAC) for naming compounds and writing chemical formulas (e.g., binary covalent, binary ionic, and ionic compounds containing polyatomic ions).
- Name and write formulas for simple alkanes, alkenes and alkynes.
- Name and write formulas for acids (binary and oxyacids).

Instructional/Engagement Activities

Assessment:

- Students will be able to predict chemical formulas for simple ionic and molecular compounds.
- Students will be able to apply a systematic set of rules (IUPAC) for naming compounds and writing chemical formulas (e.g., binary covalent, binary ionic, and ionic compounds containing polyatomic ions).
- Students will be able to name and write formulas of simple organic compounds.
- Students will be able to name and write formulas for binary acids and oxyacids.

Resources / Activities:

Modern Chemistry (p.218 - 221) (p.468-469)-(p. 716-722) (p. 724-728)

Ionic Formula Writing Lab

Standards:

3.2.C.A2 Predict the chemical formulas for simple ionic and molecular compounds.

CHEM.A.1.1.5Apply a systematic set of rules (IUPAC) for naming compounds and writing chemical formulas (e.g., binary covalent, binary ionic, ionic compounds, containing polyatomic ions).

Vocabulary:

Binary Covalent- A binary compound composed of two different nonmetal elements; **Binary Ionic**- a compound consisting of two types of ions: ions of a metal (positively charges) and ions of a nonmetal (negatively charged); **Ionic Compound**- a chemical compound of cations and anions which are held together by ionic bonds in a lattice structure; **IUPAC**- An acronym for International Union of Pure and Applied Chemistry. The IUPAC is the recognized authority for chemical standards of nomenclature, measurements and atomic mass values

Comments: Students will have to memorize the polyatomic ion chart. This may be done on a per teacher basis.

Content: Chemical Reactions and Balancing **Duration:** Jan/Feb (6 weeks)

Essential Question:	What is happening during a chemical reaction?
Skills:	• Balance chemical equations by applying the law of conservation of mass. • Classify and predict products of chemical reactions as synthesis (combination), decomposition, single displacement (replacement), double displacement (replacement), combustion. • Understand the natural tendency for systems to move in a direction of disorder or randomness (entropy) and identify the factors that affect the rates of reaction.
Instructional/Engagement Activities	
Assessment:	• Students will be able to balance chemical equations by applying the law of conservation of mass. • Students will be able to classify and predict chemical reactions as synthesis (combination, decomposition, single displacement (replacement), double displacement (replacement), and combustion.) • Students will understand the natural tendency for systems to move in a direction of disorder or randomness (entropy) and identify the factors that affect the rates of reaction. .
Resources / Activities:	Modern Chemistry (p.242 - 249)(p.260 - 293) (p. 298- 319) Qualitative Observations of Chemical Reactions Lab
Standards:	3.2.C.A4 Balance chemical equations by applying the laws of conservation of mass. Classify chemical reactions as synthesis (Combination), decomposition, single displacement (replacement), double displacement (replacement), and combustion. CHEM.B.2.1.4 Predict products of simple chemical reactions (e.g., synthesis, decomposition, single replacement, double replacement, combustion). 3.2.C.B2 Explore the natural tendency for systems to move in a direction of disorder or randomness (entropy). 3.2.10.A4 Identify the factors that affect the rates of reaction.
Vocabulary:	**Combustion**- a type of chemical reaction where a fuel and oxygen are reacted to produce carbon dioxide and water; **Decomposition**- the process by which the atoms of a compound are rearranged to form two or more different compounds; **Synthesis**- the formation of a chemical compound through the combination of simpler compounds or elements **Single Displacement (Replacement)**- a type of oxidation-reduction chemical reaction when one element is replaced by another in a compound; **Double Displacement (Replacement)**- one component each of both the reacting molecules is exchanged to form the products. During this reaction, the cations and anions of two different compounds switch places, forming two entirely different compounds; **Empirical Formula**- A chemical formula that shows the composition of a compound in terms of the relative numbers and kinds of atoms in the simplest ratio; **Limiting Reactants**- The substance that controls the quantity of product that can form in a chemical reaction; **Molecular Formula**- A chemical

formula that shows the number and kinds of atoms in a molecule, but not the arrangement of atoms; **Percent Composition**- The percentage by mass of each element in a compound.; **Percent Yield**- Refers to the efficiency of a chemical reaction; defined as the actual yield/theoretical yield x 100; **Precipitate**- an insoluble solid that emerges from a liquid solution;; **Stoichiometry**- The proportional relationships between two or more substances during a chemical reaction.

Comments:

Content: Mole Concept/Stoichiometry **Duration:** Feb. (2 weeks)

Essential Question:	What makes the mole the fundamental unit of chemistry?
Skills:	• Use the mole concept to determine number of particles and molar mass for elements and compounds and apply the mole concept to representative particles (e.g., counting, determining mass of atoms, ions, and molecules, and/or formula units). • Relate the percent composition and mass of each element present in a compound. • Use stoichiometric relationships to calculate the amounts of reactants and products involved in a chemical reaction using mole ratio • Use stoichiometry to predict quantitative relationships in a chemical reaction and describe the roles of limiting and excess reactants in a chemical reaction.
Instructional/Engagement Activities	
Assessment:	• Students will be able to use the mole concept to determine number of particles and molar mass for elements and compounds and apply the mole concept to representative particles (e.g., counting, determining mass of atoms, ions, and molecules, and/or formula units). • Students will be able to relate the percent composition and mass of each element present in a compound. • Students will be able use stoichiometric relationships to calculate the amounts of reactants and products involved in a chemical reaction using mole ratio. • Students will be able to use stoichiometry to predict quantitative relationships in a chemical reaction and describe the roles of limiting and excess reactants in chemical reactions
Resources / Activities:	Modern Chemistry (p.82 - 87), (p. 238-234) Atomic Coating Lab Counting by Weighing Lab Percent Composition of a Hydrate Lab Stoichiometry Lab
Standards:	3.2.C.A2 Use the mole concept to determine number of particles and molar mass for elements and compounds. CHEM.B.1.1.1 Apply the mole concept to representative particles (e.g., counting, determining mass of atoms, ions, and molecules, and/or formula units). SCALE Apply the mole concept to determine number of particles and molar mass for elements and compounds. CHEM.B.1.2.3 Relate the percent composition and mass of each element present in a compound. CHEM.B.2.1.2 Use stoichiometric relationships to calculate the amounts of reactants and products involved in a chemical reaction. CHEM.B.1.2.3 Relate the percent composition and mass of each element present in a compound. 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 amount of reactants and products involved in a chemical reaction. 3.2.10.A4 Predict the amounts of products and reactants in a chemical reaction using mole relationships.
Vocabulary:	**Molar Mass**- The mass in grams of 1 mole of a substance; **Mole**- counting unit for atoms equal to the number of atoms of carbon in exactly 12 grams of carbon-12 **Empirical Formula**- A chemical formula that shows the composition of a compound in terms of the relative numbers and kinds of atoms in the simplest ratio; **Limiting Reactants**- The substance that controls the quantity of product that can form in a chemical reaction; **Molecular Formula**- A chemical formula that shows the number and kinds of atoms in a molecule, but not the arrangement of atoms; **Percent Composition**- The percentage by mass of each element in a compound; **Percent Yield**- Refers to the efficiency of a chemical reaction; defined as the actual yield/theoretical yield x 100; **Stoichiometry**- The proportional relationships between two or more substances during a chemical reaction;
Comments:	

Content: Gases **Duration:** April (2 weeks)

Essential Question:	How are the gas laws useful in everyday life?
Skills:	• Utilize mathematical models to relate the volume, temperature, pressure and quantity of a gas (i.e., Boyle's Law, Charles's Law, Gay-Lussac's Law, Daltons Law of Partial Pressures, the Combined Gas Law, and the Ideal Gas Law). • Predict the amounts of reactants and products involved in a chemical reaction using molar mass volume of a gas at STP
Instructional/Engagement Activities	
Assessment:	• . Students will be able to utilize mathematical models to relate the volume, temperature, pressure and quantity of a gas (i.e., Boyle's Law, Charles Law, Gay-Lussac's Law Dalton's Law of Partial Pressures, the Combined Gas Law, and the Ideal Gas Law). • Students will be able to predict the amounts of reactants and products involved in a chemical reaction using molar mass volume of a gas at STP.
Resources / Activities:	Modern Chemistry (p.360- 367) Gas Law Lab (Boyles, Charles, Gay-Lussacs) Determining Molar Volume of Gas Lab Preparing and Testing Hydrogen Lab
Standards:	CHEM.B.2.2.1 Utilize mathematical relationships to predict changes in the number of particles, the temperature, the pressure and the volume in a gaseous system (i.e., Boyle's Law, Charles's Law, Dalton's Law of Partial Pressures, the Combined Gas Law, and the Ideal Gas Law). CHEM.B.2.2.2 Predict the amounts of reactants and products involved in a chemical reaction using molar mass volume of a gas at STP.
Vocabulary:	**Boyle's Law**- The law that states that for a fixed amount of gas at a constant temperature, the volume of the gas increases as the pressure of the gas decreases and vice versa; **Charles's Law**- The law that states that for a fixed amount of gas at a constant pressure, the volume of the gas increases as the temperature of the gas increases and vice versa; **Gay-Lussac's Law** – the law that states that for a fixed amount of gas at a constant volume, the pressure of the gas increases as the Kelvin temperature of the gas increases and vice a versa; **Combined Gas Law**- a gas law that combines Charles's law and Boyle's law; **Dalton's Law of Partial Pressure**- The law states that the total pressure of a mixture of gases is equal to the sum of the partial pressure of the component gases; **Ideal Gas Law**- The law that relates pressure, volume, temperature, the gas constant and the number of moles of a gas (or PV=nRT); **STP**- Standard temperature and pressure defined as zero degrees Celsius (0 ºC), which translates to 32 degrees Fahrenheit (32 ºF) or 273.15 degrees kelvin (273.15 K). This is essentially the freezing point of pure water at sea level, in air at

standard pressure (1 atm).

Comments:

Content: Solutions, Acids, and Bases **Duration:** April/ May (5 weeks)

Essential Question:	How do solutions, acids and bases influence people's lives?
Skills:	• Describe the interactions between acids and bases • Describe various ways that concentration can be expressed and calculated (e.g., molarity, percent by mass, percent by volume). • Explain the pH scale. • Perform a titration of an acid. • Write acid and base dissociation reactions. • Relate acidic and basic properties to the structure of the molecule. • Compare and contrast Arrhenius, Bronsted –Lowry, and Lewis acid definitions. • Calculate pH and pOH. • Calculate (H^+), pH in strong or weak acid solution. • Calculate (OH^-), pOH in a strong or weak base solution.
Instructional/Engagement Activities	
Assessment:	• Students will be able to describe the interactions between acids and bases. • Students will be able to explain the pH scale. • Students will be able to perform titration of an acid. • Students will be able to write acid and base dissociation reactions. • Students will be able relate acidic and basic properties to the structure of the molecule. • Students will compare and contrast Arrhenius, Bronsted- Lowry, and Lewis acid definitions. • Students will be able to calculate pH and pOH. • Students will be able to calculate (H^+), pH in strong or weak acid solution. • Students will be able to calculate (OH^-), pOH in a strong or weak base solution.
Resources / Activities:	Modern Chemistry (p.418-421) (p.503-505) (p.515-521) Exploring the Chemical Reaction in a Toy Lab Determining Acid Concentration of a Juice Lab
Standards:	3.2.CA4 Describe the interactions between acids and bases . CHEM.A.1.2.4D Describe various ways that concentration can be expressed and calculated (e.g., molarity, percent by mass, percent by volume).

Vocabulary:

Acid- Proton donors that yield hydronium ions in water solution, or electron-pair acceptors that combine with electron-pair donors or bases; **Arrhenius Acid**- A chemical compound that increase the concentration of hydrogen ions (H^+), in aqueous solutions; **Arrhenius Base**- A substance that increases the concentration of hydroxide ions (OH^-), in aqueous solution; **Base-** a molecule or ion containing an atom with a free pair of electrons that can be donated to an acid; an electron-pair donor; **Bronsted- Lowry Acid**- A molecule or ion that is a proton donor; **Bronsted-Lowry Base**- A molecule or ion that is a proton acceptor; **Lewis Acid**- An atom, ion, or molecule that accepts an electron pair to form a covalent bond; **Lewis Base-** An atom, ion, or molecule that donates an electron pair to form a covalent bond; **Solute**-the substance that dissolves in the solvent; **Solution**- A homogeneous mixture of two or more substances uniformly dispersed throughout a single phase; **Solvent**- the substance in which the solute dissolves.

Comments: