Applied Chemistry

This chemistry course is designed to provide the non-science student with an opportunity to develop and evaluate basic ideas and theories related to chemistry. Students will apply skills and knowledge to chemistry principles in order to explain various concepts, and solve problems. In order to accomplish these students will be challenged to think outside their comfort zone.

This course investigates the fundamental concepts of chemistry. Topics include scientific measurements, properties of matter, atomic structure, the periodic table, ionic and covalent bonding, chemical nomenclature, chemical reactions, gas laws, solutions, and acids and bases. Demonstrations are an integral part of the course and include demonstrations that reinforce the concepts presented in lecture. A practical application of chemistry to the student's daily life is emphasized throughout the course.

Course Information:

Frequency & Duration: Daily for 42 minutes; 5 periods per week
Text: Raymond E. Davis, Mickey Sarquis, Regina Frey and Jerry L. Sarquis. *Modern Chemistry*. Austin: Holt, Rinehart and Winston, 2006. Print.

It is understood that a textbook will not be given to the students – but the above textbook will be the reference and guide for this Applied Chemistry course. If a student requests a copy of the text one will be provided to them.

Content: Nature of Science **Duration:** Aug./ Sept. (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.
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.
Resources / Activities:	Holt Chemistry (p.46-65)
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; **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; **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.

Comments:

Content: Matter and Energy **Duration:** October (2 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 amongst 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:	Holt Chemistry (p.2-45)
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:	**Chemical Property**- A property of matter that describes a substance's ability to participate in a chemical reaction; **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; **Heterogeneous Mixture**- Composed of dissimilar components; **Homogeneous Mixture**- Describes something that has a uniform structure or composition throughout; **Kinetic Molecular Theory**- Explains how the behavior of physical systems depends on the combined actions of the molecules constituting the system; **Law of definite proportions**- States that a chemical compound always contains the same elements in exactly the same proportions by weight or mass; **Matter**- Anything that has mass and takes up space; **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; **Physical Property**- A characteristic of a substance, that can be measured or observed without changing the nature of the substance such as density, color or hardness
Comments:	

Content: Atoms **Duration:** Oct./ Nov. (4.5 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 form 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.
- Interpret and apply the law of conservation of energy, law of conservation of mass, constant composition (definite proportions), and multiple proportions.
- Explain why compounds are composed of integer ratios of elements.

Instructional/Engagement Activities

Assessment:

- Students will be able to describe how the discoveries of Dalton, Thomson, 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, constant composition (definite proportions) and multiple proportions.
- Students will be able to explain why compounds are composed of integer ratios of elements

Resources / Activities:

Holt Chemistry (p.72- 89)

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 elements.
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 relativity • Explain how light is absorbed or emitted by electron orbital transitions. • Predict properties of elements using trends of the periodic table.
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
Resources / Activities:	Holt Chemistry (p.90- 99) and (p.338-340) (p.358-359)
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:	**Heisenberg Uncertainty Principle-**It is impossible to know the position and momentum of an electron in an atom; **Aufbau Principle-** electrons occupies the lowest energy orbital with a vacant place; **Hund's Rule –** Orbitals of equal energy are occupied by one electron with the same spin before electrons are paired**; Pauli Exclusion Principle –** no one orbital can hold two electrons with the same spin**; 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 number that specifies the properties of atomic orbitals and the properties of electrons in orbitals.

Comments:

Content: Mole Concept **Duration:** Dec./ Jan. (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).
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).
Resources / Activities:	Holt Chemistry (p.222-240) Mole 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.
Vocabulary:	**Atomic Weight (or Atomic Mass)**- the average mass of atoms of an element , calculated using the relative abundance of isotopes in a naturally-occurring element; **Molar Mass**- The mass in grams of 1 mole of a substance; **Mole**- a counting unit for atoms and molecules equal to the number of atoms of carbon in exactly 12 grams of carbon-12

Comments:

Content: Periodicity **Duration:** January (2.5 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 relativity 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 on 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 on the periodic table and known trends. • Predict 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).
Instructional/Engagement Activities	
Assessment:	• Students will be able to relate an element's position on 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 on 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 on the periodic table and known trends. • Students will be able to predict 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).
Resources / Activities:	Holt Chemistry (p.114- 149)
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.2.2.2 Predict 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- A measure of the size of its atoms; **Average Atomic Mass**- The weighted average of the masses of all naturally occurring isotopes of an element; **Electronegativity**- A measure of the ability of an atom in a chemical compound to attract electrons; **Ionization Energy**- describes the amount of energy required to remove an electron from the atom or molecule in the gaseous state; **Periodicity**- the variations in properties of chemical elements as depicted by their position in the periodic table

Comments:

Content: Chemical Bonding **Duration:** Jan./ Feb. (4.5 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. • 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 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:	Holt Chemistry (p.188- 215) and (p.385-392)
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 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:	

Content: Naming Chemical Compunds **Duration:** March (2 weeks)

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).

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).

Resources / Activities: Holt Chemistry (p.206- 207) and (176- 182)

Standards: 3.2.C.A2 Predict the chemical formulas for simple ionic and molecular compounds.
CHEM.A.1.1.5 Apply a systematic set of rules (IUPAC) for naming compounds and writing chemical formulas (e.g., binary covalent, binary ionic, ionic compounds, containing polyatomic ions).

Vocabulary: **Binary Covalent**- A binary covalent compound is composed of two different nonmetal elements; **Binary Ionic**- a compound consisting of only two elements in which both elements are ions, a cation (which has a positive charge) and an anion (which has a negative charge); **Ionic Compounds**- 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:

Content: Chemical Reactions and Balancing **Duration:** March/ April (4 weeks)

Essential Question:	What is happening during a chemical reaction?
Skills:	• 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 ratios. • 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), and combustion. • Use stoichiometry to predict quantitative relationships in a chemical reaction and describe the roles of limiting and excess reactants in a chemical reaction. • Describe various ways that concentration can be expressed and calculated (e.g., molarity, percent by mass, percent by volume). • 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 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 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 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 • Students will be able to describe various ways that concentration can be expressed and calculated (e.g., molarity, percent by mass, percent by volume). • 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:	Holt Chemistry (p. 260- 291) and (p.300- 329)

Standards:	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. 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. Use stoichiometry to predict quantitative relationships in a chemical reaction. CHEM.A.1.2.4D Describe various ways that concentration can be expressed and calculated (e.g., molarity, percent by mass, percent by volume). 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. CHEM.B.2.1.4 Predict products of simple chemical reactions (e.g., synthesis, decomposition, single replacement, double replacement, combustion). 3.2.10.A4 Predict the amounts of products and reactants in a chemical reaction using mole relationships. 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 reactions.
Comments:	

Content: Gasses **Duration:** April (1.5 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, Dalton's 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:	Holt Chemistry (p.414- 441) Gas Law 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, Boyle's laws and Gay-Lussac'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 °C), which translates to 32 degrees Fahrenheit (32 °F) 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 (3.5 weeks)

Essential Question:	How do solutions, acids and bases influence people's lives?
Skills:	• Describe the interactions between acids and bases
Instructional/Engagement Activities	
Assessment:	• Students will be able to describe the interactions between acids and bases.
Resources / Activities:	Holt Chemistry (p.452- 488) and (p.528-556)
Standards:	3.2.CA4 Describe the interactions between acids and bases.
Vocabulary:	**Acid**- Proton donors that yield hydronium ions in water solution, or electron-pair acceptors that combine with electron-pair donors or bases; **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; **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:

Content: Nuclear Chemistry **Duration:** May/ June (2 weeks)

Essential Question:	Why is understanding nuclear chemistry important to scientists?
Skills:	• Identify the three main types of radioactive decay and compare their properties. • Describe the process of radioactive decay by using nuclear equations and explain the concepts of half-life for an isotope. • How is the half-life of an atom calculated? • Compare and contrast nuclear fission and nuclear fusion.
Instructional/Engagement Activities	
Assessment:	• Students will be able to identify the three main types of radioactive decay and compare their properties. • Students will be able to describe the process of radioactive decay by using nuclear equations and explain the concepts of half-life for an isotope. • Students understand how half-life of an atom is calculated. • Students will be able to compare and contrast nuclear fission and nuclear fusion.
Resources / Activities:	Holt Chemistry (p.640-668)
Standards:	3.2.C.A3 Identify the three main types of radioactive decay and compare their properties. Describe the process of radioactive decay by using nuclear equations and explain the concepts of half-life for an isotope. Compare and contrast nuclear fission and nuclear fusion.
Vocabulary:	**Beta Particle**- A charged electron emitted during certain types of radioactive decay, such as beta decay; **Gamma Rays**- The high-energy photons emitted by a nucleus during fission and radioactive decay; **Half-Life**- The time required for half of a sample of a radioactive substance to disintegrate by radioactive decay or by natural processes; **Nuclear Fission**- The splitting of the nucleus of a large atom into two or more fragments; releases additional neutrons and energy; **Nuclear Fusion**- The combination of the nuclei of small atoms to form larger nucleus; releases energy; **Radioactivity**- The process by which an unstable nucleus emits one or more particles or energy in the form of electromagnetic radiation

Comments: Teacher led demonstrations may be done throughout the year in order to supplement the material.