	Course Title: Chemistry **Course Description:** In this course, students will study matter on Earth and the periodic table of elements, including the relationship that exists between chemical behavior and the structure of atoms. The class will include units on the periodic table, the emission of high-energy particles resulting from nuclear changes, chemical bonding, chemical reactions and dynamic equilibrium. **Length of Course (semester long, or year-long): 2 semesters/1 year** **Quarter: 1 August-October**
Essential Questions	*How are physical and chemical properties reflected in the interactions between molecules and atoms?* *How scientists use models to prove what can happens at the molecular and atomic level if we can't see the atoms and molecules themselves?*
Standards	1.1 Identify and explain physical properties (such as density, melting point, boiling point, conductivity, and malleability) and chemical properties (such as the ability to form new substances). Distinguish between chemical and physical changes. 1.2 Explain the difference between pure substances (elements and compounds) and mixtures. Differentiate between heterogeneous and homogeneous mixtures. 1.3 Describe the three normal states of matter (solid, liquid, gas) in terms of energy, particle motion, and phase transitions. 2.3 Interpret and apply the laws of conservation of mass, constant composition (definite proportions), and multiple proportions. 2.1 Recognize discoveries from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus), and Bohr (planetary model of atom) and understand how these discoveries lead to the modern theory. 2.2 Describe Rutherford's "gold foil" experiment that led to the discovery of the nuclear atom. Identify the major components (protons, neutrons, and electrons) of the nuclear atom and explain how they interact. 2.4 Write the electron configurations for the first twenty elements of the periodic table. 2.5 Identify the three main types of radioactive decay (alpha, beta, and gamma) and compare their properties (composition, mass, charge, and penetrating power). 2.6 Describe the process of radioactive decay by using nuclear equations and explain the concept of half-life for an isotope; for example, C-14 is a powerful tool in determining the age of objects. 2.7 Compare and contrast nuclear fission and nuclear fusion.

<table>
<tr>
<td>Concepts and Skills</td>
<td>

Chemistry around us
Properties of matter
Changes to matter
Early ideas about the atom
Describe atom
Atomic Structure and the Periodic Table
Electronic Configuration
Transmutations-how atoms change

</td>
<td>
SIS1. Make observations, raise questions, and formulate hypotheses.

SIS2. Design and conduct scientific investigations.

SIS3. Analyze and interpret results of scientific investigations.

SIS4. Communicate and apply the results of scientific investigations.

Mathematical Skills:

Students are expected to know the content of the Massachusetts Mathematics Curriculum Framework, through grade 8. Below are some specific skills from the Mathematics Framework that students in this course should have the opportunity to apply:

● Construct and use tables and graphs to interpret data sets.

● Solve simple algebraic expressions.

● Convert within a unit (e.g., centimeters to meters).

● Use common prefixes such as milli-, centi-, and kilo-.

CCR Reading Standards
CCRSL.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
CCRSL.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
CCR Writing Standards
CCWSL.4 Produce clear and coherent writing in which
the development, organization, and style are appropriate to task, purpose, and audience.
</td>
</tr>
<tr>
<td>Content Objectives</td>
<td colspan="2">
<u>What is Chemistry?</u>

Identify and explain the importance of chemistry.
Identifies solids, liquids, and gases based on temperature, arrangement of particles, and particle motion

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</table>

	Properties of matter • Describes physical and chemical changes using physical and chemical properties • Explains how properties may change due to physical or chemical changes • Describes pure substance as either elements or compounds and provides examples of each • Describes heterogeneous and homogeneous mixtures and provides example of each • Describes phase changes in terms of energy, arrangement of particles, and particle motion **Changes to matter** • Solves simple problems that deal with the physical and chemical properties of mixtures and pure substances (Apply the laws of matter - the law of conservation of mass; law of constant composition). • Solves complex problems that deal with physical and chemical properties **Early ideas about matter and defining the atom** • Describe the differences between the various atomic models. • Identify the major components (protons, neutrons, and electrons) of the nuclear atom and explain their functions. • Explain the strengths and weaknesses of various atomic models, and describe how Rutherford's gold foil experiment changed the concept of the atom **Atomic Structure and the Periodic Table:** • Determine the number of electrons, protons, and neutrons from the atomic number and mass number for any element in the periodic table. • Identify the relationship between atoms, elements, and isotopes **Electron configuration:** • Writes the correct electron configuration for a given element. • Identifies the valence electron configuration of an element based on its position on the periodic table **Transmutations-how atoms change** • Identifies and describes the different types of radiation emitted during radioactive decay • Describes radioactive decay and solves simple problems for the half-life of an isotope • Describes the similarities and differences between fission and fusion

	• Solves complex problems involving radioactive decay and writes nuclear equations for decay, fission, and fusion. • Explains how the properties of alpha, beta, and gamma emissions affect their penetrating power.
Assessments/ Products/Practices	**Suggested Lessons/Labs:** ➢ Chromatography: Separating Metal Ions in Solution (LTF) ➢ Dimensional Analysis: An Exercise in Literal Equations (LTF) ➢ Keep Warm: Creating an Inquiry Lesson (LTF) ➢ Making a Semimicropycnometer: Determining the Specific Gravity of an Unknown Liquid (LTF) ➢ Mass, Temperature and Heat: Concept Building Discussion Questions (LTF) ➢ The Do's and Don'ts of Teaching Periodic Trends: A Teaching Strategy Document (LTF) ➢ Electron Configurations, Orbital Notation, and Quantum Numbers: Understanding Electron Arrangement and Oxidation States (LTF) ➢ Electron Probability: Visualizing a Probability Region (LTF) ➢ Fun With Fluorescent Dyes: Flinn Scientific Demonstration (LTF) ➢ Introduction to Molecular Modeling: Picturing Models (LTF) ➢ Isotopic Pennies: Finding the Percent Abundance of Isotopes (LTF) ➢ Laser Light: Determining the wavelength of light (LTF) ➢ Matter Waves: An Exercise in Literal Equations (LTF) ➢ Periodic Properties (LTF) ➢ Red Hot Half Decay: Modeling Nuclear Decay (LTF) ➢ What's the Matter: Describing Particular Particles (LTF) ➢ Why Do They Call It a Periodic Table?: Investigating and Graphing Periodic Trends (LTF) ➢ The Do's and Don'ts of Teaching Periodic Trends: A Teaching Strategy Document (LTF) ➢ Electron Configurations, Orbital Notation, and Quantum Numbers: Understanding Electron Arrangement and Oxidation States (LTF) ➢ Electron Probability: Visualizing a Probability Region (LTF) ➢ Fun With Fluorescent Dyes: Flinn Scientific Demonstration (LTF) ➢ Introduction to Molecular Modeling: Picturing Models (LTF) ➢ Isotopic Pennies: Finding the Percent Abundance of Isotopes (LTF) ➢ Laser Light: Determining the wavelength of light (LTF) ➢ Matter Waves: An Exercise in Literal Equations (LTF) ➢ Periodic Properties (LTF) ➢ Red Hot Half Decay: Modeling Nuclear Decay (LTF) ➢ What's the Matter: Describing Particular Particles (LTF) ➢ Why Do They Call It a Periodic Table?: Investigating and Graphing Periodic Trends (LTF) **Types of writing:** Students will complete the following exercises to demonstrate their understanding of, and their ability to apply, important information, and to

	fulfill the "assessment/product" requirements. **Notebooks:** • **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize). • **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations. • **Narrative and Explanatory Essay (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim. • **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others? **End-of-Term Assessment:** A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.
Texts, Materials, and Resources	Chemistry Textbook: Holt Laying the foundation website
	Quarter: 2 November - January
Essential Questions	*What can we determine about the properties of elements based on its position on the periodic table?* *How do such a small number of elements produce a wide range of compounds?*
Standards	3.1 Explain the relationship of an element's position on the periodic table to its atomic number. Identify families (groups) and periods on the periodic table. 3.2 Use the periodic table to identify the three classes of elements: metals, nonmetals, and metalloids. 3.3 Relate the position of an element on the periodic table to its electron configuration and compare its reactivity with other elements in the table.

	3.4 Identify trends on the periodic table (ionization energy, electronegativity, and relative size of atoms and ions). 4.1 Explain how atoms combine to form compounds through both ionic and covalent bonding. Predict chemical formulas based on the number of valence electrons. 4.2 Draw Lewis dot structures for simple molecules and ionic compounds. 4.3 Use electronegativity to explain the difference between polar and nonpolar covalent bonds. 4.4 Use valence-shell electron-pair repulsion theory (VSEPR) to predict the electron geometry (linear, trigonal planar, and tetrahedral) of simple molecules. 4.5 Identify how hydrogen bonding in water affects a variety of physical, chemical, and biological phenomena (such as, surface tension, capillary action, density, and boiling point). 4.6 Name and write the chemical formulas for simple ionic and molecular compounds, including those that contain the polyatomic ions: ammonium, carbonate, hydroxide, nitrate, phosphate, and sulfate.	
Concepts and Skills	• Periodic table organization • Ionic bonds • Covalent bonds • Hydrogen bonds	SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations. SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Mathematical Skills:** Students are expected to know the content of the *Massachusetts Mathematics Curriculum Framework,* through grade 8. Below are some specific skills from the *Mathematics Framework* that students in this course should have the opportunity to apply: ● Construct and use tables and graphs to interpret data sets. ● Solve simple algebraic expressions. ● Convert within a unit (e.g., centimeters to meters).

		● Use common prefixes such as *milli-, centi-,* and *kilo-*. **CCR Reading Standards** CCRSL.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. CCRSL.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. **CCR Writing Standards** CCWSL.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
Content Objectives	**<u>Periodic Table Organization:</u>** • Explain why atomic numbers increase on the periodic table • Identify an element as a metal, nonmetal, or metalloid • Identify the valence electron configuration of an element based on its position on the periodic table • Identify groups on the periodic table that readily react with one another and explain why noble gases do not react • Explain how and why elements combine with each other, based on their electron configurations **<u>Periodic Table Trends:</u>** • Identify most trends on the periodic table • Describe and apply all trends on the periodic table **<u>Ionic Bonds</u>** • Identifies ionic bonding as the transfer of electrons • Predict the number of valence electrons and chemical formulas for bonded atoms • Identify the correct Lewis structure for simple compounds • Describe bonding in ionic compounds based on Lewis structure • Identify the correct chemical formula for ionic compounds • Draws Lewis dot structures for ionic compounds and can explain why they are correct. • Write chemical formulas for ionic compounds	

	Covalent Bonds • Identifies covalent bonding as sharing of electrons • Predict the number of valence electrons and chemical formulas for bonded atoms • Identify the correct Lewis structure for simple compounds • Identifies the shapes of some simple molecules • Recognizes the polarity increase between covalently bonded atoms as the electronegativity difference between them increases • Identify the correct chemical formula for ionic compounds • Draws Lewis dot structures for covalent compounds and can explain why they are correct. • Predicts the shape of some simple molecules • Write chemical formulas for covalent/molecular compounds **Hydrogen Bonds** • Describes hydrogen bonding as an intermolecular force • Describes the effects of hydrogen bonding in various phenomena
Assessments/ Products/Practices	**Suggested Lessons/Labs:** ➢ The Do's and Don'ts of Teaching Periodic Trends: A Teaching Strategy Document (LTF) ➢ Electron Configurations, Orbital Notation, and Quantum Numbers: Understanding Electron Arrangement and Oxidation States (LTF) ➢ Electron Probability: Visualizing a Probability Region (LTF) ➢ Fun With Fluorescent Dyes: Flinn Scientific Demonstration (LTF) ➢ Introduction to Molecular Modeling: Picturing Models (LTF) ➢ Isotopic Pennies: Finding the Percent Abundance of Isotopes (LTF) ➢ Laser Light: Determining the wavelength of light (LTF) ➢ Matter Waves: An Exercise in Literal Equations (LTF) ➢ Periodic Properties (LTF) ➢ Red Hot Half Decay: Modeling Nuclear Decay (LTF) ➢ What's the Matter: Describing Particular Particles (LTF) ➢ Why Do They Call It a Periodic Table?: Investigating and Graphing Periodic Trends (LTF) ➢ Chemical Bonding and Intermolecular Forces: Drawing Lewis Structures to Determine Molecular Geometry, Hybridization, and Molecular Polarity (LTF) ➢ The Do's and Don'ts of Teaching Intraparticle v. Intermolecular Forces: A Teaching Strategy Document (LTF) ➢ Molecular Geometry: Investigating Molecular Shapes with VSEPR (LTF) ➢ Chemical Nomenclature: Naming and Writing Chemical Formula (LTF)

Texts, Materials, and Resources	Chemistry Textbook: Holt Laying the foundation website
	Quarter 3: February - May
Essential Questions	How does the Law of conservation of Mass and chemical equations explain the interactions of atoms and molecules both conceptually and mathematically? How are heat, temperature and state of matter related in terms of the motions of particles? How is the relationship between temperature, pressure, volume and amount of a gas described?
Standards	5.1 Balance chemical equations by applying the laws of conservation of mass and constant composition (definite proportions). 5.2 Classify chemical reactions as synthesis (combination), decomposition, single displacement, double displacement, and combustion. 5.3 Use the mole concept to determine the number of particles and the molar mass of elements and compounds. 5.4 Determine percent compositions, empirical formulas, and molecular formulas. 5.5 Calculate the mass-to-mass stoichiometry for a chemical reaction. 5.6 Calculate percent yield in a chemical reaction. 7.5 Identify the factors that affect the rate of a chemical reaction (temperature, mixing, concentration, particle size, surface area, and catalyst). 7.6 Predict the shift in equilibrium when a system is subjected to a stress (LeChatelier's Principle) and identify the factors that can cause a shift in equilibrium (concentration, pressure, volume, temperature). 6.3 Using kinetic molecular theory describe and contrast the properties of gases, liquids, and solids. Explain, at the molecular level, the behavior of matter as it undergoes phase transitions. 6.1 Using the kinetic molecular theory, explain the behavior of gases and the relationship between pressure and volume (Boyle's law), volume and temperature (Charles's law), pressure and temperature (Gay-Lussac's law), and the number of particles in a gas sample (Avogadro's hypothesis). Use the combined gas law to determine changes in pressure, volume, and temperature.

<table>
<tr><td></td><td colspan="2">6.2 Perform calculations using the ideal gas law. Understand the molar volume at 273K and 1 atmosphere (STP).

6.4 Describe the law of conservation of energy. Explain the difference between an endothermic process and an exothermic process.

6.5 Recognize that there is a natural tendency for systems to move in a direction of disorder or randomness (entropy).</td></tr>
<tr><td>Concepts and Skills</td><td>• Identify equations
• Balance equations
• Use stoichiometry to balance equations
• Predict the rates of a chemical reaction
• Determine particle motion
• Predict gas laws
• Second law of thermodynamics</td><td>SIS1. Make observations, raise questions, and formulate hypotheses.

SIS2. Design and conduct scientific investigations.

SIS3. Analyze and interpret results of scientific investigations.

SIS4. Communicate and apply the results of scientific investigations.

Mathematical Skills:

Students are expected to know the content of the Massachusetts Mathematics Curriculum Framework, through grade 8. Below are some specific skills from the Mathematics Framework that students in this course should have the opportunity to apply:

● Construct and use tables and graphs to interpret data sets.

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CCR Writing Standards
CCWSL.4 Produce clear and coherent writing in which
the development, organization, and style are appropriate to task, purpose, and audience.</td></tr>
</table>

Content Objectives	**Identify and Balance Equations** • Produce balanced chemical equations using their previously acquired knowledge of the law of conservation of mass and the parts of a chemical reaction. • Understand the importance of having balanced chemical equations. • Learn to identify and classify the 5 different types of chemical reactions • Predict products of chemical reactants based on the chemical reaction type • Use Stoichiometry to balance equations • Calculate the molar mass of elements and compounds. • Convert from grams to moles and from moles to grams. • Determine most percent compositions, empirical formulas and molecular formulas. • Compare and contrast the theoretical yield and percent yield in a chemical reaction. • Determine the theoretical yield and percent yield in chemical reaction. **Predict the rates of a Chemical Reaction** • Predict and determine the rates of chemical reactions based on the reaction conditions presented. • Demonstrate an understanding of Le Chatelier's principle. • Predict the shift in equilibri0um under certain conditions that stress the system. • Determine Particle Motion • Describe in detail the properties of gases, liquids and solids and relate these to phase transitions. **Predict the Gas Laws** • Analyze the relationship between the pressure, volume, and temperature of gases, and apply these relationships to solve problems based on the combined gas laws. • Determine the number of particles in a gas sample, using Avogadro's hypothesis. • Solve problems utilizing the Ideal Gas Law. • Utilize standard temperature (273K), and pressure STP) to solve problems. **Understand the 2nd Law of Thermodynamics** • Identify situations involving the law of conservation of energy and identify endothermic and exothermic processes. • Identify entropy in terms of order and disorder.

Assessments/ Products/Practices	**Suggested Lessons/Labs:** ➢ The Eight Solution Problem: Exploring Reactions of Aqueous Ionic Compounds (LTF) ➢ Net Ionic Equations: Making Sense of Chemical Reactions (LTF) ➢ Predicting Products of Chemical Reactions: Types of Reactions (LTF) ➢ Limiting Reactant: Exploring Molar Relationships (LTF) ➢ Mass, Moles, and Ratios: Applying Mathematical Reasoning to Chemical Quantities (LTF) ➢ Simple vs. true: Calculating Empirical and Molecular Formulas (LTF) ➢ Stoichiometry: Exploring a Student-Friendly Method of Problem Solving (LTF) ➢ Airbags: Designing A Lab with Gas Laws (LTF) ➢ Boyles Law: Relationships in Gases (LTF) ➢ Charles' Law: Investigating the Relationship Between Temperature and Volume of a Gas (LTF) ➢ Dipole Dilemmas (LTF) ➢ Don't Flip Your Lid Comparing Intermolecular Forces (LTF) ➢ Exploring Applications of IMF's (LTF) ➢ Gas Systems: Gas Simulations (LTF) ➢ Gases, Gases, Everywhere!: Preparation and Properties of Common Gases (LTF) ➢ The Great Gas Plot: Using Balloons and Graphs to Analyze Relationships (LTF) **Types of writing:** Students will complete the following exercises to demonstrate their understanding of, and their ability to apply, important information, and to fulfill the "assessment/product" requirements. **Notebooks:** ➢ **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize). ➢ The notes should include evidence of student sharing, student and teacher feedback, and revisions based on these conversations, as well as periodic student and teacher assessments using "Did I" sheets and/or rubrics. ➢ **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations. ➢ **Research Paper (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim. ➢ **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others?

	End-of-Term Assessment: A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.	
Texts, Materials, and Resources	Chemistry Textbook: Holt Laying the foundation website	
	Quarter 4: April-June	
Essential Questions	*How are the concentration and formation of a solution described? How are the rates of a chemical reaction and equilibrium position effected by different factors?* *What gives acids and bases their particular characteristics and properties? Why are there so many different definitions of acids?*	
Standards	7.1 Describe the process by which solutes dissolve in solvents. 7.2 Calculate concentration in terms of molarity. Use molarity to perform solution dilution and solution stoichiometry. 7.3 Identify and explain the factors that affect the rate of dissolving, such as, temperature, concentration, surface area, pressure, and mixing. 7.4 Compare and contrast qualitatively the properties of solutions and pure solvents (colligative properties such as boiling point and freezing point). 8.1 Define the Arrhenius theory of acids and bases in terms of the presence of hydronium and hydroxide ions in water and the Bronsted-Lowry theory of acids and bases in terms of proton donors and acceptors. 8.2 Relate hydrogen ion concentrations to the pH scale and to acidic, basic, and neutral solutions. Compare and contrast the strengths of various common acids and bases (e.g., vinegar, baking soda, soap, citrus juice). 8.3 Explain how a buffer works. 8.4 Describe oxidation and reduction reactions and give some everyday examples, such as fuel burning and corrosion. Assign oxidation numbers in a reaction.	
Concepts and Skills	• Solutions • pH of solutions and buffers	SIS1. Make observations, raise questions, and formulate hypotheses. SIS2. Design and conduct scientific investigations.

		SIS3. Analyze and interpret results of scientific investigations. SIS4. Communicate and apply the results of scientific investigations. **Mathematical Skills:** Students are expected to know the content of the *Massachusetts Mathematics Curriculum Framework,* through grade 8. Below are some specific skills from the *Mathematics Framework* that students in this course should have the opportunity to apply: ● Construct and use tables and graphs to interpret data sets. ● Solve simple algebraic expressions. ● Convert within a unit (e.g., centimeters to meters). ● Use common prefixes such as *milli-, centi-,* and *kilo-*. **CCR Reading Standards** CCRSL.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. CCRSL.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. **CCR Writing Standards** CCWSL.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
Content Objectives	**<u>Solutions:</u>** • Answer the question what is a solution? • Identify the different parts of a solution (solute, solvent and pure solvent), and describe the dissolving process. • Establish that the solute can be a solid, liquid, or a gas. • Calculate the molarity and molality of solutions. • Determine the different factors that affect the rate of dissolving and predicts simple shifts in equilibrium.	

	Determining the pH of solutions and Buffers • Demonstrate an understanding of the different theories relative to acids and bases. • Describe the pH scale and how acids, bases and neutral solutions are classified • Compare the strengths of various common acids and bases. • Calculate the concentration of hydrogen ions. • Identify pH and common points on the pH scale. • Identify the components of a buffer system and give examples of each.
Assessments/ Products/Practices	**Suggested Lessons/Labs:** ➢ Heating Curves: Investigating Changes of State (LTF) ➢ How Sublime: Exploring and Measuring the Triple Point of Dry Ice (LTF) ➢ May the Force be With you: Exploring Evaporation and Intermolecular Forces (LTF) ➢ Colligative Properties: Calculating Freezing Point and Boiling Point Changes (LTF) ➢ Conductivity of Ionic Solutions: Exploring Ions in Solutions (LTF) ➢ How Sweet It Is!: Determining Percent Sugar (LTF) ➢ It's Not Easy Being Green: Making Solutions (LTF) ➢ Preparing Solutions: Solutions (LTF) ➢ Solutions: Understanding the Basics (LTF) ➢ Le Chatelier's Principle: Shifting Equilibrium (LTF) ➢ Distributing Equilibrium: Observing Le Chatelier's Principle (LTF) ➢ Shifting Reactions A: Equilibrium Simulation (LTF) ➢ Acid-Base Equilibrium: Solving pH Problems for Weak Acids and Bases (LTF) ➢ How Weak is Your Acid?: Determining Ka (LTF) ➢ Neutral or Not?: Exploring Salt Hydrolysis (LTF) ➢ Titrations with Technology: Determining the Percent of Acetic Acid in Vinegar (LTF) ➢ Titrations – Titrations: Determining the Percent of Acetic Acid in Vinegar (LTF) ➢ What Do You Mean It's Soluble After All?: Exploring Solubility Equilibrium (LTF) **Types of writing:** Students will complete the following exercises to demonstrate their understanding of, and their ability to apply, important information, and to fulfill the "assessment/product" requirements. **Notebooks:** ➢ **Content Notes (every day or close to it):** Students will identify topics; identify the main ideas and most important details and examples associated with

	each topic; include summaries as well as student-generated follow-up questions and answers, reflections, visualizations, and responses to the content, using higher order thinking skills (e.g., predict, connect, infer, analyze, evaluate, categorize, synthesize). ➢ **Vocabulary**: Students will highlight additional, key vocabulary in their notebooks; they will build an understanding of the vocabulary using vocabulary-development exercises (e.g., word webs, Frayer Model), as well as use the vocabulary in their daily work and conversations. ➢ **Narrative and Argumentative Essays (in response to one or more Essential and Guiding Questions)/Investigation Reports:** Student work will include evidence of planning: graphic organizers, brainstorming lists; editing of language, vocabulary, grammar, structure; organized and developed ideas utilizing precise and domain specific language; student sharing, student and teacher feedback, and revisions based on these conversations. Argumentative essays/investigation reports will include an explicit claim, scientific evidence in support of the claim (from reports, data, observations, etc.), and an explanation of how the evidence connects to and verifies the claim. ➢ **Other Sample Products:** KWL Charts. Venn Diagrams, Concept Maps, H.O.T. Boxes, Others? **End-of-Term Assessment:** A common end-of-term assessment will be administered to all students enrolled in this course. The assessment will include MCAS-like questions.