

NEW MILFORD PUBLIC SCHOOLS
New Milford, Connecticut



College Prep Chemistry

June 2016

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New Milford Public Schools Mission Statement

The mission of the New Milford Public Schools, a collaborative partnership of students, educators, family and community, is to prepare each and every student to compete and excel in an ever-changing world, embrace challenges with vigor, respect and appreciate the worth of every human being, and contribute to society by providing effective instruction and dynamic curriculum, offering a wide range of valuable experiences, and inspiring students to pursue their dreams and aspirations.

Course Overview

College Prep Chemistry

College Prep Chemistry is an introductory chemistry course designed to challenge the college-bound student. Major areas of study include the structure and properties of matter, chemical behavior, and energy relationships. There is a strong emphasis on science process, quantitative and qualitative laboratory skills. Students in College Prep Chemistry must have solid math skills, the ability to read independently, and the motivation to consistently complete regular homework problems in order to succeed in the course.

Pacing Guide

Unit #	Title	Weeks	Pages
1	Properties of Matter	5	6 - 8
2	Atomic & Electron Structure	5	8 - 11
3	The Periodic Table	4	11 - 13
4	Chemical Bonding	5	13 - 16
5	Chemical Reactions	5	16 - 19
6	The Mole Concept	4	19 - 21
7	Stoichiometry	4	21 - 23
8	The Gas Laws	3	24 - 26

New Milford Public Schools

College Prep Chemistry Curriculum

Committee Member(s): Virginia Landgrebe Kristen Stolle Catherine Gardner	Course/Subject: College Prep Chemistry Grade Level: 11-12 # of Weeks: 5
Unit 1: Properties of Matter	
Identify Desired Results	
Next Generation Science Standards & Common Core Standards	
<ul style="list-style-type: none"> ● HS-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. ● RST.3 Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. ● RST.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context. ● RST.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. ● WHST.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. ● WHST 7. Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. 	
Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	Essential Questions Inquiry used to explore generalizations
<ul style="list-style-type: none"> ● Matter has properties related to its structure that can be measured and used to identify, classify and describe substances or objects. ● Matter, on all levels, has predictable properties that can be related to structures of the elements that make up that matter. 	<ul style="list-style-type: none"> ● What is matter and how is it classified? ● How can one explain the structure, properties and interactions of matter?
Expected Performances What students should know and be able to do	
Students will know the following:	

- The relationship between states of matter and their energy and their particle arrangement
- The forces and energy changes involved in changes of states of matter.
- Distinguish between physical and chemical properties and use them to identify and describe physical and chemical changes.
- Energy is transferred during a physical and chemical change.
- The relationship between accuracy and precision in measurements

Students will be able to do the following:

- Use models to describe the characteristics of the three common states of matter.
- Classify matter as a mixture (homogeneous or homogeneous) or pure substance (element or compound)
- Identify examples of non-matter
- Distinguish between solutions, suspensions, and colloids.
- Select appropriate separation techniques based on the physical properties of the components in the mixture.
- Identify and use SI units in measurements and calculations (base units and derived units)

Character Attributes

- Respect
- Cooperation

Technology Competencies

- Using online applets

Develop Teaching and Learning Plan

Teaching Strategies:

- Phenomenon: Fractional distillation
- Power point presentations with embedded practice problems
- Modeling of concepts
- Class Discussions
- Graphic Organizer (Flow Chart) of Matter Concepts
- Gradual Release Model for guided practice
- Density Demos

Learning Activities:

- Define vocabulary terms
- Practice and Reinforcement Worksheets
- Lab Safety Contract
- What Not to Do Lab Safety Worksheet
- Lab Safety Quiz
- Classification of Matter POGIL Activity using models
- Lab: Introduction to Measurement
- Lab: Separation of a Mixture
- Elements, Compounds, and Mixtures Activity
- Density Lab
- Modern Marvels: Measure It Video

Assessments	
Performance Task(s)	Other Evidence
<p>Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)</p> <p>Goal: Separation of a Mixture into its components for a</p> <p>Role: Scientist</p> <p>Audience: a municipality</p> <p>Situation: A town needs a way to separate its solid waste stream</p> <p>Product or Performance: Lab report and 3 separated components</p> <p>Standards for Success: See Rubric</p>	<p>Application that is functional in a classroom context to evaluate student achievement of desired results</p> <ul style="list-style-type: none"> ● Formative assessments include <ul style="list-style-type: none"> ○ white boarding ○ exit tickets ○ quizzes ○ homework ○ labs ○ activities ● Summative assessment includes various question types including <ul style="list-style-type: none"> ○ multiple choice ○ classification ○ relationship analysis ○ matching ○ fill-in-the-blank ○ short answer ○ problem solving
Suggested Resources	
<ul style="list-style-type: none"> ● Modern Chemistry by Holt, Rinehart and Winston 1999 ● pHet Simulation: Density https://phet.colorado.edu/ ● POGIL Activities for High School Chemistry by Laura Trout 2012 ● Flinn ChemTopic Labs Volume 2 Elements, Compounds, and Mixtures by Flinn Scientific 2003 ● Modern Marvels Measure It, Season 15, Episode 40, History Channel; Dec 23, 2008. DVD ● https://www.youtube.com/watch?v=jkOWrtA8_T8 ● Shared Science Folder on the New Milford High School J:// drive 	

<p>Committee Member(s): Virginia Landgrebe Kristen Stolle Catherine Gardner</p>	<p>Course/Subject: College Prep Chemistry Grade Level: 11-12 # of Weeks: 5</p>
<p>Unit 2: Atomic & Electron Structure</p>	

Identify Desired Results
Next Generation Science Standards & Common Core Standards
<ul style="list-style-type: none"> ● HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of

atoms.

- **HS-PS4-1.** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
- **HS-PS4-3.** Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.
- **HS-PS4-4.** Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.
- **RST.3** Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
- **RST.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.
- **RST.5** Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
- **WHST.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
- **WHST 7.** Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Enduring Understandings

Generalizations of desired understanding via essential questions
(Students will understand that ...)

- Matter, on all levels, has predictable properties that can be related to structures of the elements that make up that matter.
- The atomic structures of materials determine their properties.

Essential Questions

Inquiry used to explore generalizations

- How can one explain the structure, properties, and interactions of matter?
- What are the characteristic properties and behavior of waves?

Expected Performances

What students should know and be able to do

Students will know the following:

- The three laws that support the existence of atoms.
- The five principles of John Dalton's atomic theory.
- The contribution that Thomson and Rutherford made to the development of the atomic theory.
- How Bohr's model differed from its predecessors.
- The mass, charge, and location of the proton, neutron, and electron.
- Isotopes are atoms of the same element with varying numbers of neutrons.
- The wavelength of light emitted by an atom provides information about electron energy levels.

- The significance of the four quantum numbers.

Students will be able to do the following:

- Describe atoms of different elements in terms of their number of protons, electrons, and neutrons.
- Determine the number of subatomic particles in an isotope.
- Write electron configurations for an atom or ion using the Pauli Exclusion Principle, Hund's Rule, and the Aufbau Principle.
- Calculate the average atomic mass of an element given the atomic mass and percent abundance of each isotope.
- Calculate wavelength and frequency of electromagnetic waves and energy.

Character Attributes

- Responsibility
- Integrity

Technology Competencies

- Using Online applets
- Using Discharge tubes

Develop Teaching and Learning Plan

Teaching Strategies:

- Phenomenon: Northern Lights
- Power point presentations with embedded practice problems
- Gradual Release Model (I do, We do, You do)
- Classroom discussion
- Rules of Electron Configuration using the periodic table
- Practice Calculations of Wavelength, Frequency, Speed of Light and Energy
- Gold Foil Demo
- Cathode Ray Tube Demo
- Rutherford Demo

Learning Activities:

- Define vocabulary terms
- Practice and Reinforcement Worksheets
- Think Tube Activity
- Dalton's Playhouse for Atomic Theory
- Lab: Isotopes of Pennium
- Gas Discharge Tube lab
- Lab: Rutherford
- Lab: Flame Tests
- Lab: Visible Spectroscopy (w/ spectrosopes or rainbow glasses)
- Rutherford Scattering Video Backstage Science
<https://www.youtube.com/watch?v=XBqHkraf8iE>
- Modern Marvels Fireworks Video
- Drawing Bohr Model Atoms Worksheet

Assessments	
Performance Task(s)	Other Evidence
Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	Application that is functional in a classroom context to evaluate student achievement of desired results
<p>Goal: Determine the identify of an unknown chemical compound</p> <p>Role: Scientist</p> <p>Audience: Business</p> <p>Situation: Use flame tests to determine the identify of unknown solutions</p> <p>Product or Performance: Lab report</p> <p>Standards for Success: See rubric</p>	<ul style="list-style-type: none"> ● Formative assessments include <ul style="list-style-type: none"> ○ white boarding ○ exit tickets ○ quizzes ○ homework ○ labs ○ activities ● Summative assessment includes various question types including <ul style="list-style-type: none"> ○ multiple choice ○ classification ○ relationship analysis ○ matching ○ fill-in-the-blank ○ short answer ○ problem solving
Suggested Resources	
<ul style="list-style-type: none"> ● Modern Chemistry by Holt, Rinehart and Winston 1999 ● pHet Simulation: Build An Atom, Isotopes and Atomic Mass, Rutherford Scattering, and Neon Lights and Other Discharge Lamps https://phet.colorado.edu/ ● Flinn ChemTopic Labs Volume 3 Atomic and Electron Structure by Flinn Scientific 2003 ● Modern Marvels Fireworks!, Season 6, Episode 34, History Channel; Sept 6, 1999. DVD ● Shared Science Folder on the New Milford High School J:// drive 	

<p>Committee Member(s): Virginia Landgrebe Kristen Stolle Catherine Gardner</p>	<p>Course/Subject: College Prep Chemistry Grade Level: 11-12 # of Weeks: 4</p>
<p>Unit 3: Periodic Table</p>	

Identify Desired Results
Next Generation Science Standards & Common Core Standards
<ul style="list-style-type: none"> ● HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. ● HS-PS1-2. Construct and revise an explanation for the outcome of a simple

chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties

- **RST.3** Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
- **RST.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.
- **RST.5** Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
- **WHST 7.** Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Enduring Understandings

Generalizations of desired understanding via essential questions
(Students will understand that ...)

- Matter, on all levels, has predictable properties that can be related to structures of the elements that make up that matter.
- The atomic structures of materials determine their properties.

Essential Questions

Inquiry used to explore generalizations

- How does the arrangement of the periodic table relate to atomic structure?
- How can one explain the structure, properties and interactions of matter?

Expected Performances

What students should know and be able to do

Students will know the following:

- The roles of Mendeleev and Moseley in the development of the periodic table.
- The organization of the modern periodic table according to the periodic law.
- Periodic trends in metallic properties are related to the atomic structure of the elements.
- Periodic trends in ionization energy are related to the atomic structure of the elements.
- Periodic trends in atomic and ionic radii are related to the atomic structure of the elements.
- Periodic trends in electronegativity are related to the atomic structure of the elements.

Students will be able to do the following:

- Locate the different families of main-group elements on the periodic table, describe their characteristic properties, and relate their properties to their electron configurations.
- Use the octet rule to determine the number of valence electrons and the oxidation number of a main group element.
- Predict the reactivity of metals based on patterns in the Periodic Table

Character Attributes	
<ul style="list-style-type: none"> ● Compassion ● Cooperation 	
Technology Competencies	
<ul style="list-style-type: none"> ● Internet research ● Excel graphing 	
Develop Teaching and Learning Plan	
Teaching Strategies: <ul style="list-style-type: none"> ● Phenomenon: Alkali metals in water ● Power point presentations with embedded practice problems ● Gradual Release Model (I do, We do, You do) ● Classroom discussion ● Timeline of Historical Figures in the Development of the Periodic Table ● Graphic Organizer of the Trends in the Periodic Table ● Jigsaw Activity of Trends in the Periodic Table ● Alkali Metal Reactivity Demo 	Learning Activities: <ul style="list-style-type: none"> ● Define vocabulary terms ● Practice and Reinforcement Worksheets ● Alien Periodic Table ● Lab: Mendeleev Arrangement of Elements 1869 ● Periodicity of Elements in a Group ● Periodic Table of What? ● Cracking The Periodic Code POGIL Activity using models ● Video Clip: Brainiac Alkali Metals

Assessments	
Performance Task(s)	Other Evidence
Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	Application that is functional in a classroom context to evaluate student achievement of desired results
<p>Goal: Create a Periodic Table of objects using patterns</p> <p>Role: Father of the Periodic Table (Mendeleev)</p> <p>Audience: Peers in your class</p> <p>Situation: Use the principle of the periodic law to design a periodic table organizing everyday objects</p> <p>Product or Performance: A periodic table poster containing at least 20 "elements".</p>	<ul style="list-style-type: none"> ● Formative assessments include <ul style="list-style-type: none"> ○ white boarding ○ exit tickets ○ quizzes ○ homework ○ labs ○ activities ● Summative assessment includes various question types including <ul style="list-style-type: none"> ○ multiple choice ○ classification ○ relationship analysis ○ matching ○ fill-in-the-blank ○ short answer

Standards for Success: See rubric	o problem solving
Suggested Resources	
<ul style="list-style-type: none"> • Modern Chemistry by Holt, Rinehart and Winston 1999 • POGIL Activities for High School Chemistry by Laura Trout 2012 • Shared Science Folder on the New Milford High School J:// drive 	

Committee Member(s): Virginia Landgrebe Kristen Stolle Catherine Gardner	Course/Subject: College Prep Chemistry Grade Level: 11-12 # of Weeks: 5
Unit 4: Chemical Bonding	

Identify Desired Results

Next Generation Science Standards & Common Core Standards
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- **HS-PS1-1.** Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
- **HS-PS1-3.** Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
- **RST.3** Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
- **RST.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.
- **RST.5** Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
- **WHST 7.** Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	Essential Questions Inquiry used to explore generalizations
<ul style="list-style-type: none"> • Communicating information about chemical concepts is highly dependent upon understanding the symbolism and conventions used to represent matter and information about matter • Bonding occurs in patterns related 	<ul style="list-style-type: none"> • What role do valence electrons play in determining the chemical properties and the type of bond formed between atoms? • How are the symbolic representations used in the language of chemistry?

<ul style="list-style-type: none"> to the periodic table ● Chemical bonding in matter results in the formation of new compounds with different properties. 	<ul style="list-style-type: none"> ● How do particles combine to form the variety of matter one observes? ● How do substances combine or change (react) to make new substances?
Expected Performances What students should know and be able to do	
<p>Students will know the following:</p> <ul style="list-style-type: none"> ● The charge an ion will likely form is based on the position of the element on the periodic table and using the octet rule. ● Why the properties of an ion are different from those of the neutral atom. ● The process of forming an ionic and covalent bond. ● Why do the properties of ionic compounds depend on the electron arrangement between atoms? ● The names and formulas of cations, anions, and ionic compounds. ● That formulas for ionic compounds are written to show their balance of overall charge ● Describe the change in energy and stability that takes place as a chemical bond is formed. ● How to distinguish between nonpolar and polar covalent bonds based on differences in electronegativity. ● The differences between single, double, and triple covalent bonds. ● Resonance structures are necessary to show how electrons are distributed in chemical bonds in a molecule when several equivalent Lewis structures are possible <p>Students will be able to do the following:</p> <ul style="list-style-type: none"> ● Illustrate the process of forming an ionic or covalent bond. ● Draw Lewis structures to show the arrangement of valence electrons among atoms in molecules and polyatomic ions. ● Draw resonance structures for simple molecules. ● Name simple covalent compounds using prefixes, roots, and suffixes. 	
Character Attributes	
<ul style="list-style-type: none"> ● Perseverance ● Cooperation 	
Technology Competencies	
<ul style="list-style-type: none"> ● Online applets 	
Develop Teaching and Learning Plan	
<p>Teaching Strategies:</p> <ul style="list-style-type: none"> ● Phenomenon: Hunting the elements, sodium and chlorine ● Power point presentations with embedded practice problems ● Gradual Release Model (I do, We 	<p>Learning Activities:</p> <ul style="list-style-type: none"> ● Define vocabulary terms ● Practice and Reinforcement Worksheets ● Ionic and Covalent Bonding POGIL Activity using models

do, You do) <ul style="list-style-type: none"> ● Classroom discussion ● Demonstrate and practice the “Criss-Cross method” to write ionic formulas 	<ul style="list-style-type: none"> ● Ionic and Covalent Naming POGIL Activity using models ● Lab: Ionic vs Covalent Compounds ● Practice with Dry Erase Boards
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Assessments	
Performance Task(s)	Other Evidence
Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	Application that is functional in a classroom context to evaluate student achievement of desired results
<p>Goal: The assessment of online validity. The importance of understanding nomenclature to be an informed citizen. Dihydrogen Monoxide Environmental Issue Project.</p> <p>Role: Civilian Audience: Peers</p> <p>Situation: Students research DHMO</p> <p>Product or Performance: Write a persuasive letter with a petition to ban DHMO.</p> <p>Standards for Success: See Rubric</p>	<ul style="list-style-type: none"> ● Formative assessments include <ul style="list-style-type: none"> ○ white boarding ○ exit tickets ○ quizzes ○ homework ○ labs ○ activities ● Summative assessment includes various question types including <ul style="list-style-type: none"> ○ multiple choice ○ classification ○ relationship analysis ○ fill-in-the-blank ○ short answer ○ problem solving
<ul style="list-style-type: none"> ● Modern Chemistry by Holt, Rinehart and Winston 1999 ● POGIL Activities for High School Chemistry by Laura Trout 2012 ● www.dhmo.org ● http://www.armory.com/~crisper/DHMO/ ● Shared Science Folder on the New Milford High School J:// drive 	

Committee Member(s): Virginia Landgrebe Kristen Stolle Catherine Gardner	Course/Subject: College Prep Chemistry Grade Level: 11-12 # of Weeks: 5
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Unit 5: Chemical Reactions	
Identify Desired Results	
Next Generation Science Standards & Common Core Standards	
<ul style="list-style-type: none"> ● HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties ● RST.3 Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. ● RST.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context. ● RST.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. ● WHST 7. Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. 	
Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	Essential Questions Inquiry used to explore generalizations
<ul style="list-style-type: none"> ● Communicating information about chemical concepts is highly dependent upon understanding the symbolism and conventions used to represent matter and information about matter ● Chemical bonding in matter results in the formation of new compounds with different properties. ● Conservation of mass must be satisfied in all balanced chemical reactions. 	<ul style="list-style-type: none"> ● What are some of the chemical reactions that occur within our environment every day? ● How are the symbolic representations used in the language of chemistry? ● How does one characterize and explain reactions and make predictions about them? ● How do particles combine to form the variety of matter one observes? ● How do substances combine or change (react) to make new substances?
Expected Performances What students should know and be able to do	
<p>Students will know the following:</p> <ul style="list-style-type: none"> ● In a chemical reaction atoms rearrange to form new substances ● The signs of a chemical reaction by observation. ● Interpret the meaning of symbols used in writing chemical equations. ● Know the steps in writing balanced chemical equations. ● Relate the Law of Conservation of Mass to a balanced chemical equation. ● In a combustion reaction a hydrocarbon reacts with oxygen to form carbon 	

dioxide and water

- In a synthesis reaction two reactants form a single product
- In a decomposition reaction a single reactant forms two or more products
- In a single replacement reaction an element replaces an element from a compound, the activity series is used to determine if a single replacement reaction will take place
- In a double replacement reaction the ions of two compounds switch places such that two new compounds form. One of the products must be a solid, gas, or a molecular compound
- Differentiate between endothermic and exothermic reactions.

Students will be able to do the following:

- Classify reactions as belonging to one of five general types.
- Balance chemical equations
- Predict the products of a balanced chemical reaction using the general forms as a guide.
- Predict the products of and balance single replacement reactions using the activity series.
- Predict the products of and balance double replacement reactions using a solubility chart.

Character Attributes

- Citizenship
- Perseverance

Technology Competencies

- Online applets
- Lap Pro

Develop Teaching and Learning Plan

Teaching Strategies:

- Phenomenon: Alkali in water balancing the equation
- Power point presentations with embedded practice problems
- Gradual Release Model (I do, We do, You do)
- Classroom discussion
- Copper II chloride and Aluminum Foil Demo

Learning Activities:

- Define vocabulary terms
- Practice and Reinforcement Worksheets
- The Activity Series POGIL Activity using models
- High School Drama POGIL using models
- Lab: Single Replacement & Activity Series
- Lab: Double Replacement & Solubility Table
- Lab: Reaction Types

Assessments	
Performance Task(s)	Other Evidence
Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	Application that is functional in a classroom context to evaluate student achievement of desired results
<p>Goal: Identify the reaction type and predict the product formed.</p> <p>Role: Scientist</p> <p>Audience: Peers in your class</p> <p>Situation: Students perform a variety of chemical reactions.</p> <p>Product or Performance: Student will write a lab report</p> <p>Standards for Success: See rubric</p>	<ul style="list-style-type: none"> ● Formative assessments include <ul style="list-style-type: none"> ○ white boarding ○ exit tickets ○ quizzes ○ homework ○ labs ○ activities ● Summative assessment includes various question types including <ul style="list-style-type: none"> ○ multiple choice ○ classification ○ relationship analysis ○ matching ○ fill-in-the-blank ○ short answer ○ problem solving
Suggested Resources	
<ul style="list-style-type: none"> ● Modern Chemistry by Holt, Rinehart and Winston 1999 ● pHet Simulation: Balancing Chemical Equations https://phet.colorado.edu/ ● POGIL Activities for High School Chemistry by Laura Trout 2012 ● Shared Science Folder on the New Milford High School J:// drive 	

<p>Committee Member(s): Virginia Landgrebe Kristen Stolle Catherine Gardner</p>	<p>Course/Subject: College Prep Chemistry Grade Level: 11-12 # of Weeks: 4</p>
<p>Unit 6: The Mole Concept</p>	

Identify Desired Results
Next Generation Science Standards & Common Core Standards
<ul style="list-style-type: none"> ● HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. ● RST.3 Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. ● RST.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.

- **RST.5** Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
- **WHST.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

Enduring Understandings

Generalizations of desired understanding via essential questions
(Students will understand that ...)

- The mole is an essential unit when calculating the amount of a substance that will react in a chemical reaction.

Essential Questions

Inquiry used to explore generalizations

- How are unit analysis and the mole concept used to solve a variety of chemical calculations?
- How do mathematical representations show the relationship between the number of moles, particle and mass in a chemical reaction?
- What is meant by the conservation of matter?

Expected Performances

What students should know and be able to do

Students will know the following:

- Identify the mole as the unit used to count particles (atoms, ions, or molecules)
- One mole of any substance contains 6.02×10^{23} particles (atoms, ions, formula units, or molecules).
- Chemical formulas can be used to calculate the percentage composition of a compound
- The empirical formula shows the elements in the smallest whole number ratio of atoms that are present in a compound
- The molecular formula is determined from the empirical formula and the molar mass

Students will be able to do the following:

- Determine the molar mass of a compound from its chemical formula.
- Use Avogadro's number to convert between amount in moles and number of particles.
- Solve problems converting between mass and amount in moles using molar mass.
- Calculate % composition by mass and use it to compare compounds.
- Determine empirical formula and molecular formula of compounds using mass composition data.
- Determine the molecular formula of a compound from the empirical formula and its formula mass.

Character Attributes

<ul style="list-style-type: none"> ● Honesty ● Responsibility 	
Technology Competencies	
<ul style="list-style-type: none"> ● Internet research ● Online applets (pHet) 	
Develop Teaching and Learning Plan	
Teaching Strategies: <ul style="list-style-type: none"> ● Phenomenon: Mole blocks (1 mol blocks of 4 different elements) ● Power point presentations with embedded practice problems ● Gradual Release Model (I do, We do, You do) ● Classroom discussion 	Learning Activities: <ul style="list-style-type: none"> ● Define vocabulary terms ● Practice and Reinforcement Worksheets ● The Mole Concept POGIL Activity using models ● Percent Composition POGIL Activity using models ● Lab: Percent composition bubble gum ● Mole Day Research Project ● Lab: Flinn Mole Lab (Bob Becker) ● Practice problems

Assessments	
Performance Task(s)	Other Evidence
Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	Application that is functional in a classroom context to evaluate student achievement of desired results
<p>Goal: Use Avogadro's number to carry out a cost calculation to verify a claim</p> <p>Role: Scientist called as an expert witness</p> <p>Audience: Court Judge</p> <p>Situation: Replicate an assignment given by Professor Carroll Zahn at Pace University. Work in groups to calculate the cost of a single aluminum atom in a roll of aluminum foil. Groups will be given the opportunity to design and perform simple laboratory experiments to obtain whatever information deemed</p>	<ul style="list-style-type: none"> ● Formative assessments include <ul style="list-style-type: none"> ○ white boarding ○ exit tickets ○ quizzes ○ homework ○ labs ○ activities ● Summative assessment includes various question types including <ul style="list-style-type: none"> ○ multiple choice ○ classification ○ relationship analysis ○ matching ○ fill-in-the-blank ○ short answer ○ problem solving

<p>necessary to solve the problem.</p> <p>Product or Performance: Write a letter to the Judge to support or refute the student's claim.</p> <p>Standards for Success: The answer should be correct to three significant figures, should be documented with a detailed unit analysis, and should be reported using scientific notation. See rubric.</p>	
Suggested Resources	
<ul style="list-style-type: none"> ● Modern Chemistry by Holt, Rinehart and Winston 1999 ● POGIL Activities for High School Chemistry by Laura Trout 2012 ● Avogadro Goes to Court http://sciencecases.lib.buffalo.edu/cs/files/avogadro.pdf ● Shared Science Folder on the New Milford High School J:// drive 	

<p>Committee Member(s): Virginia Landgrebe Kristen Stolle Catherine Gardner</p> <p>Unit 7: Stoichiometry</p>	<p>Course/Subject: College Prep Chemistry Grade Level: 11-12 # of Weeks: 4</p>
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Identify Desired Results	
Next Generation Science Standards & Common Core Standards	
<ul style="list-style-type: none"> ● HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. ● RST.3 Follow precisely a complex multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. ● RST.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context. ● RST.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. 	
<p style="text-align: center;">Enduring Understandings</p> <p style="text-align: center;">Generalizations of desired understanding via essential questions (Students will understand that ...)</p>	<p style="text-align: center;">Essential Questions</p> <p style="text-align: center;">Inquiry used to explore generalizations</p>
<ul style="list-style-type: none"> ● The mole is an essential unit when calculating the amount of a substance that will react in a chemical reaction. 	<ul style="list-style-type: none"> ● How does stoichiometry relate to the principle of conservation of matter? ● How do mathematical representations show the

<ul style="list-style-type: none"> Stoichiometric analysis allows for the prediction of the relative quantities of substances involved in reactions. 	<p>relationship between the number of moles, particle and mass in a chemical reaction?</p> <ul style="list-style-type: none"> What is meant by the conservation of matter within a chemical reaction?
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Expected Performances

What students should know and be able to do

Students will know the following:

- Stoichiometry compares the amount of substances in a chemical reaction
- STP represents standard temperature (0°C) and pressure (1 atm).
- Stoichiometry problems involving chemical reactions can always be solved using mole ratios from the balanced chemical equation
- The limiting reactant is the reactant that is consumed completely in a reaction.
- The theoretical yield is the amount of product that can be formed from a given amount of limiting reactant.
- The actual yield is the amount of product collected from a real reaction.

Students will be able to do the following:

- Determine the moles of reactants or products from balanced chemical equations.
- Calculate masses of reactants or products involved in chemical reactions given data in mass, moles, or volume of gases at STP.
- Determine the limiting reactants in chemical reactions in order to predict amounts of products that can be formed.
- Calculate the percent yield of products.

Character Attributes

- Integrity
- Perseverance

Technology Competencies

- LabPro

Develop Teaching and Learning Plan

Teaching Strategies:

- Phenomenon: Pop Rocks
- Power point presentations with embedded practice problems
- Gradual Release Model (I do, We do, You do)
- Classroom discussion
- Baking Soda and Vinegar Demo (limiting reagent)

Learning Activities:

- Define vocabulary terms
- Practice and Reinforcement Worksheets
- Lab: S'mores
- Lab: Decomposition of Baking Soda
- Practice Problems

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Assessments	
Performance Task(s) Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)	Other Evidence Application that is functional in a classroom context to evaluate student achievement of desired results
<p>Goal: To determine the decomposition of baking soda chemical reaction</p> <p>Role: Scientist</p> <p>Audience: Teacher</p> <p>Situation: Use stoichiometry to determine the amount of product formed from the decomposition of baking soda.</p> <p>Product or Performance: Mass of product formed</p> <p>Standards for Success: See rubric</p>	<ul style="list-style-type: none"> ● Formative assessments include <ul style="list-style-type: none"> ○ white boarding ○ exit tickets ○ quizzes ○ homework ○ labs ○ activities ● Summative assessment includes various question types including <ul style="list-style-type: none"> ○ multiple choice ○ classification ○ relationship analysis ○ matching ○ fill-in-the-blank ○ short answer ○ problem solving
Suggested Resources	
<ul style="list-style-type: none"> ● Modern Chemistry by Holt, Rinehart and Winston 1999 ● pHet Simulation: Reactants, Products, and Leftovers https://phet.colorado.edu/ ● Shared Science Folder on the New Milford High School J:// drive 	

<p>Committee Member(s): Virginia Landgrebe Kristen Stolle Catherine Gardner</p> <p>Unit 8: Gas Laws</p>	<p>Course/Subject: College Prep Chemistry Grade Level: 11-12 # of Weeks: 3</p>
Identify Desired Results	
Next Generation Science Standards & Common Core Standards	
<ul style="list-style-type: none"> ● HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). ● RST.3 Follow precisely a complex multi-step procedure when carrying out 	

experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

- **RST.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.
- **RST.5** Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
- **WHST.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
- **WHST.7** Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Enduring Understandings

Generalizations of desired understanding via essential questions
(Students will understand that ...)

- Basic principles of the Kinetic Molecular Theory govern the interactive relationship between energy and physical phase changes.

Essential Questions

Inquiry used to explore generalizations

- How is the kinetic molecular theory used to explain the differences between solids, liquids, and gases?
- How are the gas laws used to relate temperature, pressure, volume, and mole quantities?

Expected Performances

What students should know and be able to do

Students will know the following:

- The general properties of gases.
- Define pressure, know its SI unit, and convert between standard units of pressure.
- What causes gas pressure in a closed container?
- The kinetic molecular theory states that gas particles are in constant random motion, are relatively far apart, and have volumes that are negligible when compared with the total volume of a gas.
- Relate the kinetic molecular theory to the properties of an ideal gas.
- State Boyle's law, and use it to solve problems involving pressure and volume.
- State Charles's law, and use it to solve problems involving volume and temperature.
- State Gay-Lussac's law, and use it to solve problems involving pressure and temperature.
- State Avogadro's law, and explain its importance in determining the formulas of chemical compounds.
- State problems using the ideal gas law.
- Differentiate ideal gas behavior from real gas behavior.
- Use reaction stoichiometry to solve gas stoichiometry problems.

Students will be able to do the following:

- What factors affect gas pressure?
- Convert various pressure units
- Use Boyle's law to solve problems involving pressure and volume.
- Use Charles's law to solve problems involving volume and temperature.
- Use Guy-Lussac's law to solve problems involving pressure and temperature.
- Use the Ideal gas law to solve problems using pressure, volume, temperature and moles of a gas

Character Attributes

- Courage
- Integrity

Technology Competencies

- Internet research
- Labpro
- Online applets

Develop Teaching and Learning Plan

<p>Teaching Strategies:</p> <ul style="list-style-type: none"> • Phenomenon: Hot air balloon • Power point presentations with embedded practice problems • Gradual Release Model (I do, We do, You do) • Classroom discussion 	<p>Learning Activities:</p> <ul style="list-style-type: none"> • Define vocabulary terms • Practice and Reinforcement Worksheets • Article: <i>Hot Air Balloons: Gas and Go</i> by Claudia Vanderborght, Chem Matters Dec 2002 • Vernier Labs: Pressure-Temperature, Pressures-Volume, Volume-Temperature Relationships • Vacuum Pump and other Demos • Modern Marvels Under Pressure Video
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Assessments

Performance Task(s)	Other Evidence
<p>Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)</p>	<p>Application that is functional in a classroom context to evaluate student achievement of desired results</p>
<p>Goal: Create a Tissue Paper Hot Air Balloon</p> <p>Role: Builder and designer</p>	<ul style="list-style-type: none"> • Formative assessments include <ul style="list-style-type: none"> o white boarding o exit tickets o quizzes o homework

<p>Audience: Peers</p> <p>Situation: The students will design and construct a tissue paper hot air balloon</p> <p>Product or Performance: Students will launch the above hot air balloon; they will then create a lab report based on the kinetic molecular theory and the particular gas law used.</p> <p>Standards for Success: See rubric</p>	<ul style="list-style-type: none"> o labs o activities ● Summative assessment includes various question types including <ul style="list-style-type: none"> o multiple choice o classification o relationship analysis o matching o fill-in-the-blank o short answer o problem solving
Suggested Resources	
<ul style="list-style-type: none"> ● Modern Chemistry by Holt, Rinehart and Winston 1999 ● Modern Marvels Under Pressure, Season 18, Episode 14, History Channel; Jan 30, 2012. DVD ● Shared Science Folder on the New Milford High School J:// drive 	