

NEW MILFORD PUBLIC SCHOOLS
New Milford, Connecticut



Experimental 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

Experimental Chemistry

Experimental chemistry is a laboratory-oriented course designed to give students an appreciation of the contributions of chemistry to the real world. This course concentrates on basic concepts and principles such as chemical nomenclature, measurement, properties of matter, atomic structure, periodic properties, bonding theories, chemical reactions, gas laws and energy. Lab experiments are geared toward everyday chemistry encountered in the home and environment. Concepts will be presented in a non-mathematical approach; however, basic math skills are necessary. The student must be self-disciplined and able to work well in the lab environment.

Pacing Guide

Unit #	Title	Weeks	Pages
1	Properties of Matter	7	6 - 8
2	Atomic Structure	5	8 - 11
3	The Periodic Table	5	11 - 13
4	Chemical Bonding	4	13 - 16
5	Chemical Reactions	4	16 - 18
6	The Gas Laws	7	18 - 21
7	Food Chemistry	3	21 - 24

New Milford Public Schools Experimental Chemistry Curriculum

<p>Committee Member(s): Virginia Landgrebe Kristen Stolle Catherine Gardner</p>	<p>Course/Subject: Experimental Chemistry Grade Level: 11-12 # of Weeks: 7</p>
<p>Unit 1: Properties of Matter</p>	
<p>Identify Desired Results</p>	
<p>Next Generation Science Standards & Common Core Standards</p>	
<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. 	
<p>Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)</p>	<p>Essential Questions Inquiry used to explore generalizations</p>
<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?
<p>Expected Performances What students should know and be able to do</p>	

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)
- Give 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
- Hot air balloon Power point presentations with embedded practice problems
- Gradual Release Model (I do, We do, You do)
- Classroom discussion
- Graphic Organizer (Flow Chart) of Matter Concepts
- Demo: Density

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
- Lab: Density
- Modern Marvels: Measure It Video
- Lab: Density of an irregular object
- Lab: Identification of metals

	<ul style="list-style-type: none"> • Lab: Density rainbow tubes
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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: Separation of a Mixture into its components</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>	<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"> • Chemistry by Packard, Jacobs, and Marshall 2007 • pHet Simulation: Density https://phet.colorado.edu/ • POGIL Activities for High School Chemistry by Laura Trout 2012 • Modern Marvels Measure It, Season 15, Episode 40, History Channel; Dec 23, 2008. DVD • https://www.youtube.com/watch?v=jk0WrtA8_T8 • Shared Science Folder on the New Milford High School J:// drive

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

Next Generation Science Standards & Common Core Standards

- **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-PS4-3.** 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.
- **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 ...)	Essential Questions Inquiry used to explore generalizations
<ul style="list-style-type: none"> ● 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. 	<ul style="list-style-type: none"> ● 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	
<p>Students will know the following:</p> <ul style="list-style-type: none"> ● 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. <p>Students will be able to do the following:</p> <ul style="list-style-type: none"> ● Describe atoms of different elements in terms of their number of protons, electrons, and neutrons. ● Determine the number of subatomic particles in an isotope. ● Calculate the average atomic mass of an element given the atomic mass and percent abundance of each isotope. 	
Character Attributes	
<ul style="list-style-type: none"> ● Responsibility 	

<ul style="list-style-type: none"> ● Integrity 	
Technology Competencies	
<ul style="list-style-type: none"> ● Using Online applets ● Using Discharge tubes 	
Develop Teaching and Learning Plan	
Teaching Strategies: <ul style="list-style-type: none"> ● Phenomenon: Northern Lights ● Power point presentations with embedded practice problems ● Modeling of concepts, followed by in class practice worksheets ● 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 ● Demo: Gold Foil ● Demo: Cathode Ray Tube 	Learning Activities: <ul style="list-style-type: none"> ● Define vocabulary terms ● Practice and Reinforcement Worksheets ● Think Tube Activity ● Lab: Isotopes of Pennium ● Lab: Gas Discharge Tube ● 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>	<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

Standards for Success: See rubric	<ul style="list-style-type: none"> o classification o relationship analysis o matching o fill-in-the-blank o short answer o problem solving
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Suggested Resources

<ul style="list-style-type: none"> ● Chemistry by Packard, Jacobs, and Marshall 2007 ● pHet Simulation: Build An Atom, Isotopes and Atomic Mass, Rutherford Scattering https://phet.colorado.edu/ ● Modern Marvels Fireworks!, Season 6, Episode 34, History Channel; Sept 6, 1999. DVD ● Shared Science Folder on the New Milford High School J:// drive
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Committee Member(s): Virginia Landgrebe Kristen Stolle Catherine Gardner	Course/Subject: Experimental Chemistry Grade Level: 11-12 # of Weeks: 5
Unit 3: Periodic Table	

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.
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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, on all levels, has predictable properties that can be related to structures of the 	<ul style="list-style-type: none"> ● How does the arrangement of the periodic table relate to atomic structure?

<ul style="list-style-type: none"> elements that make up that matter. The atomic structures of materials determine their properties. 	<ul style="list-style-type: none"> How can one explain the structure, properties and interactions of matter?
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 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 atomic radii are related to the atomic structure of the elements. Periodic trends in electronegativity are related to the atomic structure of the elements. <p>Students will be able to do the following:</p> <ul style="list-style-type: none"> 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	
<p>Teaching Strategies:</p> <ul style="list-style-type: none"> Phenomenon: Alkali metals in water Hot air balloon Power point presentations with embedded practice problems Modeling of concepts, followed by in class practice worksheets Gradual Release Model (I do, We do, You do) Classroom discussions Timeline of Historical Figures in the 	<p>Learning Activities:</p> <ul style="list-style-type: none"> Define vocabulary terms Practice and Reinforcement Worksheets Alien Periodic Table Lab: Mendeleev Arrangement of Elements 1869 Lab: Ekasilicon (Periodicity of Elements in Group 14) Video Clip: Brainiac Alkali Metals

<ul style="list-style-type: none"> Development of the Periodic Table • Graphic Organizer of the Trends in the Periodic Table • Jigsaw Activity of Trends in the Periodic Table • Demo: Alkali Metals reaction with water 	
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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: Create a Periodic Table of Secret Agents using patterns</p> <p>Role: Spy</p> <p>Audience: Peers in your class</p> <p>Situation: Use the principle of the periodic law to determine the characteristics of an unknown spy</p> <p>Product or Performance: Completed periodic table of known spies and a mug shot of the unknown spy.</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"> • Chemistry by Packard, Jacobs, and Marshall 2007 • 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>Unit 4: Ionic Bonding</p>	<p>Course/Subject: Experimental Chemistry Grade Level: 11-12 # of Weeks: 4</p>
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Identify Desired Results

Next Generation Science Standards & Common Core Standards

- **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.

Enduring Understandings

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

- 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 to the periodic table
- Chemical bonding in matter results in the formation of new compounds with different properties.

Essential Questions

Inquiry used to explore generalizations

- 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?
- 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

Students will know the following:

- 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 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.

Students will be able to do the following: <ul style="list-style-type: none"> • Illustrate the process of forming an ionic bond. • Draw Lewis structures to show the arrangement of valence electrons among atoms in formula units. 	
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	
Teaching Strategies: <ul style="list-style-type: none"> • Phenomenon: Hunting the elements Sodium and Chlorine • Power point presentations with embedded practice problems • Modeling of concepts, followed by in class practice worksheets • Gradual Release Model (I do, We do, You do) • Classroom discussion • Demonstrate and practice the “Criss-Cross method” to write ionic formulas 	Learning Activities: <ul style="list-style-type: none"> • Define vocabulary terms • Practice and Reinforcement Worksheets • Ionic Bonding POGIL Activity using models • Ionic Naming POGIL Activity using models • Lab: Ionic Compounds • Activity: Cut and Paste Formula • Practice with Dry Erase Boards

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
Goal: The Ionic Compound Puzzle is used to create models of ionic compounds and observe the chemical formula of the binary ionic compounds created. Role: Chemist Audience: Peers Situation: Students assemble	<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 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

compounds based on ionic charge. Product or Performance: Poster illustrating all ionic compounds created Standards for Success: See Rubric	<ul style="list-style-type: none"> o fill-in-the-blank o short answer o problem solving
<ul style="list-style-type: none"> ● Chemistry by Packard, Jacobs, and Marshall 2007 ● 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: Experimental Chemistry Grade Level: 11-12 # of Weeks: 4
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. 	
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 	<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

<p>with different properties.</p> <ul style="list-style-type: none"> ● Conservation of mass must be satisfied in all balanced chemical reactions. 	<p>predictions about them?</p> <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?
<p>Expected Performances What students should know and be able to do</p>	
<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 <p>Students will be able to do the following:</p> <ul style="list-style-type: none"> ● Classify reactions as belonging to one of five general types. ● Balance chemical equations 	
<p>Character Attributes</p>	
<ul style="list-style-type: none"> ● Citizenship ● Perseverance 	
<p>Technology Competencies</p>	
<ul style="list-style-type: none"> ● Online applets ● Lab Pro 	
<p>Develop Teaching and Learning Plan</p>	
<p>Teaching Strategies:</p> <ul style="list-style-type: none"> ● Phenomenon: Alkali metal balancing the equation ● Power point presentations with embedded practice problems ● Modeling of concepts, followed by 	<p>Learning Activities:</p> <ul style="list-style-type: none"> ● Define vocabulary terms ● Practice and Reinforcement Worksheets ● High School Drama POGIL using models

<ul style="list-style-type: none"> in class practice worksheets ● Gradual Release Model (I do, We do, You do) ● Classroom discussions 	<ul style="list-style-type: none"> ● Lab: Reaction Types ● Lab: Single Replacement ● Lab: Double Replacement
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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: Draw a reaction cartoon</p> <p>Role: Cartoonist</p> <p>Audience: Peers in your class</p> <p>Situation: Students create a series of cartoons that illustrate four type of reactions, synthesis, decomposition, single and double replacement</p> <p>Product or Performance: Student will create a poster</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"> ● Chemistry by Packard, Jacobs, and Marshall 2007 ● 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>Unit 6: Gas Laws</p>	<p>Course/Subject: Experimental Chemistry Grade Level: 11-12 # of Weeks: 7</p>
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Identify Desired Results

Next Generation Science Standards & Common Core Standards

- **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.
- 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.

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.

Character Attributes

- Courage
- Integrity

Technology Competencies

- Internet research
- Labpro
- Online applets

Develop Teaching and Learning Plan

Teaching Strategies:

- Phenomenon: Hot air balloon
- Power point presentations with embedded practice problems
- Gradual Release Model (I do, We do, You do)
- Classroom discussion
- Demo: Vacuum Pump

Learning Activities:

- Define vocabulary terms
- Practice and Reinforcement Worksheets
- Article: *Hot Air Balloons: Gas and Go* by Claudia Vanderborght, Chem Matters Dec 2002
- Vernier Labs: Pressure-Temperature, Pressures-Volume, Volume-Temperature Relationships
- Vacuum Pump Prediction and Model
- Modern Marvels Under Pressure Video

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
Goal: Create a Tissue Paper Hot Air Balloon	<ul style="list-style-type: none"> ● Formative assessments include <ul style="list-style-type: none"> ○ white boarding ○ exit tickets

<p>Role: Builder and designer</p> <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 quizzes o homework 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"> ● Chemistry by Packard, Jacobs, and Marshall 2007 ● 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 	

<p>Committee Member(s): Virginia Landgrebe Kristen Stolle Catherine Gardner</p>	<p>Course/Subject: Experimental Chemistry Grade Level: 11-12 # of Weeks: 3</p>
Unit 7: Food Chemistry	
Identify Desired Results	
Next Generation Science Standards & Common Core Standards	
<ul style="list-style-type: none"> ● HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules ● 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"> • Three primary components of food are carbohydrates, lipids, and proteins • And apply where food comes from and the future of food production 	<ul style="list-style-type: none"> • In chemical terms, what is the purpose of the food we eat?
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 difference between monosaccharides, disaccharides, and polysaccharides • The properties of saturated and unsaturated fats and relate the consumption of each to health • Five functions of proteins in the body <p>Students will be able to do the following:</p> <ul style="list-style-type: none"> • Explain the general formation and structure of carbon-based biopolymers, such as carbohydrates • Describe how polymers are formed and broken down in organisms. • Compare the structure of carbohydrates, lipids, proteins, and nucleic acids, and relate their importance to living things. • Explain the role of proteins and amino acids in living organisms. • Describe the function of carbohydrates in living organisms. • Explain the function of lipids in living organisms. • Describe nucleic acids and the function of DNA and RNA. • Identify the effects of enzymes. 	
Character Attributes	
<ul style="list-style-type: none"> • Courage • Integrity 	
Technology Competencies	
<ul style="list-style-type: none"> • Internet research • Labpro • Online applets 	
Develop Teaching and Learning Plan	
Teaching Strategies:	Learning Activities:

<ul style="list-style-type: none"> • Phenomenon: Food Inc. • The teacher assigns as homework defining key terms and outlining texts • The teacher lectures and provides guided notes reviewing nutrition. Specifically the similarities and differences in the chemical composition of three of the general classes of nutrients, namely, carbohydrates, fats and proteins. • The teacher lectures and provides guided notes about food science – the study concerned with all technical aspects of food beginning with harvesting and ending with its cooking and consumption. 	<ul style="list-style-type: none"> • Define all key vocabulary • Practice and Reinforcement Worksheets • The students will make a “foldable” study organizer for their notes on macromolecules (carbohydrates, proteins, lipids and nucleic acids). • Molecular model kits will be used to construct a three-dimensional model of a simple sugar (a carbohydrate), a fat and a protein. • The students will watch the documentary film Food Inc. which provides a critical look how our food is produced and human health, worker’s rights, animal welfare, and other ethical issues • The students will design an experiment to calculate the percent of water in fruit or vegetable. • The students will identify the nutrients found in various food samples in the Food Testing lab. • Students will test for gluten. Gluten is the protein found in flour that gives baked products its structure. The experiment will test for the amount of gluten in at least three kinds of wheat flour. • Students will complete a Study Guide reviewing all concepts in preparation for the summative assessment
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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
Goal: The talented chef Emeril Lagasse has asked you to appear on his cooking show to present the background behind "The Chemistry of Cooking". Emeril will be	<ul style="list-style-type: none"> • Formative assessments include <ul style="list-style-type: none"> o white boarding o exit tickets o quizzes

<p>specializing in desserts for the cooking show. In order to provide an interesting and informative show, you must research how solutions, thermochemistry, chemical reactions and the gas laws are involved in cooking.</p> <p>Role: Chemist and cook</p> <p>Audience: Live TV studio audience</p> <p>Situation: Prepare a PowerPoint presentation about the chemistry behind the making of an ice cream sundae with pressurized whipped cream and TWO of the following desserts: candy apples, lollipops, homemade fudge, Bananas Foster, Creme-Brulee, an apple pie, a chocolate cake, or something you choose that is approved by Emeril and your teacher.</p> <p>Product: PowerPoint</p> <p>Standards for Success: See rubric</p>	<ul style="list-style-type: none"> o homework 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"> ● Chemistry by Packard, Jacobs, and Marshall 2007 ● Shared Science Folder on the New Milford High School J:// drive 	