NEW MILFORD PUBLIC SCHOOLS
New Milford, Connecticut

Honors Chemistry

June 2015

BOE Approved 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.

New Milford High School
Core Values and Beliefs

As a collective learning community, we at New Milford High School are grounded by our Core Values and Beliefs (WAVE):

WORK Work to become lifelong learners and peer collaborators who meet challenging goals by applying 21st century skills.

ACHIEVE Achieve through hard work, honest reflection, and self-advocacy through critical thinking and problem solving.

VALUE Value civic responsibility and the diversity within our community and global society.

EMPOWER Empower students and teachers to become curious, creative, innovative, and insightful.

21st Century Learning Expectations

As a collective learning community, we at New Milford High School want our students to meet the following 21st Century Learning Expectations:

Communication:
Communicate information clearly and effectively in a meaningful way using a variety of methods.

Problem-Solving:
Analyze, synthesize, and evaluate to solve problems. Independently and collaboratively set and accomplish goals. Demonstrate innovation and adaptability in various environments.

Technology:
Students demonstrate technological literacy using relevant research tools to access and collect information to formulate new understanding.

Civic and Social:
Students demonstrate personal, social, and civic responsibility within our community and global society.

New Milford Public Schools
Honors Chemistry

Chemistry includes the study of the structure and properties of matter, chemical behavior, and energy relationships. There is strong emphasis on science process, quantitative and laboratory skills. At the honors level, this course is more rigorous, and moves at a faster pace. Additional homework may be required. In addition, Chemistry Honors students must identify an unknown substance at the end of the year.

Pacing Guide

Unit #	Title	Weeks	Pages
1	Properties of Matter	4	7 - 9
2	Atomic Structure	3	10 - 12
3	The Mole Concept	3	13 - 15
4	The Periodic Table	3	16 - 18
5	Chemical Bonding	4	19 - 21
6	Chemical Reactions	4	22 - 24
7	Stoichiometry	3	25 - 27
8	Thermodynamics	3	28 - 30
9	The Gas Laws	2	31 - 33
10	Solutions and Intermolecular Forces	2	34 - 36
11	Qualitative Analysis Unknown Lab	3	37

New Milford Public Schools
Honors Chemistry Curriculum

Committee Member(s): Virginia Landgrebe Kristen Stolle **Unit 1:** Properties of Matter	**Course/Subject:** Honors Chemistry **Grade Level:** 11-12 **# of Weeks:** 2-3

Identify Desired Results

Next Generation Science Standards & Common Core Standards

- **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.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	**Essential Questions** Inquiry used to explore generalizations
• 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.	• What is matter and how is it classified?

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.
- Observations that denote a chemical change.
- Energy is transferred during a physical and chemical change.
- The significant figure rules
- 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.
- Interpret and draw a phase diagram for a single compound system.
- Identify and use SI units in measurements and calculations (base units and derived units)
- Convert quantities using the factor label method (dimensional analysis)
- Determine the number of significant figures in a measurement and apply rules in calculations

Character Attributes

- Respect
- Cooperation

Technology Competencies

- Using online applets

Develop Teaching and Learning Plan

Teaching Strategies:	Learning Activities:
• Power point presentations with embedded practice problems • Modeling of concepts, followed by in class practice worksheets • Frequent question and answer sessions	• Classification of Matter POGIL Activity • Article: *Two Faces of Carbon* by Claire Wood, Chem Matters Dec 2004 • Lab: Introduction to Measurement • Lab: Separation of a Mixture • Elements, Compounds, and Mixtures Activity • Density Demos • Modern Marvels: Measure It Video

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: Separation of a Mixture into its components for a Role: Scientist Audience: a municipality Situation: A town needs a way to separate its solid waste stream Product or Performance: Lab report and 4 separated components Standards for Success: See Rubric	• Formative assessments include o white boarding o exit tickets o quizzes o homework o labs o activities • Summative assessment includes various question types including o multiple choice o classification

	o relationship analysis o matching o fill-in-the-blank o short answer o problem solving

Suggested Resources

- Holt Chemistry by Myers, Oldham, & Tocci 2004
- pHet Simulation: Density https://phet.colorado.edu/
- POGIL Activities for High School Chemistry by Laura Trout 2012
- ACS (American Chemical Society); Educational Resources; ChemMatters Magazine http://www.acs.org/content/acs/en/education/resources/highschool/chemmatters.html
- Modern Marvels Measure It, Season 15, Episode 40, History Channel; Dec 23, 2008. DVD
- Shared Science Folder on the New Milford High School J:// drive

Committee Member(s): Virginia Landgrebe Kristen Stolle **Unit 2:** Atomic Structure	**Course/Subject:** Honors Chemistry **Grade Level:** 11-12 **# of Weeks:** 2-3

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.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	**Essential Questions** Inquiry used to explore generalizations
• 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.	• What does an atom look like and how was the atomic model developed in the context of historical events?

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.
- Define isotope
- 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.

Character Attributes
• Responsibility • Integrity
Technology Competencies
• Using Online applets • Using Discharge tubes

Develop Teaching and Learning Plan

Teaching Strategies:	Learning Activities:
• Power point presentations with embedded practice problems • Modeling of concepts, followed by in class practice worksheets • Frequent question and answer sessions	• Dalton's Playhouse for Atomic Theory • Electron Energy and Light POGIL Activity • Article: *Fireworks!* by Kathy DeAntonis, Chem Matters Oct 2010 • Cathode Ray Tube Demo • Lab: Isotopes of Pennium • Gas Discharge Tube Demo • Lab: Flame Tests • Rutherford Scattering Video Backstage Science https://www.youtube.com/watch?v=XBqHkraf8iE • Modern Marvels Fireworks Video

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: Determine the identify of an unknown chemical compound Role: Scientist Audience: Business Situation: Use flame tests to determine the identify of unknown solutions Product or Performance: Lab report Standards for Success: See rubric	• Formative assessments include o white boarding o exit tickets o quizzes o homework o labs o activities • Summative assessment includes various question types including o multiple choice o classification

	o relationship analysis o matching o fill-in-the-blank o short answer o problem solving

Suggested Resources

- Holt Chemistry by Myers, Oldham, & Tocci 2004
- pHet Simulation: Build An Atom, Isotopes and Atomic Mass, Rutherford Scattering, and Neon Lights and Other Discharge Lamps https://phet.colorado.edu/
- POGIL Activities for High School Chemistry by Laura Trout 2012
- ACS (American Chemical Society); Educational Resources; ChemMatters Magazine http://www.acs.org/content/acs/en/education/resources/highschool/chemmatters.html
- Modern Marvels Fireworks!, Season 6, Episode 34, History Channel; Sept 6, 1999. DVD
- Shared Science Folder on the New Milford High School J:// drive

Committee Member(s): Virginia Landgrebe Kristen Stolle **Unit 3:** The Mole Concept	**Course/Subject:** Honors Chemistry **Grade Level:** 11-12 **# of Weeks:** 2-3

Identify Desired Results

Next Generation Science Standards & Common Core Standards

- **HS-PS1-7.** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
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Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	**Essential Questions** Inquiry used to explore generalizations
• The mole is an essential unit when calculating the amount of a substance that will react in a chemical reaction.	• How are unit analysis and the mole concept used to solve a variety of chemical calculations?

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
• Honesty • Responsibility
Technology Competencies
• Internet research • Online applets (pHet)

Develop Teaching and Learning Plan

Teaching Strategies:	Learning Activities:
• Power point presentations with embedded practice problems • Modeling of concepts, followed by in class practice worksheets • Frequent question and answer sessions	• The Mole Concept POGIL Activity • Percent Composition POGIL Activity • Article: *The Captivating Chemistry of Coins* by Brian Rohrig, Chem Matters April 2007 • Lab: Percent Water in a Hydrate • Mole Day • Lab: Flinn Mole Lab (Bob Becker)

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: Use Avogadro's number to carry out a cost calculation Role: Scientist called as an expert witness Audience: Court Judge 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 necessary to solve the problem. Product or Performance: Write a letter to the Judge to support or refute the student's claim. Standards for Success: The answer	• Formative assessments include o white boarding o exit tickets o quizzes o homework o labs o activities • Summative assessment includes various question types including o multiple choice o classification o relationship analysis o matching o fill-in-the-blank o short answer o problem solving

should be correct to three significant figures, should be documented with a detailed unit analysis, and should be reported using scientific notation. See rubric.	

Suggested Resources

- Holt Chemistry by Myers, Oldham, & Tocci 2004
- pHet Simulation: Molarity https://phet.colorado.edu/
- POGIL Activities for High School Chemistry by Laura Trout 2012
- ACS (American Chemical Society); Educational Resources; ChemMatters Magazine http://www.acs.org/content/acs/en/education/resources/highschool/chemmatters.html
- Avogadro Goes to Court http://sciencecases.lib.buffalo.edu/cs/files/avogadro.pdf
- Shared Science Folder on the New Milford High School J:// drive

Committee Member(s): Virginia Landgrebe Kristen Stolle **Unit 4:** Periodic Table	**Course/Subject:** Honors Chemistry **Grade Level:** 11-12 **# of Weeks:** 2-3

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.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	**Essential Questions** Inquiry used to explore generalizations
• 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.	• How does the arrangement of the periodic table relate to atomic structure?

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.
- Periodic trends in electron affinity 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
• Compassion • Cooperation
Technology Competencies
• Internet research • Excel graphing

Develop Teaching and Learning Plan

Teaching Strategies:	Learning Activities:
• Power point presentations with embedded practice problems • Modeling of concepts, followed by in class practice worksheets • Frequent question and answer sessions	• 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 • Article: *The Many Looks of the Periodic Table* by Gary Katz, Chem Matters Oct 2008 • Alkali Metal Reactivity Demo • Video Clip: Brainiac Alkali Metals

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: Create a Periodic Table of objects using patterns Role: Father of the Periodic Table (Mendeleev) Audience: Peers in your class Situation: Use the principle of the periodic law to design a periodic table organizing everyday objects Product or Performance: A periodic table poster containing at least 20 "elements". Standards for Success: See rubric	• Formative assessments include o white boarding o exit tickets o quizzes o homework o labs o activities • Summative assessment includes various question types including o multiple choice o classification o relationship analysis o matching o fill-in-the-blank o short answer o problem solving

Suggested Resources

- Holt Chemistry by Myers, Oldham, & Tocci 2004
- POGIL Activities for High School Chemistry by Laura Trout 2012
- ACS (American Chemical Society); Educational Resources; ChemMatters Magazine
http://www.acs.org/content/acs/en/education/resources/highschool/chemmatters.html
- Shared Science Folder on the New Milford High School J:// drive

Committee Member(s): Virginia Landgrebe Kristen Stolle **Unit 5:** Chemical Bonding	**Course/Subject:** Honors Chemistry **Grade Level:** 11-12 **# of Weeks:** 2-3

Identify Desired Results

Next Generation Science Standards & Common Core Standards

- **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.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	**Essential Questions** Inquiry used to explore generalizations
• 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.	• What role do valence electrons play in determining the chemical properties and the type of bond formed between atoms? • How are the symbolic representations, chemical notation, and rules of nomenclature used in the language of chemistry?

Expected Performances
What students should know and be able to do

Students will know the following:

- The charge an ion will likely form 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 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
- Formal charge is used to choose the most appropriate Lewis structure
- VSEPR theory can be used to predict the geometric structure of most molecules

- Associate the polarity of molecules with their shapes and relate the polarity and shape of molecules to the properties of the substance.

Students will be able to do the following:

- 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 and polyatomic ions.
- Name simple covalent compounds using prefixes, roots, and suffixes.
- Predict the shape of a molecule using VSEPR theory.

Character Attributes

- Perseverance
- Cooperation

Technology Competencies

- Online applets

Develop Teaching and Learning Plan

Teaching Strategies:

- Power point presentations with embedded practice problems
- Modeling of concepts, followed by in class practice worksheets
- Frequent question and answer sessions
- Use balloons to demonstrate how the number of the domains affects the bond angles around a central atom and thus the shape of a molecule.
- Use the pHet Molecule Shapes simulation to show bond angles and shapes.
- Use molecule kits to manipulate and demonstrate molecule shapes.

Learning Activities:

- Ionic and Covalent Bonding POGIL Activity
- Ionic and Covalent Naming POGIL Activity
- Article: *Linus Pauling: American Hero* by Sarah Vos, Chem Matters Oct 2007
- Article: *The Bare Essentials of Polarity* Living by Chemistry Unit 2 Smells Lesson 16 Handout
- Lab: Ionic vs Covalent Compounds
- Lab: Molecular Geometry

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: Analyze water samples for their quantity of hardness through the	• Formative assessments include o white boarding o exit tickets

principles of metal ion precipitation and separation. Rank samples in order of increasing water hardness. Role: Chemist Audience: Home-owner Situation: Design a procedure that will determine the unknown concentration of Ca^{2+} ions as mg of $CaCO_3$ per liter of solution in a 50 ml sample of water. Product or Performance: Letter to a home-owner explaining Calcium content Standards for Success: See Rubric	o quizzes o homework o labs o activities • Summative assessment includes various question types including o multiple choice o classification o relationship analysis o matching o fill-in-the-blank o short answer o problem solving

- Holt Chemistry by Myers, Oldham, & Tocci 2004
- pHet Simulation: Build a Molecule, Molecular Shapes, Molecule Polarity, & Sugar and Salt Solubility https://phet.colorado.edu/
- POGIL Activities for High School Chemistry by Laura Trout 2012
- ACS (American Chemical Society); Educational Resources; ChemMatters Magazine http://www.acs.org/content/acs/en/education/resources/highschool/chemmatters.html
- Shared Science Folder on the New Milford High School J:// drive

Committee Member(s): Virginia Landgrebe Kristen Stolle **Unit 6:** Chemical Reactions	**Course/Subject:** Honors Chemistry **Grade Level:** 11-12 **# of Weeks:** 2-3

Identify Desired Results

Next Generation Science Standards & Common Core Standards

- **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

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	**Essential Questions** Inquiry used to explore generalizations
• Communicating information about chemical concepts is highly dependent upon understanding the symbolism and conventions used to represent matter and information about matter	• What are some of the chemical reactions that occur within our environment everyday? • How are the symbolic representations, chemical notation, and rules of nomenclature used in the language of chemistry?

Expected Performances
What students should know and be able to do

Students will know the following:

- 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 forms . One of the products must be a solid, gas, or a molecular compound
- Differentiate between endothermic and exothermic reactions.
- Spectator ions do not change during reactions can can be removed from the total ionic equation to form a net ionic equation.

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.
- Write a net ionic equation for precipitation reactions in aqueous solutions.

Character Attributes

- Citizenship
- Perseverance

Technology Competencies

- Online applets
- Lap Pro

Develop Teaching and Learning Plan

Teaching Strategies:	Learning Activities:
• Power point presentations with embedded practice problems • Modeling of concepts, followed by in class practice worksheets • Frequent question and answer sessions	• The Activity Series POGIL Activity • Solubility Rules and Net Ionic Equations POGIL Activity • Article: *NASCAR Chemistry on the Fast Track* by Brain Rohrig, Chem Matters Feb 2007 • Copper II chloride and Aluminum Foil Demo • Electrolysis of Water Demo • Sweet 16 Chemistry Ion Tournament • Lab: Single Replacement • Lab: Double Replacement

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: Understand the applications of a sacrificial metal Role: Author	• Formative assessments include o white boarding o exit tickets o quizzes

Audience: Peers in your class Situation: Metal objects are susceptible to oxidation (rusting) in the environment. Product or Performance: Write a paper explaining a use for sacrificial metals in a real-life situation Standards for Success: See rubric	○ homework ○ labs ○ activities • Summative assessment includes various question types including ○ multiple choice ○ classification ○ relationship analysis ○ matching ○ fill-in-the-blank ○ short answer ○ problem solving

Suggested Resources

- Holt Chemistry by Myers, Oldham, & Tocci 2004
- pHet Simulation: Balancing Chemical Equations https://phet.colorado.edu/
- POGIL Activities for High School Chemistry by Laura Trout 2012
- ACS (American Chemical Society); Educational Resources; ChemMatters Magazine http://www.acs.org/content/acs/en/education/resources/highschool/chemmatters.html
- Shared Science Folder on the New Milford High School J:// drive

Committee Member(s): Virginia Landgrebe Kristen Stolle **Unit 7:** Stoichiometry	**Course/Subject:** Honors Chemistry **Grade Level:** 11-12 **# of Weeks:** 2-3

Identify Desired Results

Next Generation Science Standards & Common Core Standards

- **HS-PS1-7.** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	**Essential Questions** Inquiry used to explore generalizations
• The mole is an essential unit when calculating the amount of a substance that will react in a chemical reaction. • Stoichiometric analysis allows for the prediction of the relative quantities of substances involved in reactions.	• How does stoichiometry relate to the principle of conservation of matter?

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.
- Interpret data to determine amounts of reactants or products involved in reactions in aqueous solutions given data in volumes and molarities (M) of solutions.
- 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:	Learning Activities:
• Power point presentations with embedded practice problems • Modeling of concepts, followed by in class practice worksheets • Frequent question and answer sessions	• What Happens If I Run Out Of Ingredients (Reactants)? POGIL Activity • Article: *Nitrogen from Fertilizers: Too Much of a Good Thing* by Beh Nolte, Chem Matters April 2010 • Lab: S'mores • Lab: Decomposition of Baking Soda • Baking Soda and Vinegar Demo (limiting reagent)

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: To determine the decomposition of baking soda chemical reaction Role: Scientist Audience: Teacher Situation: Use stoichiometry to determine the amount of product formed from the decomposition of baking soda. Product or Performance: Mass of product formed Standards for Success: See rubric	• Formative assessments include o white boarding o exit tickets o quizzes o homework o labs o activities • Summative assessment includes various question types including o multiple choice o classification o relationship analysis o matching o fill-in-the-blank o short answer o problem solving

Suggested Resources

- Holt Chemistry by Myers, Oldham, & Tocci 2004
- pHet Simulation: Reactants, Products, and Leftovers https://phet.colorado.edu/
- POGIL Activities for High School Chemistry by Laura Trout 2012
- ACS (American Chemical Society); Educational Resources; ChemMatters Magazine http://www.acs.org/content/acs/en/education/resources/highschool/chemmatters.html
- Shared Science Folder on the New Milford High School J:// drive

Committee Member(s): Virginia Landgrebe Kristen Stolle **Unit 8:** Thermochemistry	**Course/Subject:** Honors Chemistry **Grade Level:** 11-12 **# of Weeks:** 2-3

Identify Desired Results

Next Generation Science Standards & Common Core Standards

- **HS-PS1-4.** Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
- **HS-PS3-4.** Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	**Essential Questions** Inquiry used to explore generalizations
• All changes in and interactions of matter are associated with changes in energy.	• How is energy involved in physical and chemical processes?

Expected Performances
What students should know and be able to do

Students will know the following:

- Differentiate between heat and temperature.Temperature depends on the average kinetic energy of the atoms
- Energy changes occur as either heat transfer or work, or a combination of both
- Enthalpy is the amount of heat content used or released in a system at constant pressure. Enthalpy is usually expressed as the change in enthalpy.
- Calorimetry measures the enthalpy change during a chemical reaction
- Heat Capacity of an object depends on both its mass and its chemical composition
- When only temperature changes, the change in molar enthalpy is represented by□ = □□□
- Hess's Law indicates that the thermodynamic changes for any particular process are the same, whether the changes are treated an a single reaction or a series of steps
- Use Hess's Law and standard enthalpies of formation to calculate enthalpy (ΔH).
- Reactions that have a positive enthalpy change are endothermic; and reactions that have a negative enthalpy change are exothermic

Students will be able to do the following:

- Convert temperature readings between the Kelvin, Celsius, and Fahrenheit scales.
- Perform calculations using molar heat capacity data.

- Calculate the enthalpy change for a given amount of substance for a given change in temperature.

Character Attributes

- Loyalty
- Respect

Technology Competencies

- Labpro
- Internet research

Develop Teaching and Learning Plan

Teaching Strategies:	Learning Activities:
• Power point presentations with embedded practice problems • Modeling of concepts, followed by in class practice worksheets • Frequent question and answer sessions	• Calorimetry – Measurement of Heat Energy POGIL Activity • Article: *Thermometers* by Brian Rohrig, Chem Matters Dec 2006 • Vernier Lab: Hess's Law • Vernier Lab: Heat of Fusion for Ice • Lab: Specific Heat Capacity of Metals • Hot Pack Demo

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: Creating a hot/cold pack Role: You are a manufacturer Audience: General public/consumers Situation: Write a lab procedure to create a hot or cold pack and carry out their experiment Product or Performance: Create a safe, inexpensive hot or cold pack Standards for Success: See rubric	• Formative assessments include o white boarding o exit tickets o quizzes o homework o labs o activities • Summative assessment includes various question types including o multiple choice o classification o relationship analysis o matching o fill-in-the-blank o short answer o problem solving

Suggested Resources
• Holt Chemistry by Myers, Oldham, & Tocci 2004 • pHet Simulation: States of Matter & Gas Properties https://phet.colorado.edu/ • POGIL Activities for High School Chemistry by Laura Trout 2012 • ACS (American Chemical Society); Educational Resources; ChemMatters Magazine http://www.acs.org/content/acs/en/education/resources/highschool/chemmatters.html • Shared Science Folder on the New Milford High School J:// drive

Committee Member(s): Virginia Landgrebe Kristen Stolle **Unit 9:** Gas Laws	**Course/Subject:** Honors Chemistry **Grade Level:** 11-12 **# of Weeks:** 2-3

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).

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	**Essential Questions** Inquiry used to explore generalizations
• Basic principles of the Kinetic Molecular Theory govern the interactive relationship between energy and physical phase changes.	• 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 particle 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 Guy-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.
- Distinguish between diffusion and effusion.
- Describe the relationship between gas behavior and chemical formulas such as those expressed by Graham's law of diffusion, Gay-Lussac's law of combining

volumes, and Dalton's law of partial pressures.
- 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

Teaching Strategies:	Learning Activities:
• Power point presentations with embedded practice problems • Modeling of concepts, followed by in class practice worksheets • Frequent question and answer session	• Gas Variables POGIL Activity • Article: *Hot Air Balloons: Gas and Go* by Claudia Vanderborght, Chem Matters Dec 2002 • Vernier Lab: Pressure-Temperature Relationship • Vacuum Pump and other Demos • Modern Marvels Under Pressure Video

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: Role: Audience: Situation: The bends Product or Performance:	• Formative assessments include o white boarding o exit tickets o quizzes o homework o labs

Standards for Success:	○ activities ● Summative assessment includes various question types including ○ multiple choice ○ classification ○ relationship analysis ○ matching ○ fill-in-the-blank ○ short answer ○ problem solving

Suggested Resources

- Holt Chemistry by Myers, Oldham, & Tocci 2004
- pHet Simulation: States of Matter & Gas Properties https://phet.colorado.edu/
- POGIL Activities for High School Chemistry by Laura Trout 2012
- ACS (American Chemical Society); Educational Resources; ChemMatters Magazine http://www.acs.org/content/acs/en/education/resources/highschool/chemmatters.html
- 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

Committee Member(s): Virginia Landgrebe Kristen Stolle **Unit 10:** Solutions & Intermolecular Forces	**Course/Subject:** Honors Chemistry **Grade Level:** 11-12 **# of Weeks:** 2-3

Identify Desired Results

Next Generation Science Standards & Common Core Standards

- **HS-PS1-5.** Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
- **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.

Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)	**Essential Questions** Inquiry used to explore generalizations
• The types of bonds a substance has influences its chemical and physical properties.	• How is the kinetic molecular theory used to explain the differences between solids, liquids, and gases? • How do intermolecular forces influence the physical and chemical properties of a substance?

Expected Performances
What students should know and be able to do

Students will know the following:

- Compare and contrast ionic and molecular substances by physical characteristics and types of forces that govern their behavior.
- Understand the difference between **inter**molecular forces and **intra**molecular forces
- Describe dipole-dipole forces.
- Explain how a hydrogen bond is responsible for many of the unique properties of water.
- Describe London dispersion forces and relate their strength to other forces of attraction.
- Define molarity and calculate the molarity of a solution.
- Identify applications of solubility principles and relate them to polarity and intermolecular forces.
- Explain what happens at the particle level when a solid compound dissolves in a liquid.
- Predict the solubility of an ionic compound by using a solubility table.
- Describe solutions in terms of their degree of saturation.
- Relate changes in boiling and freezing temperature to the concentration of a solute in a solution
- Molarity is defined as moles of solute per liter of solution.

- Solubility is affected by temperature in both gases and solids.
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Students will be able to do the following:

- Calculate concentration using common units.
- Preparing a solution of a certain molarity.
- Use molarity in stoichiometric calculations.
- Use a solubility table to predict the solubility of an ionic compound

Character Attributes

- Cooperation
- Citizenship

Technology Competencies

- Labpro
- Online applets

Develop Teaching and Learning Plan

Teaching Strategies:	Learning Activities:
• Power point presentations with embedded practice problems • Modeling of concepts, followed by in class practice worksheets • Frequent question and answer sessions	• Molarity POGIL Activity • Article: *Salting Road: The Solution for Winter Driving* by Doris Kimbrough, Chem Matters Feb 2006 • Vernier Lab: Beer's Law • Lab: Effect of Temperature on Solubility of a Salt

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:Determine the percent copper in brass Role: Forensic Scientist Audience: Court Situation: Use Beer's Law to create a calibration curve of standard copper solutions and determine the percent copper in various brass substances Product or Performance: Lab report Standards for Success: See rubric	• Formative assessments include o white boarding o exit tickets o quizzes o homework o labs o activities • Summative assessment includes various question types including o multiple choice o classification o relationship analysis o matching o fill-in-the-blank

	o short answer o problem solving

Suggested Resources

- Holt Chemistry by Myers, Oldham, & Tocci 2004
- pHet Simulation: Molarity, Salts and Solubilitieshttps://phet.colorado.edu/
- POGIL Activities for High School Chemistry by Laura Trout 2012
- ACS (American Chemical Society); Educational Resources; ChemMatters Magazine http://www.acs.org/content/acs/en/education/resources/highschool/chemmatters.html
- Shared Science Folder on the New Milford High School J:// drive