Pine Hill Public Schools Curriculum			
Content Area:	Science		
Course Title/ Grade Level:	Chemistry Advanced/11		
Unit 1:	Periodic Table, Atomic Structure, and Bonding	Month:	September to December
Unit 2:	Molecular Structure and Properties	Month:	January to February
Unit 3:	Behavior of Gases	Month:	February to March
Unit 4:	Chemical Equations and Conversions	Month:	March to May
Unit 5:	Energy and Thermodynamics	Month:	May to June
BOE Approval Date:	6/29/2016		

Pine Hill Public Schools Science Curriculum	
Unit Title: Periodic Table, Atomic Structure, and Bonding	**Unit #**: 1
Course or Grade Level: Chemistry Advanced/11	**Length of Time**: ~16 weeks
NGSS Performance Expectations (PE's)	● 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. ● 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. ● HS-PS1-7: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. ● HS-PS1-8: Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy release during the processes of fission, fusion, and radioactive decay. ● HS-PS2-4: Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects. ● HS-PS2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. ● HS-PS3-5: Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

Cross Cutting Concepts	**Science and Engineering Practices**
✓ Patterns ❑ Cause and Effect ✓ Scale, Proportion, and Quantity ❑ Systems and Systems Models ✓ Energy and Matter in Systems ✓ Structure and Function ❑ Stability and Change in Systems **Nature of Science (NOS)** ❑ NOS-Science is a Way of Knowing ✓ NOS-Scientific Knowledge Assumes an Order and Consistency in Natural Systems ✓ NOS-Science is a Human Endeavor ❑ NOS-Science Addresses Questions About the Natural and Material World	❑ Asking questions and defining problems ✓ Developing and using models ✓ Planning and carrying out investigations ❑ Analyzing and interpreting data ✓ Using mathematics and computational thinking ❑ Constructing explanations and designing solutions ❑ Engaging in argument from evidence ✓ Obtaining, evaluating, and communicating information **Nature of Science (NOS)** ❑ Scientific Investigations Use a Variety of Methods ❑ Scientific Knowledge is Based on Empirical Evidence ❑ Scientific Knowledge is Open to Revision in Light of New Evidence ✓ Scientific Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

Content	● Tools of the trade: Lab equipment and laboratory safety ● How chemists use chemical formulas to track changes in matter, how matter is conserved in chemical processes, the organization of the periodic table ● Models of the atom, how atoms differ from one another, nuclear reactions, how elements are created

	● The systematic arrangement of electrons in an atom, how ionic compounds are formed, valence electrons and ionic bonding, how the periodic table reflects electron arrangement ● The basic types of bonds between atom, the role of electrons in bonding, the properties and types of elements associated with each type of bond, the formation of new substances through bonding
Skills	● Safely and correctly use tools and equipment in the chemistry lab ● Perform a series of chemical reactions and interpret the results ● Relate the particles of atoms to isotopes and nuclear reactions ● Provide evidence for the presence of certain atoms within compounds ● Investigate the properties of substances
Assessments	● Classwork: Inquiry Lesson Activities ● Homework: Lesson Practice ● Quizzes: Mid-section quizzes ● Tests: Section tests ● Labs: Observations and Data Analysis
Interventions/ differentiated instruction	● Offer a variety of materials at different levels including teacher-prepared notes and graphic organizers ● Provide advanced notice of tests ● Present material to accommodate auditory, visual, and kinesthetic learners ● Supply enrichment activities or assignments for more advanced learners
Lesson resources/Activities	● **Labs**: experiments used to learn techniques and further explore the content including Periodic Trends and Properties, A Penny for Your Thoughts, Isotopes of Kissium, Super Silver Experiment, Flame Tests, Creating Ionic Compounds, The Copper Cycle, and Lightbulb Lab ● **Computer Access**: online interactives and simulations related to unit topics including building atoms and recognizing the use of nuclear reactors ● **Activities**: inquiry-based exercises requiring manipulation of materials including identifying patterns in the periodic table and creating ionic compounds using cards

Unit 1 Lab Materials List

Items purchased yearly at the store are **bolded*

- ➢ calcium turnings
- ➢ aluminum foil
- ➢ magnesium ribbon
- ➢ **lighters (for Bunsen burners)**
- ➢ iron chloride
- ➢ magnesium sulfate

- hydrochloric acid
- litmus paper
- thermometer **batteries**
- zinc filings
- sodium hydroxide
- pennies
- **Cookies and Cream Hershey kisses (2 bags)**
- **Almond Hershey kisses (2 bags)**
- electronic scale **batteries**
- copper wire
- silver nitrate
- filter paper
- plastic weigh cups
- sodium chloride
- sodium nitrate
- strontium chloride
- sodium carbonate
- strontium nitrate
- potassium chloride
- potassium sulfate
- potassium nitrate
- copper sulfate
- copper chloride
- copper nitrate
- **wooden splints/toothpicks/popsicle sticks**
- sodium hydroxide
- calcium carbonate
- sodium phosphate
- testtubes
- plastic pipettes
- copper powder
- 8 M nitric acid
- zinc filings
- 1 M sulfuric acid
- 8 M sodium hydroxide
- hot plates
- paper clips (large)
- **holiday lights**
- **9 volt batteries**
- Silicon Dioxide
- Ethanol
- Paraffin (wax)
- Copper shot
- Sucrose (sugar)
- dropper bottles
- **disposable gloves**

Pine Hill Public Schools Science Curriculum	
Unit Title: Molecular Structure and Properties	**Unit #**: 2
Course or Grade Level: Chemistry Advanced/11	**Length of Time**: ~4 weeks
NGSS Performance Expectations (PE's)	● 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.

	● 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. ● HS-PS2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. ● HS-PS3-5: Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

Cross Cutting Concepts	**Science and Engineering Practices**
❑ Patterns ✓ Cause and Effect ❑ Scale, Proportion, and Quantity ❑ Systems and Systems Models ❑ Energy and Matter in Systems ✓ Structure and Function ❑ Stability and Change in Systems **Nature of Science (NOS)** ❑ NOS-Science is a Way of Knowing ❑ NOS-Scientific Knowledge Assumes an Order and Consistency in Natural Systems ❑ NOS-Science is a Human Endeavor ❑ NOS-Science Addresses Questions About the Natural and Material World	❑ Asking questions and defining problems ✓ Developing and using models ❑ Planning and carrying out investigations ❑ Analyzing and interpreting data ❑ Using mathematics and computational thinking ✓ Constructing explanations and designing solutions ❑ Engaging in argument from evidence ✓ Obtaining, evaluating, and communicating information **Nature of Science (NOS)** ✓ Scientific Investigations Use a Variety of Methods ✓ Scientific Knowledge is Based on Empirical Evidence ❑ Scientific Knowledge is Open to Revision in Light of New Evidence ❑ Scientific Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

Content	● Molecular formulas, structural formulas, orientation of structural formulas ● Drawing structural formulas, bonding rules for HONC ● Covalent bond, Lewis dot symbols and structures, bonded and lone pairs ● Octet rule, double and triple bonds ● Polarity, intermolecular force, and electronegativity
Skills	● Manipulate molecular models to explain structural formulas and/or isomers ● Use the HONC 1234 rule to draw structural formulas of covalent compounds ● Investigate the role of electrons in covalent bonding using puzzle pieces ● Apply the octet rule when drawing Lewis structures involving double and triple bonds ● Analyze results of an experiment to explain intermolecular force ● Predict types of bonding based on the electronegativity scale
Assessments	● Classwork: Inquiry Lesson Activities ● Homework: Lesson Practice ● Quizzes: Mid-section quizzes ● Tests: Section tests ● Labs: Observations and Data Analysis

Interventions/ differentiated instruction	● Offer a variety of materials at different levels including teacher-prepared notes and graphic organizers ● Provide advanced notice of tests ● Present material to accommodate auditory, visual, and kinesthetic learners ● Supply enrichment activities or assignments for more advanced learners
Lesson resources/Activities	● **Labs**: experiments used to learn techniques and further explore the content including Ester Synthesis and Attractive Molecules ● **Computer Access**: online interactives and simulations related to unit topics including creating structural and Lewis dot formulas of molecules, investigating electronegativity and how it changes polarity ● **Activities**: inquiry-based exercises requiring manipulation of materials including comparing smells and molecular formulas and creating molecular models

Unit 2 Lab Materials List

Items purchased yearly at the store are **bolded*

- ➢ **fish oil**
- ➢ **apricot oil**

- **banana extract**
- **pineapple extract**
- **peppermint oil**
- **spearmint oil**
- **rum flavor extrac**t
- plastic pipettes
- isopentanol
- butanol
- ethanol
- dropper bottles
- 18 M sulfuric acid
- 8 M butyric acid
- **disposable gloves**
- hexane
- combs (wand)
- socks (wool)
- wax paper
- **vinegar (dilute acetic acid)**
- **isopropanol (rubbing alcohol)**

Pine Hill Public Schools Science Curriculum	
Unit Title: Behavior of Gases	**Unit #**: 3
Course or Grade Level: Chemistry Advanced/11	**Length of Time**: ~4 weeks
NGSS Performance Expectations (PE's)	● 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.

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

Cross Cutting Concepts	**Science and Engineering Practices**
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Content	● Direct and indirect relationships ● Temperature scales ● The behavior of gas particles ● The relationships between gas pressure, temperature, and volume ● How to determine the numbers of gas molecules in a sample ● The relationships among pressure, temperature, volume, and number of molecules in a gas
Skills	● Interpret graphs that compare variables affecting gases ● Use computer simulations to explain and support the kinetic molecular theory ● Graph and quantify the relationship between gas pressure, volume, and temperature ● Use models to explain how molecules cause gas pressure ● Calculate the number of moles of air particles in a given volume
Assessments	● Classwork: Inquiry Lesson Activities ● Homework: Lesson Practice ● Quizzes: Mid-section quizzes ● Tests: Section tests ● Labs: Observations and Data Analysis

Interventions/ differentiated instruction	● Offer a variety of materials at different levels including teacher-prepared notes and graphic organizers ● Provide advanced notice of tests ● Present material to accommodate auditory, visual, and kinesthetic learners ● Supply enrichment activities or assignments for more advanced learners
Lesson resources/Activities	● **Labs**: experiments used to learn techniques and further explore the content including Pressure in Popcorn, Ideal Breath, Cartesian Diver, Marshmallow Syringe, Can Crusher, Absolute Zero Apparatus, Microwave Marshmallow, Inflate a Balloon, and Rising Water Candle ● **Computer Access**: online interactives and simulations related to unit topics including drawing conclusions about the relationships among Pressure, Volume, Temperature, and Number of Particles ● **Activities**: inquiry-based exercises requiring manipulation of materials including developing arguments for changes observed with marshmallows in a syringe and the combination of baking soda and vinegar

Unit 3 Lab Materials List

Items purchased yearly at the store are **bolded*

- ➢ **popcorn kernels**

- **regular marshmallows**
- **mini marshmallows**
- empty aluminum soda cans
- empty plastic soda bottles
- droppers
- **candles**
- **food coloring**
- **foil pie pans**
- **lighter**
- **baking soda**
- **vinegar**
- **balloons**
- plastic syringes
- paper towels
- sponges
- Absolute Zero Apparatus
- **ice**
- plastic tubing
- **drinking straws**

NGSS Performance Expectations (PE's)	● 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. ● HS-PS1-7: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

Cross Cutting Concepts	**Science and Engineering Practices**
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Content	● Chemical equations ● Tracking mass and conservation of mass ● Balancing chemical equations, and using coefficients as counting units ● Combination, decomposition, and exchange reactions ● Moles and grams, scientific notation ● Molar mass of compounds, and comparing a mole's worth ● Relating mass and moles, and converting between mass and moles
Skills	● Provide a basic translation of a chemical reaction using chemical equations ● Provide evidence that supports the law of conservation of mass ● Balance a simpler chemical equations and explain the role of coefficients ● Identify patterns in chemical equations and classify different types of reactions ● Translate numbers into scientific notation and vice versa, explain the magnitude of a mole, and define and locate molar mass for an element ● Calculate the molar mass of a compound ● Convert the number of moles of a compound or an element to mass in grams and convert the mass of a sample in grams to moles
Assessments	● Classwork: Inquiry Lesson Activities ● Homework: Lesson Practice ● Quizzes: Mid-section quizzes ● Tests: Section tests ● Labs: Observations and Data Analysis

Interventions/ differentiated instruction	● Offer a variety of materials at different levels including teacher-prepared notes and graphic organizers ● Provide advanced notice of tests ● Present material to accommodate auditory, visual, and kinesthetic learners ● Supply enrichment activities or assignments for more advanced learners
Lesson resources/Activities	● **Labs**: experiments used to learn techniques and further explore the content including Chemical Equations and Observations, Chemical and Physical Changes, Types of Chemical Reactions, Titration, and Solid Evidence ● **Computer Access**: online interactives and simulations related to unit topics including modeling how to balance a chemical equation ● **Activities**: inquiry-based exercises requiring manipulation of materials including Counting by Weighing and What's in a Mole?

Items purchased yearly at the store are **bolded*

- sodium bicarbonate **(baking soda)**
- hot plates
- iron screws
- empty aluminum soda cans
- nickels (coins)
- sodium chloride **(salt)**
- **rubber bands**
- **uncooked pasta**
- **paper clips (small)**
- wooden modeling kit spheres
- magnesium sulfate
- silver nitrate
- barium chloride
- hydrochloric acid
- magnesium ribbon
- **lighter**
- **iron nails**
- copper sulfate
- straws
- **steel wool**
- bromothymol blue
- droppers
- **hydrogen peroxide**
- potassium iodide
- calcium turnings
- sodium carbonate
- barium nitrate
- ethanol
- plastic pipettes
- calcium chloride
- **acetic acid (vinegar)**
- **sucrose (sugar)**
- **gummy bears**
- **red flavored drink mix**
- **drinking straws**
- small nails
- **modeling clay**
- potassium chloride
- sodium bromide
- sodium hydroxide **(drain cleaner)**
- rubbing alcohol
- ammonium hydroxide **(window cleaner)**
- **lemon juice**
- calcium carbonate **(antacid tablet)**
- **red cabbage (juice)**
- universal indicator
- conductivity apparatus (see Unit 1)
- methanol
- ammonia
- litmus paper
- nitric acid
- bromothymol blue
- potassium nitrate
- magnesium nitrate
- copper nitrate
- dropper bottles
- **disposable gloves**

Pine Hill Public Schools Science Curriculum	
Unit Title: Energy and Thermodynamics	**Unit #**: 5
Course or Grade Level: Chemistry Advanced/11	**Length of Time**: ~4 weeks

NGSS Performance Expectations (PE's)	● 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 ● 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-PS3-1: Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. ● 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).

Cross Cutting Concepts	**Science and Engineering Practices**
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Content	● Energy and exothermic processes ● Heat, exothermic or endothermic processes, and kinetic energy ● Heat transfer and the first and second laws of thermodynamics ● Particle view of energy and measuring heat transfer ● Specific heat capacity and bonding, numbers, and heat ● Substances that burn and combustion reactions
Skills	● Define energy and exothermic reactions to describe fire ● Distinguish between exothermic and endothermic processes, explain sensory experiences of hot and cold, and discuss energy changes from a molecular viewpoint ● Explain situations involving energy transfer, define thermal equilibrium, and state the first and second laws of thermodynamics

	● Complete simple calculations involving heat transfer for water samples, describe basic differences between thermal energy, heat, and temperature, and define a calorie ● Define and calculate specific heat capacity ● Define and describe combustion and describe the chemical composition of substances that burn
Assessments	● Classwork: Inquiry Lesson Activities ● Homework: Lesson Practice ● Quizzes: Mid-section quizzes ● Tests: Section tests ● Labs: Observations and Data Analysis
Interventions/ differentiated instruction	● Offer a variety of materials at different levels including teacher-prepared notes and graphic organizers ● Provide advanced notice of tests ● Present material to accommodate auditory, visual, and kinesthetic learners ● Supply enrichment activities or assignments for more advanced learners
Lesson resources/Activities	● **Labs**: experiments used to learn techniques and further explore the content including Heat Transfer, Specific Heat Capacity, Heat and Phase Changes, Combustion, and Calorimetry ● **Computer Access**: online interactives and simulations related to unit topics including observing kinetics of chemical reactions, compare heat transfer in gas and liquid samples, and identifying patterns in heat and phase changes ● **Activities**: inquiry-based exercises requiring manipulation of materials including comparing endothermic and exothermic processes, compare sensory experiences of temperature

Unit 5 Lab Materials List

Items purchased yearly at the store are **bolded*

- **lighter**
- sand
- sodium bicarbonate **(baking soda)**
- **candles**
- **iron wire**
- **isopropanol (rubbing alcohol)**
- potassium chlorate
- **sugar**
- concentrated sulfuric acid
- **cornstarch**
- **disposable gloves**
- iron powder
- magnesium powder
- aluminum powder
- hydrochloric acid
- calcium chloride, anhydrous
- ammonium chloride
- thermometer **batteries**
- **ice**
- brass rod
- **foam cups**
- **large marshmallow**
- **paraffin oil**
- **vinegar**
- calcium carbonate
- **table salt**
- **steel wool**
- **wooden splints**
- copper wire
- zinc oxide
- calcium chloride
- cheese puffs
- toasted corn snacks
- **paper clips**
- safety pins
- corks
- **modeling clay**
- **empty tuna fish can**
- **empty soda cans with tabs**
- **aluminum foil**
- wire mesh