DELAWARE VALLEY SCHOOL DISTRICT

PLANNED INSTRUCTION

A PLANNED COURSE FOR:

Honors Chemistry

Grade Level: 10,11,12

Date of Board Approval: ______2018_____________

DELAWARE VALLEY SCHOOL DISTRICT

Planned Instruction

Title of Planned Instruction: Honors Chemistry

Subject Area: Science **Grade(s):**10,11,12

Course Description:

Honors Chemistry covers all the topics of general chemistry. Significantly more material is covered at a faster pace than in the regular section of Chemistry. In addition, considerable application of math is required for the problem solving and critical reasoning in Honors Chemistry. The course requires laboratory investigations, an increased use of technology, and the analysis of applied problems using real data. This course is designed for highly motivated students of exceptional ability who have a strong interest in science.

Time/Credit for the Course:

FULL YEAR, 1 CREDIT

Curriculum Writing Committee:

Marisa Avery

DELAWARE VALLEY SCHOOL DISTRICT

Curriculum Map

1. **Marking Period One -Overview with time range in days:** 45 days
   Introduce methods of evaluating data and introduce qualitative and quantitative relationships in matter.

   Marking Period One -Goals:
   Understanding of:

   - Collect density data using various methods of measurement for mass and volume
   - Create a spreadsheet in which students will categorize and arrange data
   - Appraise and choose number of significant digits for each data entry
   - Evaluate the result of experimental calculation and compare answer to an accepted value
   - Employ methods of descriptive statistics to analyze, critique, and compare density measurements
   - Demonstrate knowledge of linear functions for data analysis
   - Construct unit conversions
   - Conversions between moles, mass, molecules, and atoms
   - Calculations of percent composition, empirical formulas, and molecular formulas
   - Develop a repertoire of techniques for identifying, naming, and determining the formula of the following types of chemical compounds: alkanes, alcohols, ionic and molecular
   - Evaluate the reactant chemicals in a chemical reaction for reaction type, synthesis, combustion, single replacement, double replacement or oxidation-reduction

2. **Marking Period Two -Overview with time range in days:** 45 days
Develop understanding of stoichiometry, limiting reactants, solubility rules, molarity of ions in solution. Introduce periodic trends, their contributing factors, and gain a deep understanding of energy calculations with the electromagnetic spectrum.

Marking Period Two -Goals:
Understanding of:

- Balance equations to find the stoichiometric ratio between reactants and products
- Synthesize the relationships among number, mass and volume of matter to predict, both quantitatively and qualitatively, the outcome of chemical reactions including limiting reagent reactions and predicting percent yield
- Evaluate ionic compounds based on solubility and structure
- Predict the reaction outcome in terms of mass of solid formed and molarities of ions remaining when two solutions containing ionic compounds are mixed
- Develop the necessary analysis to determine chemical identity from solubility, color and pH data
- Develop the trends of physical properties for the elements based on position in the periodic table
- Calculate energy, wavelength, and frequency based on values of the elements/ compounds in the electromagnetic spectrum
- Relate physical properties to the electronic structure of an element

3. **Marking Period Three -Overview with time range in days:** 45 days
Introduce basic and advanced concepts of periodic law, atomic structure, and molecular geometry. Introduce basic and advanced concepts of kinetic molecular theory, gas laws, and acids and bases.

Marking Period Three -Goals:
Understanding of:

- Model molecular geometries based on valence configuration of the central atom in a molecular compound
- Predict intermolecular forces and hybridization based on the geometry and polarity of a molecule
- Correctly draw Lewis structures based on the VSEPR Theory

- Assess gaseous systems based on temperature, pressure, volume and number of moles
- Apply Boyle's, Charles', Gay-Lussac's, combined, and ideal gas laws to calculate the pressure, volume, temperature, or moles of gases.
- Categorize chemicals as acids or bases
- Categorize reactions as strong or weak acid or base
- Develop methods, especially laboratory methods, for quantifying the results of acid/base reactions
- Implement laboratory methods that incorporate the use of electronic data collection and data graphing in Excel
- The pH can be controlled by buffers
- Comparing pH to pKa can determine the extent of labile hydrogen ions in a conjugate acid-base pair
- Solubility can be understood as a chemical equilibrium

4. **Marking Period Four –Overview with time range in days:** 45 days
Principles and concepts of chemical equilibrium are introduced, along with methods to analyze and collect data from an equilibrium system. Introduce thermochemistry, reaction kinetics, and develop an understanding of the principles of electrochemistry including oxidation-reduction. Represent these systems mathematically and graphically.

Marking Period Four -Goals:
Understanding of:

- Many classes of reactions have both forward and reverse reactions
- The current state of a reversible reaction can be characterized by the amount of reactants that have become products
- The reaction quotient is the ratio of products to reactants
- When a system is at equilibrium macroscopic variables do not change over time
- Equilibrium results when the rate of the forward reaction equals the rate of the reverse reaction
- The equilibrium constant can be used to determine the if the equilibrium favors reactants or products
- Equilibrium systems respond to changes by partially countering the effect of the change

- Equilibrium systems respond to change by bringing the reaction quotient to equal the equilibrium constant
- Principles of chemical equilibrium can be applied to acid-base chemistry
- Develop through laboratory experiments the principles of calorimetry
- Analyze a chemical system in terms of entropy and enthalpy to predict spontaneous chemical reactions
- When the difference in Gibb's free energy is larger than the thermal energy in a chemical reaction, the equilibrium constant is extreme
- When the difference in Gibb's free energy is comparable to the thermal energy,
- the equilibrium constant is near 1
- Propose a rate law for a chemical reaction based on experimental data
- Relate the order of an individual reactant to a unique linear function
- Predict a reaction mechanism based on the rate law for a reaction
- Draw Boltzman distributions and potential energy diagrams for a reaction based on the principles of reaction kinetics
- Justify the identification of redox reactions in terms of electron transfer
- Design an experiment in the laboratory involving a redox reaction
- Interpret the results of an experiment involving a redox reaction
- Predict qualitative or quantitative change in electrochemical cells based on halfcell reactions or Faraday's Law
- Analyze data from reactions in electrochemical cells
- Interpret from data underlying redox reaction in galvanic and electrolytic cells

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UNIT: Conversions, Naming, and Chemical Reactions

Big Idea #1:

- Chemistry is the study of matter and the changes it undergoes.

Essential Questions:

- What are the differences between pure substances and mixtures?

Concepts:

- The use of significant figures assures that quantitative observations are both accurate and precise.
- Different compounds can be formed from different combinations of the same elements according to the law of multiple proportions.
- Observations of matter can be qualitative, quantitative, direct or indirect.

Competencies:

- Explain the structure of matter, its physical properties, and what happens when one material comes in contact with another

Big Idea #2:

- Chemical changes are represented by a balanced chemical equation that identifies the ratios with which reactants react and products form.

Essential Questions:

- How are moles used to connect numbers of particles on the macroscopic level?

Concepts:

- Empirical formulas are the lowest whole number ratios of atoms in a compound and can be converted to molecular formulas.
- Mass percent's can be used to verify the purity of compounds.

Competencies:

- Complete conversion calculations with the correct number of significant figures
- Select and apply mathematical routines to mass data to identify the composition of substances and/or mixtures.
- Students can connect the number of particles, moles, mass, and volume of substances to one another.
- Students correctly name and write the formula for molecular and ionic compounds, alkanes, and alcohols.

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UNIT: Stoichiometry and The Periodic Table

Big Idea #1:

- Chemical reactions are predictable.

Essential Questions:

- How do stoichiometric ratios relate reactants to products in a chemical reaction?
- What factors identify the types of chemical reactions?

Concepts:

- According to the law of conservation of matter, the mass of the products in a chemical reaction is equal to the mass of the reactants.
- The amounts of reactants and products involved in a chemical reaction can be predicted using mole relationships.

Competencies:

- Explain the structure of matter, its properties, and what happens when one material comes in contact with another.
- Predict products of simple chemical reactions and write the correct balanced chemical equations for those reactions.
- Apply the mole concept, or Avogadro's number, in stoichiometric calculations, including those involving limiting reactants and percent yield.

Big Idea #2:

- Periodic trends in the properties of atoms allow for the prediction of physical and chemical properties.

Essential Questions:

- How does the periodic table help to determine the types of bonds that will form, what elements, gain or lose electrons, or the polarity of molecules?
- How do quantum numbers help determine electron position?

Concepts:

- Chemical periodicity is the basis for the arrangement of the periodic table.
- The polarity of a molecule can be determined by the distribution of electrons around the molecule.
- Trends in the periodic table can predict the properties and behaviors of elements.
- Physical properties of matter can be classified as intensive (like density) or extensive (like mass).

Competencies:

- Use multiple conversions to calculate moles, mass, or atoms in a chemical sample.
- Explain the structure of matter, its properties, and what happens when one material comes in contact with another.
- Use the periodic table to describe electronegativity, ionization energy, electron affinity, atomic size, and ionic size.
- Complete energy calculations by using the speed of light constant and Planck's constant.

UNIT: Structure and Properties of Matter

Big Idea #1:

- Chemical bonding determines the properties and shapes of molecules

Essential Questions:

- What properties in substances are forces of attraction between particles important in determining?
- What are the strong electrostatic forces of attraction holding atoms together in a unit called?
- How does the distribution of electrons in atoms affect the formation of a compound?

Concepts:

- The type of bonding which holds the substance together determines its physical properties such as melting point, boiling point, electrical conductivity, water solubility and vapor pressure.
- London dispersion forces, dipole-dipole, and hydrogen bonding are intermolecular forces to describe the strength of molecules.
- Different compounds can be formed through a series of collisions called a reaction mechanism.

Competencies:

- The student can determine the main intermolecular force within a molecule to determine its properties.
- Explain how a bonding model involving delocalized electrons is consistent with properties of metals and the shell model of the atom.
- Use Lewis diagrams and VSEPR to predict the geometry of molecules, predict polarity, and identify hybridization.

Big Idea #2:

- Chemical reactions are predictable.

Essential Questions:

- How are Lewis structures used to show bonding in chemical compounds?
- How do stoichiometric ratios relate reactants to products and gases in a system at equilibrium?
- How are solutions classified as acidic, basic, or neutral?

Concepts:

- Identify lone pairs in molecules to help determine chemical bond and formation according to the VSEPR Theory
- According to the Le Chatelier's Principle systems at equilibrium will respond to stress by counteracting the stress.
- Acids and bases will be defined according to the Arrhenius and Bronsted-Lowry definitions
- Conversions between concentration and pH/ pOH will be completed

Competencies:

- Deduce Lewis structures of molecules and ions
- Draw Lewis structures for compounds whose central atom does not obey the octet rule
- Use the gas laws to calculate temperature, pressure of volume given enough information.
- Apply gas law equations to calculate changes in variables depending on conditions
- Demonstrate how changes in matter are accompanied by changes in energy
- Complete an acid base titration and use the concept of molarity to determine the concentration of a titration reaction.
- Compare the strengths of acids and bases and apply these concepts to buffer solutions

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UNIT: Equilibrium and Thermochemistry

Big Idea #1:

- Chemistry is the study of matter and the changes it undergoes.

Essential Questions:

- What are the factors that affect the rate at which a chemical reaction occurs?
- How can chemical potential energy be related to the heat lost or gained in chemical reactions?
- What is the difference between spontaneous and nonspontaneous processes?

Concepts:

- A chemical reaction will proceed until equilibrium is reached or until a limiting reactant is exhausted.
- Experimental data is the only way to determine the rate of a reaction.
- Different compounds can be formed through a series of collisions called a reaction mechanism.
- Energy is a conserved quantity, which means it cannot be created or destroyed.

Competencies:

- Explain the rate of a chemical reaction through data interpretation
- Predict and or evaluate a reaction mechanism using the balanced chemical reaction and the experimentally determined rate law
- Explain radioactive decay as a first order rate of reaction
- Calculate the spontaneity of a reaction based on enthalpy, entropy, and temperature of a chemical reaction

Big Idea #2:

- Chemical reactions are predictable.

Essential Questions:

- How do stoichiometric ratios relate reactants to products in an electrochemical cells and oxidation-reduction reactions?
- What are the unique characteristics of electrochemical reactions?

Concepts:

- According to the law of conservation of matter, the mass of the products in a chemical reaction is equal to the mass of the reactants.
- The amounts of reactants and products involved in a chemical reaction can be predicted using mole and coulomb relationships.

Competencies:

- Explain the structure of matter, its properties, and what happens when one material comes in contact with another.
- Predict products of electrochemical reactions and write the correct balanced chemical equations for those reactions.
- Apply the mole concept to electrons in stoichiometric calculations, including those involving half-reactions and yields at the anode and cathode.

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Curriculum Plan

Unit: **Conversions, Naming, and Chemical Reactions** **Time Range in Days:** 45 days

Standard(s): PA Academic Standards, PA Core State Standards for English Language Arts & Literacy in Science and Technical Subjects, Academic Standards for Science and Technology and Engineering Education

Standards Addressed: (See Appendix for Description)
S11.A.1.1.5 , S11.A.1.2.2 , S11.A.1.3.4 , S11.A.2.1.2 , S11.A.2.1.3 , S11.A.2.1.5 , S11.A.2.2.1 , S11.A.3.1.1 , S11.A.3.1.2 , S11.A.3.1.3 , S11.A.3.2.1 , S11.A.3.3.2 , S11.A.3.3.3 , S11.C.1.1.5 , S11.C.2.1.1 , S11.C.3.1.2 , RST.1 , RST.2 , RST.3 , RST.4 , RST.5 , RST.6 , RST.7 , RST.8 , RST.9 , RST.10 , WHST.1 , WHST.2 , WHST.4 , WHST.5 , WHST.6 , WHST.7 , WHST.8 , WHST.9 , WHST.10 , 3.2.C.A1 , 3.2.C.A2 , 3.2.C.A4

Overview: This unit introduces methods of collecting and evaluating data with appropriate precision. The proper nomenclature for chemical compounds is studied. Qualitative and quantitative relationships that exist in interactions of matter are presented.

Focus Question(s):

- What are safe laboratory practices?
- What are the principles of balancing equations?
- How are accuracy and precision used in laboratory measurements?
- What are the proper protocols for naming chemical species?

Goals: Students will be able to:

- Use lab equipment to make precise measurements
- Explain the specific laboratory safety considerations for each lab activity
- Correctly name and write chemical formulas for most common chemicals
- Complete mole conversions

Objectives:

- Determine the number of significant digits in a set of data. (DOK – Level 2)

- Evaluate the number of significant digits in a value calculated from data. (DOK – Level 3)
- Evaluate the precision of a scientific instrument. (DOK – Level 3)
- Understand that laboratory safety is a fundamental science practice (DOK-Level 2)
- Calculate the percent difference of an experimental determination. (DOK – Level 3)
- Analyze the overall error in an experimental determination. (DOK – Level 4)
- Compare overall error to percent difference using the if/then statement in Excel. (DOK – Level 4)
- Determine the density of regular solid, irregular solid and liquid. (DOK – Level 3)
- Use the physical property of density to identify a substance. (DOK – Level 2)
- Create an Excel spreadsheet, formatting each cell in the spreadsheet to the correct number of significant digits. (DOK – Level 2)
- Write formulas in the Excel spreadsheet to do calculations with the data collected. (DOK – Level 2)
- Determine the regression equation of best fit (linear). (DOK – Level 2)
- Use equations to represent lines. (DOK – Level 2)
- Appraise a substance as an element, compound or mixture. (DOK – Level 2)
- Identify and name ions, including polyatomic ions. (DOK – Level 2)
- Categorize a compound as ionic or molecular. (DOK – Level 2)
- Recognize chemical symbols. (DOK – Level 1)
- Name chemical compounds from chemical formulas. (DOK – Level 3)
- Write chemical formulas from compound names. (DOK – Level 3)
- Determine molar mass. (DOK – Level 1)
- List the physical properties of matter. (DOK – Level 1)
- Correlate the position of an element in the periodic table with its physical properties. (DOK – Level 2)
- Describe the heating and cooling curves of a substance. (DOK – Level 3)
- Melting point of stearic or benzoic acid lab. (DOK – Level 3)
- Use data from melting point lab to apply regression and piecewise skills (DOK – Level 4)
- Make a xy scatter plot in Excel. (DOK – Level 2)

- Use series function in Excel to establish domains for a piece wise function from the melting point lab. (DOK – Level 3)
- Use trend line function in Excel to determine regression equations and correlation coefficients. (DOK – Level 2)
- Determine of moles given mass, particles or volume. (DOK – Level 2)
- Determine the percent composition of a compound. (DOK – Level 2)
- Construct the empirical formula of a compound given percent composition, mass of individual elements or combustion analysis data. (DOK – Level 3)
- Determine the molecular formula given the empirical formula and molar mass. (DOK – Level 2)
- Determine the percent water in hydrates such as copper sulfate pentahydrate and magnesium sulfate heptahydrate in the lab. (DOK – Level 3)
- Determine the mole ratio of water to anhydrous salt in copper sulfate pentahydrate and magnesium sulfate heptahydrate in the lab. (DOK – Level 3)
- Determine the mole ratio of water to anhydrous salt in an unknown hydrate given molar mass of anhydrous salt. (DOK – Level 4)

Core Activities and Corresponding Instructional Methods:

- Integrate academic and content specific vocabulary o Direct instruction and practice on significant digits, unit conversions, compound nomenclature, limiting reagent problems, and predict amount of products and remaining reactants
  - Lead a classroom discussion that prompts students to compare and contrast various methods utilized in obtaining solutions
  - Guided practice: Include step-by-step written explanation of solutions to open-ended questions
  - Build background knowledge by using Microsoft Excel and Vernier probes

    o Graphing utility (Microsoft Excel, LoggerPro)
- Analyze examples of applications of functions o Classroom discussion and guided practice on building models from analyzing data in a real-world situation (i.e. melting point, combustion analysis)
  - Develop both a verbal and/or written logical argument to support conclusions about observations, problem solving and data interpretation

Assessments:

Diagnostic: Keystone Algebra I and Biology Exams

Formative:

- Teacher observation and questioning
- Homework preparation
- Graded homework
- Quizzes
- Chapter Tests
- Lab reports

Summative:

- Common Assessment for Unit 1
- Cumulative Final Assessments

Extensions:

- Rigorous worksheets in chemistry
- Textbook applications and extensions
- Students can design their own density experiment on a substance of their choice and modify the spreadsheet accordingly.
- Students can design their own melting point experiment from a list of acceptable substances and modify the spreadsheet accordingly.
- Additional exercises in General Chemistry, pg. 24-26 #1.18, 1.28, 1.30, 1.22, 1.26, 1.28, 1.30, 1.34, 1.40; Pg. 55-57 #2.14, 2.30, 2.31, 2.34, 2.36, 2.40, 2.42, 2.46, 2.48, 2.50; Pg. 89-93 #3.9, 3.14, 3.16, 3.18, 3.24, 3.30, 3.40, 3.44, 3.46, 3.52, 3.54, 3.60.

Correctives:

- Remediation practice worksheets
- More extensive direct instruction
- Review exercises in General Chemistry, practice exercises on pages 11, 17, 21, 22, 37, 43, 45, 47, 49, 51, 65-68, 71, 72, 75, 79, or see additional problems at the end of each chapter.

Materials and Resources:

- Chemistry textbook
- Vernier LoggerPro
- Microsoft Office Suite
- SMART notebook
- Media Player
- Smartboard
- Edmodo web site
- Practice worksheets
- Graphing calculator
- Laptop computers
- Digital balances
- Rulers
- Syringes
- Graduated cylinders
- Assorted metals
- Water
- Ethyl alcohol
- Thermometers or temperature probes
- Beakers
- Hot plates
- Stearic or benzoic acid
- Crucibles
- Hydrates

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Unit: Stoichiometry and The Periodic Table **Time Range in Days:** 45 days

Standard(s): PA Academic Standards, PA Core State Standards for English Language Arts & Literacy in Science and Technical Subjects

Standards Addressed: (See Appendix for Description)
S11.A.1.1.4 , S11.A.1.1.5 , S11.A.1.3.1 , S11.A.2.1.2 , S11.A.2.1.3 , S11.A.2.1.5 , S11.A.2.2.1 , S11.A.3.1.1 , S11.A.3.1.2 , S11.A.3.1.4 , S11.A.3.2.1 , S11.A.3.2.3 , S11.A.3.3.2 , S11.A.3.3.3 , S11.C.1.1.1 , S11.C.1.1.3 , S11.C.1.1.5 , S11.C.2.1.1 , S11.C.2.1.2 , S11.C.2.1.4 , S11.C.3.1.2 , S11.C.3.1.6 , RST.1 , RST.2 , RST.3 , RST.4 , RST.5 , RST.6 , RST.7 , RST.8 , RST.9 , RST.10 , , WHST.1 , WHST.2 , WHST.4 , WHST.5 , WHST.6 , WHST.7 , WHST.8 , WHST.9 , WHST.10 , 3.2.C.A1 , 3.2.C.A2 , 3.2.C.A5 , 3.2.12.A5

Overview: Develop understanding of stoichiometry, limiting reactants, solubility rules, molarity of ions in solution. Introduce periodic trends, their contributing factors, and gain a deep understanding of energy calculations with the electromagnetic spectrum.

Focus Question(s):

- How can the solubility of chemical compounds be predicted?
- Predict gas behavior as they undergo pressure, volume and temperature changes?
- What information does the periodic table provide?

Goals: Students will be able to

- Write balanced equations and correctly predict products
- Predict the yield for a variety of chemical reactions
- Analyze reactants reagents in solution to learn the principles of solubility
- Analyze data from experiments and computer simulations to understand the relationships in conversions from moles to grams to atoms

Objectives:

- Write chemical equations for the combustion of a given alkane or alcohol. (DOK – Level 2)

- Balance chemical equations using trial and error and augmented matrices. (DOK – Level 3)
- Predict results quantitatively of a chemical reaction. (DOK – Level 4)
- Determine theoretical yield of a chemical reaction given stoichiometric amounts of reactants. (DOK – Level 4)
- Predict theoretical yield of a chemical reaction given a limiting reactant. (DOK – Level 4)
- Determine percent yield of chemical reactions. (DOK – Level 3)
- Determine the percent water in hydrates such as copper sulfate pentahydrate and magnesium sulfate heptahydrate in the lab. (DOK – Level 3)
- Determine the mole ratio of water to anhydrous salt in copper sulfate pentahydrate and magnesium sulfate heptahydrate in the lab. (DOK – Level 3)
- Appraise compounds as acids, bases, acidic salts, basic salts or neutral salts. (DOK – Level 3)
- Memorize solubility rules. (DOK – Level 1)
- Write ionic and net ionic equations using solubility rules. (DOK – Level 3)
- Differentiate eight unknown white solids lab (DOK – Level 3)
- Write equations for the reactions of acids and bases. (DOK – Level 3)
- Design solutions of a specific molarity. (DOK – Level 2)
- Evaluate volume of a specific solution needed for a reaction. (DOK – Level 4)
- Appraise the dilution factor for molarity of ions when solutions are mixed. (DOK – Level 3)
- Calculate wavelengths and frequencies of electromagnetic radiation. (DOK – Level 2)
- Determine the wavelength and frequency of an electron in any hydrogen series. (DOK – Level 3)
- Write electronic configurations for atoms and ions. (DOK – Level 2)
- Draw the electronic diagram of atoms and ions. (DOK – Level 2)
- Determine an atom or ion to be paramagnetic or diamagnetic. (DOK – Level 2)
- Determine quantum numbers for electrons within atoms. (DOK – Level 3)
- Explain the Aufbau principle, Hund’s rule, the Pauli Exclusion Principle and the Heisenberg uncertainty principle. (DOK – Level 3)
- Use shielding, Coulomb’s Law and stability principles to explain trends of periodic properties. (DOK – Level 4)

- Evaluate situations for potential and kinetic energy. (DOK – Level 2)

Core Activities and Corresponding Instructional Methods:

- Integrate academic and content specific vocabulary ○ Direct instruction on atomic structure, nature if gases and thermodynamic systems
    - Lead a classroom discussion that prompts students to compare and contrast various methods utilized in obtaining solutions
    - Guided practice: Include step-by-step written explanation of solutions to open-ended questions
    - Build background knowledge by using Microsoft Excel and Vernier probes
      ○ Graphing utility (Microsoft Excel, LoggerPro)
- Analyze examples of applications of functions
    - Classroom discussion and guided practice on building models from analyzing data in a real world situation (i.e. molecular geometries, hand warmer analysis)
    - Develop both a verbal and/or written logical argument to support conclusions about behaviors of about observations, problem solving and data interpretation

Assessments:

Diagnostic: Keystone Algebra I and Biology Exams

Formative:

- Teacher observation and questioning
- Homework preparation
- Graded homework
- Quizzes
- Chapter Tests
- Lab reports

Summative:

- Common Assessment for Unit 2
- Cumulative Final Assessments

Extensions:

- Rigorous worksheets in chemistry
- Rigorous practice programs
- Textbook applications and extensions
- Additional exercises in Chemistry, pg. 92-93 #3.68, 3.70, 3.76, 3.84, 3.92; Pg. 246-249 #7.16, 7.24, 7.28, 7.32, 7.44, 7.50, 7.52, 7.56, 7.62, 7.72, 7.74, 7.80, 7.82, 7.84; Pg. 282-283 #8.28, 8.38, 8.44, 8.49, 8.53, 8.60, 8.66.

Correctives:

- Remediation practice worksheets
- More extensive direct instruction
- Review exercises in Chemistry, practice exercises 83, 85, 85, 216, 218, 224, 226, 232, 233, 235, 239, 244, 257, 261, 264, 267, 280, or see additional problems at the end of each chapter.

Materials and Resources:

- Chemistry textbook
- Vernier LoggerPro
- Microsoft Office Suite
- SMART notebook
- Media Player
- Smartboard
- Edmodo web site
- Practice worksheets
- Laptop computers
- Digital balances
- Volumetric flasks
- Erlenmeyer flasks
- Beakers
- Hot plates
- Troughs
- Spectrophotometer
- $CuSO_4$

- Evaporating dishes
- Hot plate
- Pipettes
- Test tubes
- Video
- Hydrochloric acid
- Sodium hydroxide
- Citric acid
- Aluminum metal
- Iron bolts
- Magnesium metal
- Magnesium oxide
- Test reagents
- pH paper
- Test tubes

DELAWARE VALLEY SCHOOL DISTRICT

<u>Unit:</u> Structure and Properties of Matter **<u>Time Range in Days:</u>** 45 days

Standard(s): PA Academic Standards, PA Core State Standards for English Language Arts & Literacy in Science and Technical Subjects

Standards Addressed: (See Appendix for Description)

S11.A.1.1.3 , S11.A.1.1.4 , S11.A.1.1.5 , S11.A.1.3.1 , S11.A.1.3.4 , S11.A.2.1.2 , S11.A.2.1.3 , S11.A.2.1.5 , S11.A.2.2.1 , S11.A.3.1.1 , S11.A.3.1.2 , S11.A.3.1.3 , S11.A.3.2.2 , S11.A.3.2.3 , S11.C.1.1.1 , S11.C.1.1.3 , S11.C.2.1.1 , S11.C.2.13 , RST.1 , RST.2 , RST.3 , RST.4 , RST.5 , RST.6 , RST.7 , RST.8 , RST.9 , RST.10 , WHST.1 , WHST.2 , WHST.4 , WHST.5 , WHST.6 , WHST.7 , WHST.8 , WHST.9 , WHST.10 , 3.2.12.A4 , 3.2.12.A5

Overview: Introduce basic and advanced concepts of periodic law, atomic structure, and molecular geometry. Introduce basic and advanced concepts of kinetic molecular theory, gas laws, and acids and bases.

Focus Question(s):

- How can electronic structure predict molecular geometry?
- How are Lewis structures used to show bonding in chemical compounds?
- What is the relationship between pressure, volume, and temperature?
- How do stoichiometric ratios relate reactants to products and gases in a system at equilibrium?
- How are solutions classified as acidic, basic, or neutral?

Goals: Students will be able to

- Predict the shape of molecules using valence electrons, Lewis diagrams and bonding theory
- Analyze data from experiments and computer simulations to understand the relationships in gaseous parameters of temperature, volume and pressure
- Define kinetic molecular theory and use it to explain differences in real versus ideal gases
- Explain that many reactions involve the transfer of hydrogen ions
- Discuss and compare ionization of strong and weak acids and bases

Objectives:

- Draw Lewis dot diagram for an element. (DOK – Level 2)

- Use Lewis dot diagrams of elements to construct a Lewis dot diagram of a molecular compound or polyatomic ion. (DOK – Level 4)
- Use valence shell electron pair repulsion theory (VSEPR) to predict geometry of molecules. (DOK – Level 3)
- Use hybrid orbital theory to predict molecular geometries. (DOK – Level 3)
- Indicate resonance structures when necessary. (DOK – Level 4)
- Use bond polarity and molecular geometry to determine polarity of a molecular structure. (DOK – Level 4)
- Use molecular polarity and structure to enumerate intermolecular forces on a compound. (DOK – Level 4)
- Identify a substance as a potential Lewis acid or base. (DOK – Level 4)
- Convert pressure from psi, mm Hg, tor, in Hg, Pascal to atm. (DOK – Level 2)
- Draw closed end and open-ended manometer descriptions of pressure. (DOK – Level 2)
- Use ideal gas law, Charles's Law and Boyle's Law to evaluate pressure, volume and temperature changes on a gas sample. (DOK – Level 2)
- Determine the value of the gas constant R in the laboratory using hydrogen gas formation. (DOK – Level 3)
- Apply the principles of stoichiometry to gas reactions. (DOK – Level 3)
- Use Dalton's Law of partial pressure to correct pressures when gas is collected over water. (DOK – Level 3)
- Use Graham's Law to determine molecular masses or velocities of relative gas samples. (DOK – Level 3)
- Distinguish between strong acids and weak acids. (DOK – Level 2)
- Distinguish between strong bases and weak bases. (DOK – Level 2)
- Write equilibrium law expressions for molecular equilibrium (DOK – Level 2)
- Evaluate the concentrations of all reagents in a molecular equilibrium (DOKLevel3)
- Predict changes in molarity as stress is applied to a system at equilibrium (DOK Level 3)
- Predict the direction of the reaction to reach equilibrium (DOK-Level 3)
- Describe weak acid-base as conjugate pairs. (DOK – Level 3)
- Identify the pH of a salt using its conjugate acid. (DOK – Level 3)
- Describe weak acid-base as conjugate pairs. (DOK – Level 3)

- Predict equilibrium law expressions for weak acids and bases (DOK-Level 3)
- Evaluate the pH of a solution at any point in a titration (DOK-Level 4)
- Evaluate the pH at the equivalence point of a titration (DOK-Level 4)
- Evaluate the equilibrium constant from the half-equivalence point (DOK-Level-4)
- Evaluate the molar mass of a solid acid from titration data (DOK-Level3)
- Write equilibrium expressions for insoluble salts. (DOK – Level 2)
- Calculate solubility product constant and ionic concentrations at equilibrium. (DOK – Level 3)
- Qualitatively and quantitatively evaluate the common ion effect in solubility problems. (DOK – Level 3)

Core Activities and Corresponding Instructional Methods:

- Integrate academic and content specific vocabulary
  - Direct instruction and practice on all three types of equilibrium concepts and problems
  - Lead a classroom discussion that prompts students to compare and contrast various methods utilized in obtaining solutions
  - Guided practice: Include step-by-step written explanation of solutions to open-ended questions
  - Build background knowledge by using Microsoft Excel and Vernier probes
  - Graphing utility (Microsoft Excel, LoggerPro)
- Analyze examples of applications of functions o Classroom discussion and guided practice on building models from analyzing data in a real-world situation (i.e. determining equilibrium constants for acids, bases and insoluble salts, molar mass of solid acids

  and ionic concentrations in samples)
  - Develop both a verbal and/or written logical argument to support conclusions about behaviors of systems at equilibrium

Assessments:

Diagnostic: Keystone Algebra I and Biology Exams

Formative:

- Teacher observation and questioning
- Homework preparation
- Graded homework
- Quizzes
- Chapter Tests
- Lab reports

Summative:

- Common Assessment for Unit 3
- Cumulative Final Assessments

Extensions:

- Rigorous worksheets in chemistry
- Rigorous practice programs
- Textbook applications and extensions
- Additional exercises in Chemistry, pg. 317-319 #9.3, 9.16, 9.30, 9.38, 9.41, 9.44, 9.49, 9.62; Pg. 361-362 #10.7, 10.11, 10.17, 10.33, 10.41; Pg. 169-173 #5.13, 5.20, 5.24, 5.32, 5.56, 5.67, 5.78; Pg. 131 #5.27, 5.28; Pg. 133 #4.78; Pg.586-588 #16.4, 16.5, 16.15, 16.17, 16.21, 16.22, 16.31, 16.37, 16.54.

Correctives:

- Remediation practice worksheets
- More extensive direct instruction
- Review exercises in Chemistry, practice exercises on pages 290, 298, 300, 301, 304, 307, 310, 312, 333, 337, 346, 351, 409, 141, 149, 151, 152, 153, 156, 158, 108, 123, 127, 128, 549, 550, 553, 554, 557, 558, 563.

Materials and Resources:

- Chemistry textbook
- NetOp Vision
- VernierLoggerPro
- Adobe Photoshop
- Microsoft Office Suite
- DERIVE
- Minitab 12
- SMART notebook
- Inspiration 8
- Smartboard
- Edmodo web site
- Practice worksheets
- Laptop computers
- Derive software
- Digital balances
- Probes (as needed)
- Computer interface boxes
- Chemistry lab resources (as needed)
- Internet
- Resource library of chemistry textbooks
- Eudiometer tubes
- Bunsen burners
- Beakers
- pH probes
- Computer interface boxes
- Burettes
- Acids (solid acids, hydrochloric and/or nitric)
- sodium hydroxide
- Acid/base indicators
- Ionic and molecular solids (white)
- Well plates

- Test reagents
- Test tubes
- Test reagents
- pH paper

DELAWARE VALLEY SCHOOL DISTRICT

Unit: Equilibirum and Thermochemistry **Time Range in Days:** 45 days

Standard(s): PA Academic Standards, PA Core State Standards for English Language Arts & Literacy in Science and Technical Subjects

Standards Addressed: (See Appendix for Description)
S11.A.1.1.4 , S11.A.1.1.5 , S11.A.1.2.2 , S11.A.1.3.1 , S11.A.2.1.2 , S11.A.2.1.5 , S11.A.2.2.1 , S11.A.3.1.1 S11.A.3.3.2 , S11.A.3.1.2 , S11.A.3.1.3 , S11.A.3.2.1 , S11.A.3.2.2 , S11.A.3.2.3 , S11.C.1.1.1 , S11.C.1.1.3 , S11.C.2.1.2 , S11.C.2.1.3 , RST.1 , RST.2 , RST.3 , RST.4 , RST.5 , RST.6 , RST.7 , RST.8 , RST.9 , RST.10 , WHST.1 , WHST.2 , WHST.4 , WHST.5 , WHST.6 , WHST.7 , WHST.8 , WHST.9 , WHST.10 , 3.2.C.A2 , 3.2.C.A4 , 3.2.12.A4

Overview: Principles and concepts of chemical equilibrium are introduced. Introduce methods to collect and analyze data from equilibrium system. Present frameworks to model equilibrium systems at the atomic level using particle representations and represent these systems mathematically and graphically. Introduce principles and concepts of reaction kinetics, voltaic and galvanic cells, oxidation-reduction.

Focus Question(s):

- What is the relationship between enthalpy and entropy in a chemical reaction?
- What is a system at equilibrium?
- What are the fundamental principles of chemical equilibrium?
- What is the difference between systems with equilibrium and systems without equilibrium?
- What is reaction kinetics?
- What reactions produce the energy in a electrochemical cell?
- How does the process of electrolysis produce products?
- How are principles of electrochemistry applied to mass quantities?

Goals: Students will be able to

- Analyze the spontaneity of a chemical reaction using entropy and enthalpy
- Analyze, solve and explain molecular equilibrium scenarios
- Analyze, solve and explain acid base equilibrium scenarios
- Analyze, solve and explain solubility equilibrium scenarios
- Analyze data from chemical reaction to determine a rate law
- Predict the direction of current flow and voltage of a battery

- Analyze solid samples for mass percent of transition metal elements

Objectives:

- Determine the heat absorbed or evolved in a calorimetry experiment. (DOK – Level 2)
- Determine the specific heat of a metal experimentally. (DOK – Level 2)
- Determine the temperature change of water when hot metal is added. (DOK – Level 1)
- Convert between calories and joules. (DOK – Level 1)
- Determine the heat evolved or absorbed during an aqueous chemical reaction in units of kilojoules per mole. (DOK – Level 3)
- Describe the enthalpy as internal energy associated with bond energy and structural conformation. (DOK – Level 4)
- Describe the entropy of a system in terms of state of matter and number of bonds. (DOK – Level 3)
- Describe the Gibb's Free energy as a function of the entropy and enthalpy. (DOK – Level 3)
- Use the signs of entropy and enthalpy to determine sign of free energy. (DOK – Level 3)
- Write heat of formation equations for compounds. (DOK – Level 2)
- Use the enthalpy of two or more chemical reactions to prove Hess's Law, both algebraically and experimentally. (DOK – Level 3)
- List the factors that affect the rate of reaction. (DOK – Level 1)
- Determine the instantaneous rate of reaction and the average rate of reaction from a concentration vs. time graph. (DOK – Level 3)
- Determine the exponents in a rate law from hypothetical reaction data. (DOK – Level 3)
- Determine the exponents in a rate law from actual reaction data. (DOK – Level 3)
- Determine the rate constant from reaction data. (DOK – Level 2)
- Qualitatively describe the relationship between data and the exponent in the rate law. (DOK – Level 3)
- Write the linear form of a first order reaction rate as a logarithm. (DOK – Level 3)
- Write the linear form of a second order reaction rate as an inverse. (DOK – Level

3)

- Determine the rate constant from the slope of the linear form. (DOK – Level 3)
- Identify radioactive decay as a first order rate problem. (DOK – Level 2)
- Calculate half-lives for zero, first and second order reactions. (DOK – Level 3)
- Calculate times for zero, first and second order reactions to reach a particular concentration. (DOK – Level 3)
- Distinguish between time and limiting reagent problems. (DOK – Level 3)
- Evaluate a reaction mechanism as appropriate based on the principles of kinetics. (DOK – Level 3)
- Evaluate rate data collected in the lab using graphs including semi-log scales. (DOK – Level 4)
- Draw Boltzman distribution at two different temperatures indicating activation energy on a single graph. (DOK – Level 3)
- Draw potential energy diagram indicating activation energy with and without a catalyst and Δ H. (DOK – Level 3)
- Assign oxidation numbers to elements in compounds. (DOK – Level 2)
- Appraise oxidizing agent and reducing agent. (DOK – Level 3)
- Balance oxidation/reduction equations by ion-election method. (DOK – Level 3)
- Determine percent iron in a sample using redox titration. (DOK – Level 3)

Core Activities and Corresponding Instructional Methods:

- Integrate academic and content specific vocabulary
    - Direct instruction and practice on solving rate problems, writing oxidation-reduction equations and explaining the principles of the electrochemical cells
    - Lead a classroom discussion that prompts students to compare and contrast various methods utilized in obtaining solutions
    - Guided practice: Include step-by-step written explanation of solutions to open-ended questions
    - Build background knowledge by using Microsoft Excel ○ Graphing utility (Microsoft Excel, LoggerPro)
- Analyze examples of applications of functions ○ Classroom discussion and guided practice on building models from analyzing data in a real-world situation (i.e.

iodine clock reaction, acid disproportionation of sodium thiosulfate, copper plated cathode)

- Develop both a verbal and/or written logical argument to support conclusions about behaviors of graphs

Assessments:

Diagnostic: Keystone Algebra I and Biology Exams

Formative:

- Teacher observation and questioning
- Homework preparation
- Graded homework
- Quizzes
- Chapter Tests
- Lab reports

Summative:

- End of year cumulative assessments

Extensions:

- Rigorous worksheets in chemistry
- Rigorous practice programs
- Textbook applications and extensions
- Additional exercises in Chemistry, pg. 537-540 #15.15.5, 15.6, 15.8, 15.16, 15.34, 15.41, 15.44; Pg. 205-207 #6.9, 6.23, 6.24, 6.32, 6.34, 6.45, 6.54; Pg657-658 #18.4, 18.5, 18.7, 18.8, 18.14, 18.19, 18.27; Pg. 503-506 #14.13, 14.16, 14.21, 14.28, 14.35, 14.4714.49; 698-699 #19.5, 19.6, 19.10, 19.12, 19.16, 19.24, 19.32.

Correctives:

- Remediation practice worksheets
- More extensive direct instruction
- Review exercises in Chemistry, practice exercises on pages 520, 521, 523, 526, 528, 529, 531, 533536, 186, 187, 191, 193, 194, 196 197, 198, 202, 203, 638, 640, 646, 650, 652, 653, 654, 472, 477, 481, 483, 485, 490, 491, 496, 667, 675, 678, 680, 681693, 695.

Materials and Resources:

- Chemistry textbook
- Vernier LoggerPro
- Microsoft Office Suite
- SMART notebook
- Media Player
- Smartboard
- Edmodo web site
- Practice worksheets
- Graphing calculator
- Laptop computers
- Digital balances
- Temperature probes
- Thermometers
- Styrofoam cups
- Beakers
- Cuvettes
- Stopwatches
- Computer interface boxes
- Graph paper
- Semi-log paper
- Video
- Potassium iodate
- Starch
- Sodium metabisulfite
- Sulfuric acid
- Sodium thiosulfate
- Test tubes
- Potassium permanganate
- Iron (II) sulfate
- Sodium hypochlorite (commercial bleach)

- Potassium iodide
- Potassium permanganate
- Iron (II) sulfate
- Potassium iodide
- Sodium sulfite
- Sulfuric acid

DELAWARE VALLEY SCHOOL DISTRICT

Primary Textbook(s) Used for this Course of Instruction

Name of Textbook: General Chemistry: The Essential Concepts, Seventh Addition

Textbook ISBN #: 0-07-340275-3

Textbook Publisher &Year of Publication: McGraw Hill, 2014

Curriculum Textbook is utilized in: Honors Chemistry

DELAWARE VALLEY SCHOOL DISTRICT

Pennsylvania Academic Standards

S8.A.1.1.4: Develop descriptions, explanations, predictions and models using evidence.
S8.A.1.2.3: Describe fundamental scientific or technological concepts that could solve practical problems (e.g., Newton's laws of motion, Mendelian genetics).
S8.A.1.3.1: Use ratio to describe change (e.g., percents, parts per million, grams per cubic centimeter, mechanical advantage).
S8.A.1.3.2: Use evidence, observations or explanations to make inferences about change in systems over time (e.g., carrying capacity, succession, population dynamics, loss of mass in chemical reactions, indicator fossils in geologic time scale) and the variables affecting these changes.
S8.A.1.3.3: Examine systems changing over time, identifying the possible variables causing this change, and drawing inferences about how these variables affect this change.
S8.A.1.1.2: Explain how certain questions can be answered through scientific inquiry and/or technological design.
S8.A.2.1.4: Interpret data/observations; develop relationships among variables based on data/observations to design models as solutions.
S8.A.2.1.5: Use evidence from investigations to clearly communicate and support conclusions.
S8.A.2.1.6: Identify a design flaw in a simple technological system and devise possible working solutions
S8.A.2.2.1: Describe the appropriate use of instruments and scales to accurately and safely measure time, mass, distance, volume or temperature under a variety of conditions.
S8.A.3.1.1: Describe a system (e.g., watershed, circulatory system, heating system, agricultural system) as a group of related parts with specific roles that work together to achieve an observed result.
S8.A.3.1.2: Explain the concept of order in a system [e.g., (first to last: manufacturing steps, trophic levels); (simple to complex: cell, tissue, organ, organ system)].
S8.A.3.1.3: Distinguish among system inputs, system processes, system outputs and feedback (e.g., physical, ecological, biological, informational).
S8.A.3.1.4: Distinguish between open loop (e.g., energy flow, food web) and closed loop (e.g., materials in the nitrogen and carbon cycles, closed-switch) systems.
S8.A.3.3.1: Identify and describe patterns as repeated processes or recurring elements in human-made systems (e.g., trusses, hub-and-spoke system in communications and transportation systems, feedback controls in regulated systems).
S8.C.1.1.1: Explain the differences among elements, compounds and mixtures.
S8.C.1.1.2: Use characteristic physical or chemical properties to distinguish one substance from another (e.g., density, thermal expansion/contraction, freezing/melting points, streak test).
S8.C.1.1.3: Identify and describe reactants and products of simple chemical reactions.
S8.C.2.1.2: Explain how energy is transferred from one place to another through convection, conduction or radiation.
S8.C.2.1.3: Describe how one form of energy (e.g., electrical, mechanical, chemical, light, sound, nuclear) can be converted into a different form of energy.

S8.C.2.2.1: Describe the Sun as the major source of energy that impacts the environment.
S8.C.2.2.2: Compare the time span of renewability for fossil fuels and the time span of renewability for alternative fuels.
S8.C.3.1.1: Describe forces acting on objects (e.g., friction, gravity, balanced versus unbalanced).
S8.C.3.1.2: Distinguish between kinetic and potential energy.
S11.A.1.1.3: Evaluate the appropriateness of research questions (e.g., testable vs. not-testable). **S11.A.1.1.4:** Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g., momentum, Newton's universal law of gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, ideal gas laws).
S11.A.1.1.5: Analyze or compare the use of both direct and indirect observation as means to study the world and the universe (e.g., behavior of atoms, functions of cells, birth of stars).
S11.A.1.2.2: Use case studies (e.g., Wright brothers' flying machine, Tacoma Narrows Bridge, Henry Petroski's Design Paradigms) to propose possible solutions and analyze economic and environmental implications of solutions for real world problems.
S11.A.1.3.1: Use appropriate quantitative data to describe or interpret change in systems (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).
S11.A.1.3.4: Compare the rate of use of natural resources and their impact on sustainability.
S11.A.2.1.2: Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design.
S11.A.2.1.3: Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.
S11.A.2.1.5: Communicate results of investigations using multiple representations.
S11.A.2.2.1: Evaluate appropriate methods, instruments and scale for precise quantitative and qualitative observations (e.g., to compare properties of materials, water quality).
S11.A.3.1.1: Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output and measurements to explain a system and its parts.
S11.A.3.1.2: Analyze and predict the effect of making a change in one part of a system on the system as a whole.
S11.A.3.1.3: Use appropriate quantitative data to describe or interpret a system (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).
S11.A.3.1.4: Apply the universal systems model of inputs, processes, outputs and feedback to a working system (e.g., heating, motor, food production) and identify the resources necessary for operation of the system.
S11.A.3.2.1: Compare the accuracy of predictions represented in a model to actual observations and behavior.
S11.A.3.2.2: Describe advantages and disadvantages of using models to simulate processes and outcomes.

S11.A.3.2.3: Describe how relationships represented in models are used to explain scientific or technological concepts (e.g., dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps).
S11.A.3.3.2: Compare stationary physical patterns (e.g., crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties.
S11.A.3.3.3: Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves).
S11.B.3.2.3: Explain how natural processes (e.g., seasonal change, catastrophic events, habitat alterations) impact the environment over time.
S11.B.3.3.2: Compare the impact of management practices (e.g., production, processing, research, development, marketing, distribution, consumption, byproducts) in meeting the need for commodities locally and globally.
S11.C.1.1.1: Explain that matter is made of particles called atoms and that atoms are composed of even smaller particles (e.g., protons, neutrons, electrons).
S11.C.1.1.3: Explain the formation of compounds (ionic and covalent) and their resulting properties using bonding theories.
S11.C.1.1.5: Predict the behavior of gases through the application of laws (e.g., Boyle's law, Charles' law, or ideal gas law).
S11.C.2.1.1: Compare or analyze waves in the electromagnetic spectrum (e.g., ultraviolet, infrared, visible light, X-rays, microwaves) as well as their properties, energy levels and motion.
S11.C.2.1.2: Describe energy changes in chemical reactions.
S11.C.2.1.3: Apply the knowledge of conservation of energy to explain common systems (e.g., refrigeration, rocket propulsion, heat pump).
S11.C.2.1.4: Use Ohm's Law to explain relative resistances, currents and voltage.
S11.C.2.2.2: Explain the practical use of alternative sources of energy (i.e., wind, solar, and biomass) to address environmental problems (e.g., air quality, erosion, resource depletion).
S11.C.3.1.1: Explain common phenomena (e.g., a rock in a landslide, an astronaut during a spacewalk, a car hitting a patch of ice on the road) using an understanding of conservation of momentum.
S11.C.3.1.2: Design or evaluate simple technological or natural systems that incorporate the principles of force and motion (e.g., simple machines, compound machines).
S11.C.3.1.3: Describe the motion of an object using variables (i.e., acceleration, velocity, displacement).
S11.C.3.1.4: Explain how electricity induces magnetism and how magnetism induces electricity as two aspects of a single electromagnetic force.
S11.C.3.1.5: Calculate the mechanical advantage for moving an object by using a simple machine.
S11.C.3.1.6: Identify elements of simple machines in compound machines.
S11.D.1.2.1: Evaluate factors affecting availability, location, extraction and use of natural resources.

DELAWARE VALLEY SCHOOL DISTRICT

PA Core State Standards for English Language Arts & Literacy in Science and Technical Subjects

Reading Standards for Literacy in Science and Technical Subjects 6-12 Grades **9-10 students:**

RST.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST.2: Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon or concept; provide an accurate summary of the text.

RST.3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements or performing technical tasks attending to special cases or exceptions defined in the text.

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 relevant to grades 9–10 texts and topics.

RST.5: Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

RST.6: Analyze the author's purpose in providing an explanation, describing a procedure or discussing an experiment in a text, defining the question the author seeks to address. **RST.7:** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

RST.8: Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

RST.9: Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

RST.10: By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Writing Standards for Literacy in History/Social Studies, Science and Technical Subjects 6-12
Grades **9-10 students:**

WHST.1: Write arguments focused on discipline-specific content.

a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons and evidence.
b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audience's knowledge level and concerns.
c. Use words, phrases and clauses to link the major sections of the text, create cohesion and clarify the relationships between claim(s) and reasons, between reasons and evidence and between claim(s) and counterclaims.
d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
e. Provide a concluding statement or section that follows from or supports the argument presented.

WHST.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments or technical processes.

a. Introduce a topic and organize ideas, concepts and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables) and multimedia when useful to aiding comprehension.
b. Develop the topic with well-chosen, relevant and sufficient facts, extended definitions, concrete details, quotations or other information and examples appropriate to the audience's knowledge of the topic.
c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion and clarify the relationships among ideas and concepts.
d. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

WHST.4: Produce clear and coherent writing in which the development, organization and style are appropriate to task, purpose and audience.

WHST.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

WHST.6: Use technology, including the Internet, to produce, publish and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

WHST.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated 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.

WHST.8: Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

WHST.9: Draw evidence from informational texts to support analysis, reflection and research.

WHST.10: Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes and audiences.

Academic Standards for Science and Technology and Engineering Education

3.2.C.A1: Differentiate between physical properties and chemical properties. Differentiate between pure substances and mixtures; differentiate between heterogeneous and homogeneous mixtures. Explain the relationship of an element's position on the periodic table to its atomic number, ionization energy, electro-negativity, atomic size, and classification of elements. Use electro-negativity to explain the difference between polar and nonpolar covalent bonds.

3.2.C.A2: Compare the electron configurations for the first twenty elements of the periodic table. Relate the position of an element on the periodic table to its electron configuration and compare its reactivity to the reactivity of other elements in the table. Explain how atoms combine to form compounds through both ionic and covalent bonding. Predict chemical formulas based on the number of valence electrons. Draw Lewis dot structures for simple molecules and ionic compounds. Predict the chemical formulas for simple ionic and molecular compounds. Use the mole concept to determine number of particles and molar mass for elements and compounds. Determine percent compositions, empirical formulas, and molecular formulas.

3.2.C.A4: Predict how combinations of substances can result in physical and/or chemical changes. Interpret and apply the laws of conservation of mass, constant composition (definite proportions), and multiple proportions. Balance chemical equations by applying the laws of conservation of mass. Classify chemical reactions as synthesis (combination), decomposition, single displacement (replacement), double displacement, and combustion. Use stoichiometry to predict quantitative relationships in a chemical reaction.

3.2.C.A5: MODELS Recognize discoveries from Dalton (atomic theory), Thomson (the electron), Rutherford (the nucleus), and Bohr (planetary model of atom), and understand how each discovery leads to modern theory. Describe Rutherford's "gold foil" experiment that led to the discovery of the nuclear atom. Identify the major components (protons, neutrons, and electrons) of the nuclear atom and explain how they interact.

3.2.12.A4: Apply oxidation/reduction principles to electrochemical reactions. Describe the interactions between acids and bases.

3.2.12.A5:MODELS/PATTERNS Use VSEPR theory to predict the molecular geometry of simple molecules. CONSTANCY AND CHANGE Predict the shift in equilibrium when a system is subjected to a stress.