RADNOR HIGH SCHOOL
Course Overview

Advanced Chemistry (College Prep)
Course #332

General Information

Credits: 1.0
Weighted: N/A
Prerequisite: Advanced Biology
Co-Requisite: Advanced Algebra 2 or higher
Length: Full Year
Format: Meets Daily

Course Description

Advanced Chemistry is a college-preparatory course that prepares students for further study in science at the college level. Advanced chemistry covers the traditional first year topics of chemistry including the structure of the atom, the formation of compounds, chemical reactions, the periodic table, stoichiometry, the gas laws, and periodic properties. Some level of independent work is required.

Materials & Text

Essential:

Chemistry
by Wilbraham, Staley, Matta, and Waterman (Addison-Wesley: 2002)

Additional:

Scientific calculator
Laboratory notebook

Assessment & Grading

Student grade is based on homework, lab reports, quizzes and tests. Homework is assigned daily along with weekly lab reports. The midterm and final exam are cumulative assessments that each comprises 10% of the course grade. The Radnor High School grading system and scale will be used to determine letter grades.

Common Core Standards

Key Ideas and Details

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

Craft and Structure

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

Integration of Knowledge and Ideas

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.
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.

Range of Reading and Level of Text Complexity

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

Text Types and Purposes

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.
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).

Production and Distribution of Writing

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
5. 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.

MARKING PERIOD ONE

- ***Chapter 2: Matter & Change***
- ***Chapters 3 & 4: Scientific Measurement & Problem Solving***
- ***Chapter 5: Atomic Structure***

Keystone Connections:

CHEM.A.1.1 Identify and describe how observable and measurable properties can be used to classify and describe matter and energy.

- **CHEM.A.1.1.1** Classify physical or chemical changes within a system in terms of matter and/or energy.
- **CHEM.A.1.1.2** Classify observations as qualitative and/or quantitative.
- **CHEM.A.1.1.3** Utilize significant figures to communicate the uncertainty in a quantitative observation.

CHEM.A.1.2 Compare the properties of mixtures.

- **CHEM.A.1.2.2** Differentiate between homogeneous and heterogeneous mixtures (e.g., how such mixtures can be separated).

CHEM.A.2.1 Explain how atomic theory serves as the basis for the study of matter.

- **CHEM.A.2.1.1** Describe the evolution of atomic theory leading to the current model of the atom based on the works of Dalton, Thomson, Rutherford, and Bohr.

- **CHEM.A.2.1.2** Differentiate between the mass number of an isotope and the average atomic mass of an element.

Pennsylvania Standards, Anchors, and Eligible Content

3.2.C.A1.

- Differentiate between physical properties and chemical properties.
- Differentiate between pure substances and mixtures; differentiate between heterogeneous and homogeneous mixtures.

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.

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.

ANCHORS

- **S11.C.1.1** Explain the relationship between the structure and properties of matter.
- **S11.C.2.1** Analyze energy sources and transfer of energy, or conversion of energy.

ELIGIBLE CONTENT

- **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.1.1.2** Explain the relationship between the physical properties of a substance and its molecular or atomic structure.

Student Objectives:

At the conclusion of this quarter, students should be able successfully to complete the following:

Chapter 2: Matter and Change

- Identify element symbols and names.
- Identify the characteristics of matter and substances.
- Classification of Matter (Element, Compound, Pure substance vs. compound, Mixtures)
- Compare and contrast substances (elements & compounds) and mixtures (heterogeneous and homogeneous).

- Compare various methods to separate mixtures, such as distillation.
- Understand the differences and properties among solids, liquids, gases, and plasma.
- Compare and contrast physical and chemical properties and changes.
- Identify when a chemical change has occurred using certain indicators.
- Define the law of conservation of mass.
- Identify reactants vs. products.

Chapter 3 and 4: Scientific Measurement and Problem Solving

- Distinguish between qualitative vs. quantitative measurements.
- Practice metric conversions and prefix use.
- Convert between scientific notation and standard notation.
- Identify older measurement systems and their uses.
- Use dimensional analysis, problem solving techniques, and estimation to complete metric conversions.
- Convert between the Celsius and Kelvin temperature scales.
- Identify the number of significant figures in a measurement or calculation.
- Calculate the percent error of measurements.
- Define and calculate density.
- Compare and contrast accuracy and precision.

Chapter 5: Atomic Structure

- Describe the contributions of the following to the history of atomic theory:
    - Democritus
    - Dalton
    - Thomson
    - Rutherford
    - Chadwick
- List and critique Dalton's Atomic Theory
- Describe, compare, and contrast the atomic models
    - Democritis
    - Thomson's plum pudding
    - Rutherford
    - Bohr
    - Modern Quantum Mechanical
- Describe nucleus, protons, neutrons, and electrons in terms of their location in the atom, relative size, and charge.
- Identify the atomic number, mass number, and atomic mass for any element.
- Calculate the number of protons, neutrons, and electrons in an atom.
- Given a nuclear symbol calculate the number of protons, electrons and neutrons.
- Differentiate between the Law of Definite Proportions and the Law of Multiple Proportions
- Explain how isotopes of an atom are different and the same.
- Calculate atomic mass from isotope data.
- Explain how isotopes differ and why the atomic masses are not whole numbers.
- Identify and name the common groups of the periodic table.

- Identify and name the parts of the Periodic Table (group or family, period, metals, nonmetals, metalloids, solid, liquid, gas, alkali elements, alkaline earth elements, representative elements, halogens, noble gases, transition elements, lanthanides and actinides (inner transition or rare earth elements)
- Compare and contrast the differences among metals, nonmetals, and metalloids.

Activities, Assignments, & Assessments

Common Core Labs

- Making Observations
- Identification of Chemical/Physical Changes
- Chemical Measurement and Reporting
- Density
- Magnesium Oxide
- Alchemy – Copper to Gold
- Isotopes/Atomic Mass

Assignments

- Approximately 2-4 hours of independent work per week.
- Associated chapter exercises and worksheets.

Assessments

- Chapter tests and quizzes
- Lab reports

Terminology

- Matter, element, compound, substance, mixture, homogeneous mixture, heterogeneous mixture, solution, phase, Distillation, solid, liquid, gas, plasma, Law of Conservation of Matter, physical property, chemical property, physical change, chemical change, reactants, products, qualitative, quantitative, Scientific Notation, Significant figures, Percent Error, accuracy, precision, density, metric system, SI (International System) units, temperature, Kelvin, Celsius, Absolute zero, units, Dimensional Analysis, conversion factors, estimation, atom, proton, electron, neutron, nucleus, Periodic Table, groups or families, period, Alkali, Alkaline earth, Halogens, Noble gases, Representative elements, Transition elements, Lanthanides and Actinides, Inner transition elements, Rare earth elements, metals, nonmetals, metalloids, diatomic elements, JJ Thomson – cathode ray tube, Ernest Rutherford – gold foil experiment, James Chadwick – neutron, Atomic Models – atomos, plum pudding, nuclear, orbit, cloud, Law of Multiple Proportions, Law of Definite Proportions, Dalton's Atomic Theory Postulates, Isotopes, Atomic number, Atomic Mass, Mass number, Average atomic mass, Atomic mass units (amu)

Media, Technology, Web Resources

- Teacher developed PowerPoint presentations

MARKING PERIOD TWO

- ***Chapter 28: Nuclear Chemistry***
- ***Chapter 13: Electrons in Atoms***
- ***Chapter 14: Chemical Periodicity***
- ***Chapter 15/16/6: Chemical Names and Formulas***

Keystone Connections:

CHEM.A.1.1 Identify and describe how observable and measurable properties can be used to classify and describe matter and energy.

- **CHEM.A.1.1.5** Apply a systematic set of rules (IUPAC) for naming compounds and writing chemical formulas (e.g., binary covalent, binary ionic, ionic compounds containing polyatomic ions).
- **CHEM.A.1.1.4** Relate the physical properties of matter to its atomic or molecular structure.

CHEM.A.1.2 Compare the properties of mixtures.

- **CHEM.A.1.2.1** Compare properties of solutions containing ionic or molecular solutes (e.g., dissolving, dissociating).
- **CHEM.A.1.2.3** Describe how factors (e.g., temperature, concentration, surface area) can affect solubility.
- **CHEM.A.1.2.5** Describe how chemical bonding can affect whether a substance dissolves in a given liquid.

CHEM.A.2.1 Explain how atomic theory serves as the basis for the study of matter.

- **CHEM.A.2.1.1** Describe the evolution of atomic theory leading to the current model of the atom based on the works of Dalton, Thomson, Rutherford, and Bohr.

CHEM.A.2.2 Describe the behavior of electrons in atoms.

- **CHEM.A.2.2.1** Predict the ground state electronic configuration and/or orbital diagram for a given atom or ion.
- **CHEM.A.2.2.2** Predict characteristics of an atom or an ion based on its location on the periodic table (e.g., number of valence electrons, potential types of bonds, reactivity).
- **CHEM.A.2.2.3** Explain the relationship between the electron configuration and the atomic structure of a given atom or ion (e.g., energy levels and/or orbitals with electrons, distribution of electrons in orbitals, shapes of orbitals).
- **CHEM.A.2.2.4** Relate the existence of quantized energy levels to atomic emission spectra.

CHEM.A.2.3 Explain how periodic trends in the properties of atoms allow for the prediction of physical and chemical properties.

- **CHEM.A.2.3.1** Explain how the periodicity of chemical properties led to the arrangement of elements on the periodic table.
- **CHEM.A.2.3.2** Compare and/or predict the properties (e.g., electron affinity, ionization energy, chemical reactivity, electronegativity, atomic radius) of selected elements by using their locations on the periodic table and known trends.

Pennsylvania Standards, Anchors, and Eligible Content

3.2.C.A1.

- Explain the relationship of an element's position on the periodic table to its atomic number, ionization energy, electronegativity, atomic size, and classification of elements.
- Use electronegativity 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

3.2.C.A3.

- Identify the three main types of radioactive decay and compare their properties.
- Describe the process of radioactive decay by using nuclear equations and explain the concept of half life for an isotope.
- Compare and contrast nuclear fission and nuclear fusion.

ANCHORS

- **S11.C.1.1** Explain the relationship between the structure and properties of matter.
- **S11.C.2.1** Analyze energy sources and transfer of energy, or conversion of energy.

ELIGIBLE CONTENT

- **S11.C.1.1.2** Explain the relationship between the physical properties of a substance and its molecular or atomic structure.
- **S11.C.1.1.3** Explain the formation of compounds (ionic and covalent) and their resulting properties using bonding theories.
- **S11.C.1.1.4** Explain how the relationships of chemical properties of elements are represented in the repeating patterns within the periodic table.
- **S11.C.2.1.1** Compare or analyze waves in the electromagnetic spectrum (e.g., ultraviolet, infrared, visible light, Xrays, microwaves) as well as their properties, energy levels, and motion.

Student Objectives:

At the conclusion of this quarter, students should be able successfully complete the following skills:

Chapter 28: Nuclear Chemistry

- Recognize the difference between nuclear and chemical reactions.
- Define radioactivity, radiation, radioactive decay, and stability.
- Describe the contributions of the following to nuclear chemistry:
    - Becquerel
    - Curies
    - Roentgen
- Compare and contrast the three types or radiation: alpha, beta, gamma
- Recognize radioactive elements by their stability.
- Discuss the processes of radioactivity and radioactive decay.
- Balance nuclear equations in order to satisfy the law of conservation of mass.
- Define the half-life of a radioisotope and solve half-life problems.
- Compare and contrast fission and fusion reactions.
- Compare and contrast the uses and dangers of nuclear radiation

Chapter 13: Electrons in Atoms

- Compare and contrast the various parts of the Electromagnetic Spectrum.
- Relate and calculate Energy, wavelength, and frequency, including Planck's constant and the speed of light.
- Explain the origin of the atomic emission spectrum of an element.
- Compare and contrast models of the atom:
    - Thomson's plum-pudding model
    - Bohr model – orbital diagram
    - Quantum Mechanical model
- Compare and contrast the historical aspect of the Quantum Theories:
    - Bohr's Atomic Model and calculations
    - Louis de Broglie - wave-particle duality
    - Werner Heisenberg - Heisenberg's Uncertainty Principle
    - Erwin Schrödinger - Schrödinger's Quantum Wave Equation
    - Quantum Mechanical Model
- Apply the aufbau principle, the Pauli Exclusion Principle, and Hund's rule in writing electron configurations of the elements.
- Write orbital diagrams for atoms and ions.
- Write electron configurations for atoms and ions using the periodic table (including the noble gas shorthand).
- Predict possible electron configuration exceptions.
- Determine how many valence electrons an atom has by using the periodic table.
- Assess the differences between cations and anions using electron configuration.
- Draw Lewis dot structures for different elements.

Chapter 14: Chemical Periodicity

- Compare the historical aspect of the scientists involved in developing the periodic table:
    - John Newlands – Law of Octaves
    - Johann Dobereiner – triads

- Julius Lothar Meyer – the periodic table
- Dimitri Mendeleev – the periodic table
- Stanislao Cannizzaro – standardized atomic masses
- Henry Moseley – Modern Periodic Law

- Explain why you can infer the properties of an element based those of the other elements in the periodic table.
- Use electron configurations to classify the elements as noble gases, representative elements, transition metals, or inner transition metals.
- Review the parts of the periodic table.
- Describe the trends (group and period) of the periodic table:
  - Atomic Radius
  - Ionic Radius
  - Ionization Energy
  - Electronegativity
  - Shielding Effect
  - Effective Nuclear Charge

Chapter 6: Chemical Names and Formulas

- Identify the charges of ions and write their corresponding electron configurations.
- Distinguish among chemical formulas, molecular formulas and formula units.
- Use experimental data to show that a compound obeys the law of definite proportions.
- Write chemical formulas and names for metal vs. non-metal binary compounds.
- Recognize and use prefixes.
- Apply the rules for naming and writing formulas for binary compounds.
- Apply the rules for naming and writing formulas for tertiary compounds.
- Name and write formulas for common acids.
- Write chemical formulas and names for hydrate compounds.
- Identify whether a given element forms a cation or anion.
- Use both the stock and older naming system for variable charged cations.
- Define a polyatomic ion and give the names and formulas of the most common ones.
- Write chemical formulas for ionic compounds by balancing positive and negative charges.
- Apply the rules for naming ionic compounds (including compounds with transition metals & polyatomic ions).
- Determine the formula and charge for polyatomic ions.
- Compare and contrast the properties of ionic and molecular compounds.
- Apply the rules & prefixes for naming covalent/molecular compounds.
- Identify and list the diatomic molecules.

Activities, Assignments, & Assessments

Common Core Labs

- Half-Life
- Spectral Analysis

Assignments

- Approximately 2-4 hours of independent work per week.
- Associated chapter exercises and worksheets.

Assessments

- Chapter tests and quizzes
- Lab reports
- Common midterm exam.

Terminology

- Radioisotopes, Radioactivity, Radiation, Radioactive decay, Nuclear reactions, Alpha radiation, Beta radiation, Gamma radiation, Neutron, Positron, Becquerel, Marie and Pierre Curie, Roentgen, Half-life, Nuclear reactions, Nuclear power and reactors, Fission, Fusion, Atomic Emission spectrum, Electromagnetic spectrum – gamma, x-rays, ultraviolet, visible, infrared, radio, tv, microwaves, Energy, Frequency, Wavelength, Speed of light, Planck's constant, Units of frequency, wavelength, and energy and conversions for them, Niels Bohr – atomic model, Ground state, Excited state, Energy level, Quanta, Photons, Louis de Broglie's wave-particle duality theory, Werner Heisenberg's Uncertainty Principle, Schrödinger's Quantum Wave Equation, Quantum Mechanical Model, Orbits vs. orbitals, Quantum Theory, Electron configuration, Electron notation, Electron dot notation, Shorthand (abbreviated) notation, Aufbau Principle, Hund's Rule, Pauli Exclusion Principle, Cation, Anion, Valence electrons, Law of Octaves, Triads, Periodic Law (original and modern), Atomic Radius Trends, Ionic Radius Trends, Ionization Energy Trends, Electronegativity Trends, Shielding Effect, Nuclear Charge, Chemical formula, Molecule, Compound, Ion, Monatomic ion, Polyatomic ion, Variable charge, Oxidation numbers (charges), Binary compound, Ternary compound, Diatomic elements

Media, Technology, Web Resources

- Teacher developed PowerPoint presentations

MARKING PERIOD THREE

- ***Chapter 15/16/6: Ionic and Covalent Bonding***
- ***Chapter 7: Chemical Quantities***
- ***Chapter 8: Chemical Reactions***

Keystone Connections:

CHEM.B.1.3 Explain how atoms form chemical bonds.

- **CHEM.B.1.3.1** Explain how atoms combine to form compounds through ionic and covalent bonding.
- **CHEM.B.1.3.2** Classify a bond as being polar covalent, non-polar covalent, or ionic.
- **CHEM.B.1.3.3** Use illustrations to predict the polarity of a molecule.

CHEM.B.1.4 Explain how models can be used to represent bonding.

- **CHEM.B.1.4.1** Recognize and describe different types of models that can be used to illustrate the bonds that hold atoms together in a compound (e.g., computer models,

ball-and-stick models, graphical models, solid-sphere models, structural formulas, skeletal formulas, Lewis dot structures).

- **CHEM.B.1.4.2** Utilize Lewis dot structures to predict the structure and bonding in simple compounds.

CHEM.A.1.2 Compare the properties of mixtures.

- **CHEM.A.1.2.4** Describe various ways that concentration can be expressed and calculated (e.g., molarity, percent by mass, percent by volume).

CHEM.B.1.1 Explain how the mole is a fundamental unit of chemistry.

- **CHEM.B.1.1.1** Apply the mole concept to representative particles (e.g., counting, determining mass of atoms, ions, molecules, and/or formula units).

CHEM.B.1.2 Apply the mole concept to the composition of matter.

- **CHEM.B.1.2.1** Determine the empirical and molecular formulas of compounds.
- **CHEM.B.1.2.2** Apply the law of definite proportions to the classification of elements and compounds as pure substances.
- **CHEM.B.1.2.3** Relate the percent composition and mass of each element present in a compound.

CHEM.B.2.1 Predict what happens during a chemical reaction.

- **CHEM.B.2.1.3** Classify reactions as synthesis, decomposition, single replacement, double replacement, or combustion.
- **CHEM.B.2.1.4** Predict products of simple chemical reactions (e.g., synthesis, decomposition, single replacement, double replacement, combustion).
- **CHEM.B.2.1.5** Balance chemical equations by applying the Law of Conservation of Matter.

Pennsylvania Standards, Anchors, and Eligible Content

3.2.C.A1.

- Use electronegativity to explain the difference between polar and nonpolar covalent bonds.

3.2.C.A2.

- Explain how atoms combine to form compounds through both ionic and covalent bonding.
- Use the mole concept to determine number of particles and molar mass for elements and compounds.
- Determine percent compositions, empirical formulas, and molecular formulas.
- 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

3.2.C.A4.

- 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.

ANCHORS

- **S11.C.1.1** Explain the relationship between the structure and properties of matter.
- **S11.C.2.1** Analyze energy sources and transfer of energy, or conversion of energy.

ELIGIBLE CONTENT

- **S11.C.1.1.3** Explain the formation of compounds (ionic and covalent) and their resulting properties using bonding theories.
- **S11.C.2.1.2** Describe energy changes in chemical reactions.

Student Objectives:

At the conclusion of this quarter, students should be able successfully to complete the following skills:

Chapter 15/16/6: Ionic and Covalent Bonding

- Understand electronegativity and the continuum of nonpolar covalent, polar covalent and ionic types of bonding.
- Use the periodic table to infer the number of valence electrons in an atom.
- Describe the formation of cations from metals and anions from nonmetals.
- Describe the relationship of electron configuration to bonding structures.
- Compare and contrast the types of chemical bonding
  - Ionic bonding
  - Covalent bonding
  - Metallic bonding
- Use the characteristics of ionic compounds to explain the electrical conductivity of ionic compounds when melted or in aqueous solution.
- Use the theory of metallic bonds to explain the physical properties of metals
- Draw Lewis Structures for both covalent and ionic bonding.
- Describe Alloys.
- Draw Electron dot structures.
- Identify and apply the octet rule.
- Describe and give examples of coordinate covalent bonding, resonance structures, and exceptions to the octet rule.
- Understand what resonance is and how to recognize it.
- Recognize and explain a coordinate covalent bond.
- Recognize and use the electron dot structures to show the formation of single, double, and triple covalent bonds.
- Recognize unshared pairs (lone pairs) of electrons.
- Describe and draw simple Valence shell electron pair repulsion theory (VSEPR): linear, trigonal planar, tetrahedral, trigonal pyramidal, bent.
- Know the difference between intra- and intermolecular forces.

Chapter 7: Chemical Quantities

- Calculate the molar mass for a compound.
- Use Avogadro's number to calculate the number of representative particles in a sample.
- Use the molar mass of a substance to convert between grams and moles.
- Calculate the percent composition (percent by mass) of a substance from its chemical formula or experimental data.
- When given the percent composition or mass data, calculate the simplest or empirical formula.
- Determine a molecular formula from empirical formula data.
- Describe and apply the mole concept.
- Describe how Avogadro's number is related to a mole of any substance.
- Apply mole conversions – grams, moles, and Avogadro's number relationships.

Chapter 8: Chemical Reactions

- Balance a chemical equation.
- Write balanced chemical equations using appropriate symbols when given the names of the reactants and products.
- Identify the parts of a chemical equation: reactants, products, yields, coefficients, symbols for the states of matter.
- Identify a reaction as synthesis (combination), decomposition, single replacement, double replacement, or combustion.
- Use the type of reaction to predict the products of that reaction according to the activity series and solubility rules.

Activities, Assignments, & Assessments

Common Core Labs

- Molecular Modeling
- Ionic/Covalent Properties
- Empirical Formula of Hydrates
- Types of Reactions
- Precipitates
- Mass Relationships with chemical change (silver) – two part experiment

Assignments

- Approximately 2-4 hours of independent work per week.
- Associated chapter exercises.

Assessments

- Chapter tests and quizzes
- Lab reports
- Common cumulative final exam

Terminology

- Ionic Bonding, Covalent Bonding, Metallica Bonding, Lewis structures, valence electrons,

electron dot structure, octet rule, electronegativity, cation, anion, alloys, molecule, molecular compound, chemical formula, covalent bond, unshared pair, coordinate covalent bond, resonance structure, nonpolar covalent bond, polar covalent bond, VSEPR Theory, dipole, van der waals forces, hydrogen bonds, Molar mass, percent composition, empirical formula, molecular formula, mole, Avogadro's number, element symbols, reactants, products, yields, coefficients, symbols for gas, liquid, solid, precipitate, and aqueous solution, balanced chemical equation, synthesis (or combination) equation, decomposition equation, single displacement equation, double displacement equation, combustion equation, Activity series, Solubility rules

Media, Technology, Web Resources

- Teacher developed PowerPoint presentations

MARKING PERIOD FOUR

- ***Chapter 9: Stoichiometry***
- ***Chapter 10: States of Matter***
- ***Chapter 12: Gas Laws***

Keystone Connections:

CHEM.B.2.1 Predict what happens during a chemical reaction.

- **CHEM.B.2.1.1** Describe the roles of limiting and excess reactants in chemical reactions.
- **CHEM.B.2.1.2** Use stoichiometric relationships to calculate the amounts of reactants and products involved in a chemical reaction.

CHEM.B.2.2 Explain how the kinetic molecular theory relates to the behavior of gases.

- **CHEM.B.2.2.1** Utilize mathematical relationships to predict changes in the number of particles, the temperature, the pressure, and the volume in a gaseous system (i.e., Boyle's law, Charles's law, Dalton's law of partial pressures, the combined gas law, and the ideal gas law).
- **CHEM.B.2.2.2** Predict the amounts of reactants and products involved in a chemical reaction using molar volume of a gas at STP.

Pennsylvania Standards, Anchors, and Eligible Content

STANDARDS

3.2.C.A3.

- Describe the three normal states of matter in terms of energy, particle motion, and phase transitions.
- Use stoichiometry to predict quantitative relationships in a chemical reaction.

ANCHORS

- **S11.C.1.1** Explain the relationship between the structure and properties of matter.
- **S11.C.2.1** Analyze energy sources and transfer of energy, or conversion of energy.

ELIGIBLE CONTENT

- **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.1.1.6** Describe factors that influence the frequency of collisions during chemical reactions that might affect the reaction rates (e.g., surface area, concentration, catalyst, temperature).

Student Objectives:

At the conclusion of this quarter, students should be able successfully complete the following skills:

Chapter 9: Stoichiometry

- Use stoichiometry and mole ratios to calculate the amount of one substance (mass, volume, number or particles) when given the amount of another substance.
- When given more than one reaction amount, determine the limiting reactant and excess reactant.
- Calculate theoretical yield, actual yield, and percent yield from a balanced chemical equation.

Chapter 10: States of Matter

- Know how the Kinetic Molecular Theory describes the following for solids, liquids and gases as it relates to motion of particles, forces between particles, and space between particles.
- Relate kinetic energy and temperature
- Measurement of gas pressure through the use of the barometer and manometer.
- Calculate pressure with various units using pressure conversion factors.
- Define standard temperature and pressure (STP).
- Convert temperature measurements between Celsius and Kelvin.
- Describe absolute zero in terms of motion of particles.
- Describe the nature of a liquid in terms of the attractive forces between particles.
- Interpret gas and liquid solubility curves.
- Understand the difference between evaporation and boiling.
- Interpret heating and cooling curves through phase changes.
- Describe the differences among three types of solutions (unsaturated, saturated, and supersaturated) as well as colloids and suspensions.
- Interpret phase diagrams of water vs other chemicals.
- Understand the process of sublimation, deposition, freezing, melting, condensation, evaporation, triple point, and critical point.
- Interpret heating/cooling curves.

Chapter 12: Gas Laws

- Interpret the Kinetic Theory of Matter
- Perform pressure conversions.
- Define Standard Temperature and Pressure (STP)
- Describe the properties of gases.
- Solve gas problems using the following laws:
    - Boyle's

- Charles'
- Gay-Lussac's
- Combined gas law
- Ideal gas law
- Avogadro's hypothesis
- Dalton's law of partial pressure
- Graham's law of effusion and diffusion

- Calculate gas density and molar mass using the ideal gas law.
- Perform Gas Law Stoichiometry.

Activities, Assignments, & Assessments

Common Core Labs

- Mass Relationships with chemical change and silver: Part 2

Assignments

- Approximately 2-4 hours of independent work per week.
- Associated chapter exercises.

Assessments

- Chapter tests and quizzes
- Lab reports
- Common cumulative final exam

Terminology

- stoichiometry, moles, grams, mole ratio, limiting reagent, excess reagent, theoretical yield, actual yield, percent yield, gas, solid, liquid, kinetic theory, gas pressure, barometer, manometer, vacuum, atmospheric pressure, pressure units - kilopascal, mm Hg, torr, atmosphere, Standard Temperature and Pressure (STP), absolute zero, solubility curves, unsaturated, saturated, and supersaturated solutions, colloids, suspensions, phase diagram, sublimation, deposition, freezing, melting, condensation, vaporization, evaporation, boiling point, normal boiling point, melting point, triple point, critical point, heating/cooling curve, crystal, allotropes, pressure, volume, temperature, Boyle's Law, Charles's Law, Gay-Lussac's Law, Combined Gas Law, Ideal Gas Equation, Avogadro's Principle, Molar Volume, Graham's Law, Molar Volume, Gas Law Stoichiometry

Media, Technology, Web Resources

- Teacher developed PowerPoint presentations