PLANNED INSTRUCTION

A PLANNED COURSE FOR:

General Chemistry

Curriculum writing committee:
Jessica Hill

Grade Level: 10, 11, 12

Date of Board Approval: ____2024_____

Course Weighting: General Chemistry

Major Assessments	**45%**
Skills Application	**30%**
Skills Practice	**20%**
Participation	**5%**
Total	**100%**

Curriculum Map

Overview:
This course is designed to familiarize students with a theoretical and practical study of the chemical and physical properties of matter. Chemistry has a strong math reasoning component. Topics discussed include measurement, matter, atomic structure, electronic structure, the periodic table, mole concept and stoichiometry, chemical formulas, types of chemical equations, ionic and covalent bonding, limiting reactants and molarity. Laboratory safety and techniques are emphasized within this course. Chemistry is intended to be accessible to all college-bound students.

Time/Credit for the Course:

- Full Academic Year
- 180 days
- 1 credit
- 1 period per day

Goals:

Marking Period 1: 45 days

- **Unit #1: Measurement** (27 Days)
    - Measurement
    - SI Units
    - Significant Figures
    - Rounding
    - Density
    - Qualitative vs Quantitative
    - Accuracy vs Precision
    - Uncertainty
    - Error Analysis (Percent Error and/or Percent Difference)
- **Unit #2: Properties and Changes in Matter** (11 days)
    - States of Matter
    - Energy of states of matter
    - Law of Conservation of Mass
    - Open vs Closed System
    - Chemical and Physical Properties
    - Extensive vs Intensive Properties
    - Chemical and Physical Changes
    - Classification of Matter
    - Pure Substances (Elements, Compounds, and Molecules)
    - Mixtures (Homogeneous and Heterogeneous)
    - Separation Techniques
- **Unit #3: Atomic Structure** (7 days)
    - Atoms
    - Protons
    - Neutrons
    - Electrons
    - Atomic Number
    - Ions

Marking Period 2: 45 days

- **Unit #3: Atomic Structure Continued** (8 days)
    - Hyphen Notation
    - Nuclear Notation
    - Average Atomic Mass
    - Mass Number
    - Isotopes
    - Relative Abundance
    - Mass Spectroscopy
- **Unit #4: Electronic Structure** (14 days)
    - Rutherford, Bohr, and Quantum Mechanical Model
    - Energy levels vs sublevels
    - Aufbau Principle

    - Pauli Exclusion Principle
    - Hund's Rule
    - Electron Configurations and Noble Gas Notations of Atoms and Ions
    - Orbital Diagrams of Atoms and Ions
    - Isoelectronic species
    - Valance Electrons
    - Chemical Reactivity of Atoms
    - Ionization Energy
    - Coulomb's Law
    - Effective Nuclear Charge
    - Photoelectron Spectroscopy
- **Unit 5: The Periodic Table** (14 days)
    - Organization of the Elements
    - Classification of Elements
    - Properties of Elements
    - Periodic Trends
    - Coulomb's Law
    - Effective Nuclear Charge
- **Unit 6: Chemical Formulas and Nomenclature** (9 days)
    - Counting Atoms in Molecules
    - Naming/Formulas of Organic Compounds
    - Diatomic Molecules
    - Naming/Formulas of Binary Covalent Compounds

Marking Period 3: 45 days

- **Unit 6: Chemical Formulas and Nomenclature** (19 days)
    - Polyatomic Ions
    - Naming/Formulas of Organic Compounds
    - Naming/Formulas of Binary Covalent Compounds
    - Naming/Formulas of Ionic Compounds
- **Unit 7: The Mole** (26 days)
    - The Mole
    - Molar Mass
    - Avogadro's Number
    - Mole to Mole Ratio
    - Molar Conversions with dimensional analysis
    - Percent Composition
    - Empirical and Molecular Formulas

Marking Period 4: 45 days

- **Unit 8: Stoichiometry** (15 days)
    - Balancing Chemical Reactions
    - Stoichiometry with dimensional analysis
    - Mole to Mole Ratio in Reactions
    - Percent Yield
    - Limiting and Excess Reactants

- **Unit 9: Types of Reactions** (7 days)
    - Predicting Synthesis Reactions
    - Predicting Decomposition Reactions
    - Predicting Single-Replacement Reactions
    - Predicting Double-Replacement Reactions
    - Predicting Combustion Reactions
    - Predicting Products of Reactions
- **Unit 10: Atomic Emissions** (23 days)
    - Atomic Emission Spectra
    - Electrons and the Structure of Atoms
    - The Nature of Light
    - Quantization of Energy
    - The Photoelectric Effect
    - Using Planck's Constant and Frequency
    - Energy and Chemical Bonds

Big Ideas:

- **BIG IDEA 1: SIZE, PROPORTION, AND QUANTITY**
    - In chemistry, quantities are expressed at both large and small scales. Understanding these quantities and how they relate across different scales is essential for explanations, predictions, and arguments in chemistry.
- **BIG IDEA 2: STRUCTURE AND PROPERTIES**
    - Properties of substances emerge from the arrangement/structure of atoms and molecules and the interactions between them. The structure and properties of substances fosters the ability to predict properties of substances, develop explanations of chemical phenomena, and develop a deeper understanding of complex systems.
- **BIG IDEA 3: TRANSFORMATIONS**
    - Chemistry fundamentally involves rearranging matter. To understand these changes, we need to think at different levels—observing both the big picture and the atomic details. This could mean simply tracking product amounts or visualizing forces between molecules in a mix. The speed of change matters too, as particles need to move and collide for reactions to happen.
- **BIG IDEA 4: ENERGY**
    - Energy plays two key roles in understanding and managing chemical systems. First, it aids in the tracking of how energy is distributed among system components through processes like heat exchange, chemical reactions, and phase changes. Second, it assists in the evaluation of the driving forces behind chemical processes, like enthalpy and entropy. These forces are linked to the dynamic balance found in many chemical systems, and how changing conditions can shift this balance.

Textbook and Supplemental Resources:

- **Name of Textbook:** Inspire Chemistry
- **Textbook ISBN-13 number:** 978-0-07-688442-1
- **Textbook Publisher and Year of Publication:** McGraw-Hill Education, 2020

Curriculum Plan

Time/Days: 27 days

Unit 1: Scientific Measurement

- **Standards:**
  - PA Steels Standards
    3.2.9-12.G
  - PA Academic Standards
    3.2.C.A2, 3.2.C.A3, 3.2.10.A6., 3.2.C.A6., 3.2.12.A6
- **Anchors:**
  - CHEM.A.1.1
- **Eligible Content:**
  - 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.

Objectives: Students will be able to

DOK Level 1-

- Identify the difference between accuracy and precision in measurements.
- Define significant figures in measurement.
- State how many significant figures are in various measurements.
- Convert between standard and scientific notation.
- Identify standard international (SI) units of measurement.
- Identify sources of qualitative and quantitative data.
- Identify sources of uncertainty.
- Calculate density, mass, and volume of a substance using the density equation.
- Identify the scenarios to utilize percent error/percent difference.
- Identify various types of laboratory equipment and scientific measurement instruments.

DOK Level 2-

- Interpret and/or employ various scientific measurement instruments.
- Demonstrate basic laboratory safety practices in carrying out laboratory procedures.
- Classify a group of measurements as either precise or not precise.
- Classify a group of measurements as either accurate or not accurate.
- Relate significant figure rules to measurements and calculations.
- Relate scientific notation to represent very large/small measurements.
- Categorize the Metric System and the Imperial system of measurement.
- Explain potential sources of uncertainty.
- Categorize quantitative and qualitative data.

DOK Level 3-

- Compare and contrast accuracy and precision.
- Use accuracy and precision to draw conclusions of experimental data.

- Apprise and utilize SI units of measurement.
- Investigate and explain the significance of significant figures in experimental data.
- Assess experimental measurements that would be best to employ in a given scenario.
- Formulate and draw conclusions from dimensional analysis calculations.
- Formulate and draw conclusions from a procedure to determine the density of an irregularly shaped object.
- Assess experimental validity with percent error calculations.
- Determine the density of solid and liquid samples using mass and volume displacement.
- Cite lab evidence to determine the identity of an unknown sample.
- Draw conclusions about the precision of measuring instruments based on the recorded values and uncertainties in measurements.

DOK Level 4-

- Analyze where significant digits are crucial for accurate results.
- Critique a real-world scenario that fails to adhere to the rules of significant digits in its measurements.
- Analyze how different errors may affect experimental data.

Core Activities and Corresponding Instructional Methods:

- Reference Unit 1 Folder: Density Lab, Accuracy and Precision Lab (Activity Examples)
- Instructional texts
- Lecture of instructional content
- Phenomena investigation
- Collaborative learning

Assessments:

- **Diagnostic:**
  - Informal discussion
  - Introductive inquiry
  - Warm- ups
- **Formative:**
  - Instructor observation
  - Instructor questioning techniques
  - Homework assignments
  - Classwork assignments
  - Practice Quizzes
  - Exit Tickets
  - Quizzes
- **Summative:**
  - Unit 1 Common Assessment
  - Unit 1 Quiz 1: Quantitative, Qualitative, SI Units & Density
  - Unit 1 Quiz 2: Accuracy, Precision and Sig Figs
  - Unit 1 Quiz 3: Unit Conversions
  - Post-Lab Assessment Questions and/or Lab Reports

Extensions:

- Rigorous and/or challenging additional worksheets and activities
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Additional laboratory enrichment experiences using measurement apparatus.

Correctives:

- Additional practice worksheets
- Textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Unit 2: Properties and Changes in Matter **Time/Days: 11 days**

- **Standards:**
  - PA Steels Standards
    3.2.9-12.G
  - PA Academic Standards
    3.2.C.A1., 3.2.10.A3., 3.2.C.A3., 3.2.C.A4, 3.2.C.A5, 3.2.10.A6., 3.2.C.A6., 3.2.12.A6
- **Anchors:**
  - CHEM.A.1.1, CHEM.A.1.2
- **Eligible Content:**
  - CHEM.A.1.1.1: Classify physical or chemical changes within a system in terms of matter and/or energy.
  - CHEM.A.1.2.2: Differentiate between homogeneous and heterogeneous mixtures (e.g., how such mixtures can be separated).

Objectives: Students will be able to
DOK Level 1-

- Identify the various types of chemistry.
- Define matter.
- Identify the states of matter.
- Recognize the properties of the states of matter.
- State the Law of Conservation of Mass.
- Describe chemical and physical properties of matter.
- Define intensive and/or extensive property in matter.
- Define chemical and physical changes in matter.
- List various separation techniques.
- Convert between Celsius, Kelvin, and Fahrenheit temperature values.

DOK Level 2-

- Interpret and/or employ various scientific measurement instruments.
- Demonstrate basic laboratory safety practices in carrying out laboratory procedures.
- Relate temperature to kinetic energy within a sample of matter.
- Classify substances as elements, molecules, compounds, or mixtures.
- Infer laboratory separation techniques to separate various types of mixtures.

DOK Level 3-

- Draw conclusions of the kinetic energy between particles in the different states of matter.
- Compare physical and chemical changes in matter.
- Compare physical and chemical properties in matter.
- Compare intensive and extensive properties in matter.
- Differentiate pure substances and mixtures.
- Differentiate homogenous and heterogeneous mixtures.
- Investigate how temperature impacts changes in physical states of matter.

DOK Level 4-

- Critique the effectiveness of separation techniques in real-world scenarios.
- Create a hypothesis for why some substances float in water while others do not.
- Draw conclusions about the relationship between particle arrangement and density in different states of matter.
- Cite evidence of how molecular structure influences the properties of matter.
- Analyze how different errors may affect experimental data.

Core Activities and Corresponding Instructional Methods:

- Reference Unit 2 Folder: Chemical and Physical Changes Lab (Activity Examples)
- Instructional texts
- Lecture of instructional content
- Phenomena investigation
- Collaborative learning

Assessments:

- **Diagnostic:**
  - Informal discussion
  - Introductive inquiry
  - Warmups
- **Formative:**
  - Instructor observation
  - Instructor questioning techniques
  - Homework assignments
  - Classwork assignments
  - Practice Quizzes
  - Exit Tickets
  - Quizzes
- **Summative:**
  - Unit 2 Common Assessment
  - Unit 2 Quiz 1: Chemistry and Matter
  - Unit 2 Quiz 2: Properties, Changes, and Types of Matter
  - Post-Lab Assessment Questions and/or Lab Reports

Extensions:

- Rigorous and/or challenging additional worksheets and activities
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Additional laboratory enrichment experiences using measurement apparatus.

Correctives:

- Additional practice worksheets
- Textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Unit 3: Atomic Structure **Time/Days: 15 days**

- **Standards:**
  - PA Steels Standards
    3.2.9-12.A
  - PA Academic Standards
    3.2.10.A1, 3.2.C.A1, 3.2.10.A5, 3.2.C.A5. 3.2.C.A2, 3.2.C.A5, 3.2.12.A2, 3.2.10.A4, 3.2.10.A6, 3.2.C.A6, 3.2.12.A6
- **Anchors:**
  - CHEM.A.1.1, CHEM.A.2.1
- **Eligible Content:**
  - CHEM.A.1.1.4: Relate the physical properties of matter to its atomic or molecular structure.
  - 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.

Objectives: Students will be able to
DOK Level 1-

- Identify notable scientists.
- Define an atom.
- Identify the subatomic particles.
- Define the charges of subatomic particles.
- Define an ion.
- Define an isotope.
- Define atomic number, average atomic mass, and mass number.
- Identify the hyphen notation and nuclear notation for various atoms and/or ions.
- Calculate the number of protons, neutrons, and electrons in an atom, ion, and/or isotope.

DOK Level 2-

- Interpret and/or employ various scientific measurement instruments.
- Demonstrate basic laboratory safety practices in carrying out laboratory procedures.
- Summarize the contributions notable scientists to the development of the modern atomic theory.
- Predict the charge of various ions.
- Categorize atoms, ions and isotopes.
- Compare the mass of protons, neutrons and electrons.
- Compare relative masses of isotopes and explain their contributions to average atomic mass.

DOK Level 3-

- Formulate a hypothesis on how changing the number of electrons in an atom affects its chemical properties.
- Formulate and draw conclusions from a method to determine the average atomic mass of elements using relative abundance of isotopes.
- Draw conclusions about the relationship between mass number and isotopes.
- Investigate how mass spectrometry is used to determine relative abundances of isotopes of an element.

DOK Level 4-

- Analyze the role of mass spectrometry in determining the mass of isotopes.
- Synthesize how isotopes of an element differ in their atomic structure.

Core Activities and Corresponding Instructional Methods:

- Reference Unit 3 Folder: Rutherford Gold Foil Example, Isotopic Masses and Abundances, Average Atomic Mass of Cadmium Activity (Activity Examples)
- Instructional texts
- Lecture of instructional content
- Phenomena investigation
- Collaborative learning

Assessments:

- **Diagnostic:**
  - Informal discussion
  - Introductive inquiry
  - Warmups
- **Formative:**
  - Instructor observation
  - Instructor questioning techniques
  - Homework assignments
  - Classwork assignments
  - Practice Quizzes
  - Exit Tickets
  - Quizzes
- **Summative:**
  - Unit 3 Common Assessment
  - Unit 3 Quiz 1: Subatomic Particles
  - Unit 3 Quiz 2: Isotopes and Percent Abundance
  - Post-Lab Assessment Questions and/or Lab Reports

Extensions:

- Rigorous and/or challenging additional worksheets and activities
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Additional laboratory enrichment experiences using measurement apparatus.

Correctives:

- Additional practice worksheets
- Textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Unit 4: Electronic Structure **Time/Days: 14 days**

- **Standards:**
  - PA Steels Standards
    3.2.9-12.A
  - PA Academic Standards
    3.2.10.A5, 3.2.C.A1, 3.3.C.A2, 3.2.10.A5, 3.2.C.A5, 3.2.12.A2, 3.2.10.A6., 3.2.C.A6., 3.2.12.A6
- **Anchors:**
  - CHEM.A.2.2
- **Eligible Content:**
  - 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.

Objectives: Students will be able to
DOK Level 1-

- Describe atomic orbitals in terms of their size, shape, and relative energy values.
- Identify the s, p, d, and f blocks on the periodic table.
- Define the Aufbau Principle, Pauli Exclusion Principle, and Hund's Rule.
- List the sublevels in the energy levels of atoms, ions, and isotopes.
- Identify the number of valance electrons in various atoms, ions, and isotopes.
- Define valence electrons.
- List the maximum number electrons that occupy the s, p, d, and f subshells.

DOK Level 2-

- Interpret and/or employ various scientific measurement instruments.
- Demonstrate basic laboratory safety practices in carrying out laboratory procedures.
- Compare and contrast the characteristics of an atom's nucleus and electron cloud.
- Categorize the Bohr and Quantum Mechanical Models of the atom.
- Classify the elements based on electron configuration stability.
- Predict which elements will be more/less stable based on their electron configurations.

DOK Level 3-

- Formulate an explanation for why elements in the same group of the periodic table have similar chemical properties.

- Formulate electron configurations for elements using the principles of orbital energy (Aufbau Principle), electron spin (Pauli Exclusion Principle), & orbital capacity (Hund's Rule).
- Draw conclusions of electron configurations to predict elemental behavior.
- Investigate how the number of protons, neutrons, and electrons affects an atom's overall charge.
- Assess the relationship between electron arrangement and the chemical reactivity of an element.
- Compare electron configurations for elements with their location on the periodic table.
- Summarize the relationship between electron configurations and the properties of elements.

DOK Level 4-

- Analyze the relationship between atomic structure and an element's placement on the periodic table.
- Apply the concept of atomic structure to emphasize the chemical properties of elements.
- Critique the validity of the Bohr model of the atom in comparison to the quantum mechanical models in explaining the behavior of electrons.
- Create a prediction of the change in chemical behavior of an element in a scenario where its electron configuration is altered.

Core Activities and Corresponding Instructional Methods:

- Reference Unit 4 Folder: Electron Configuration: The Boarding House, Hog Hilton (Activity Examples)
- Instructional texts
- Lecture of instructional content
- Phenomena investigation
- Collaborative learning

Assessments:

- **Diagnostic:**
  - Informal discussion
  - Introductive inquiry
  - Warm ups
- **Formative:**
  - Instructor observation
  - Instructor questioning techniques
  - Homework assignments
  - Classwork assignments
  - Practice Quizzes
  - Exit Tickets
  - Quizzes

- **Summative:**
    - Unit 4 Common Assessment
    - Unit 4 Quiz 1: Electron Configurations
    - Post-Lab Assessment Questions and/or Lab Reports

Extensions:

- Rigorous and/or challenging additional worksheets and activities
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Additional laboratory enrichment experiences using measurement apparatus.

Correctives:

- Additional practice worksheets
- Textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Unit 5: The Periodic Table **Time/Days: 14 days**

- **Standards:**
  - PA Steels Standards
    3.2.9-12.A
  - PA Academic Standards
    3.2.10.A1, 3.2.C.A1, 3.2.C.A2, 3.2.10.A6, 3.2.C.A6, 3.2.12.A6
- **Anchors:**
  - CHEM.A.2.2, CHEM.A.2.3
- **Eligible Content:**
  - 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.2.3.1: 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.

Objectives: Students will be able to
DOK Level 1-

- Define Periodic Law
- Identify the main groups/families on the periodic table (alkali metals, alkaline earth metals, transition metals, actinides, lanthanides, halogens, and noble gases)
- Define Periodic trends.
- Define Coulomb's Law
- Define Effective Nuclear Charge.
- Identify and describe trends for atomic radius, ionization energy, and electronegativity.

DOK Level 2-

- Interpret and/or employ various scientific measurement instruments.
- Demonstrate basic laboratory safety practices in carrying out laboratory procedures.
- Distinguish between the periodic families and their properties.
- Classify elements as metals, nonmetals or metalloids based on their properties.

DOK Level 3-

- Categorize the elements by group on the periodic table.
- Differentiate between metals, nonmetals, metalloids.
- Draw a conclusion about the relationship between group number and the number of valence electrons.
- Predict properties of elements using periodic trends.
- Correlate the periodic trends to electron configuration.

DOK Level 4-

- Synthesis examples of metals, nonmetals, and metalloids
- Connect the locations of elements on the table with the repeating pattern of properties.

- Apply concepts of coulomb's law and effective nuclear charge to explain patterns of periodic trends.
- Analyze the reasons behind the placement of Hydrogen in Group 1.

Core Activities and Corresponding Instructional Methods:

- Reference Unit 5 Folder: Mendeleev Lab (Activity Examples)
- Instructional texts
- Lecture of instructional content
- Phenomena investigation
- Collaborative learning

Assessments:

- **Diagnostic:**
  - Informal discussion
  - Introductive inquiry
  - Warm ups
- **Formative:**
  - Instructor observation
  - Instructor questioning techniques
  - Homework assignments
  - Classwork assignments
  - Practice Quizzes
  - Exit Tickets
  - Quizzes
- **Summative:**
  - Unit 5 Common Assessment
  - Unit 5 Quiz 1: Organizing the Periodic Table
  - Unit 5 Quiz 2: Periodic Trends
  - Post-Lab Assessment Questions and/or Lab Reports

Extensions:

- Rigorous and/or challenging additional worksheets and activities
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Additional laboratory enrichment experiences using measurement apparatus

Correctives:

- Additional practice worksheets
- Textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Unit 6: Chemical Formulas and Nomenclature **Time/Days: 28 days**

- **Standards:**
  - PA Steels Standards
    3.2.9-12.B, 3.2.9-12.C
  - PA Academic Standards
    3.2.10.A2, 3.2.C.A2, 3.2.C.A4, 3.2.10.A6, 3.2.C.A6, 3.2.12.A6
- **Anchors:**
  - CHEM.A.1.1, CHEM.B.1.3
- **Eligible Content:**
  - 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.B.1.3.1: Explain how atoms combine to form compounds through ionic and covalent bonding.

Objectives: Students will be able to
DOK Level 1-

- Memorize the seven diatomic molecules.
- Memorize and/or use common polyatomic ions in nomenclature.

DOK Level 2-

- Interpret and/or employ various scientific measurement instruments.
- Demonstrate basic laboratory safety practices in carrying out laboratory procedures.
- Determine the number of atoms in a given sample of molecules.
- Classify compounds as ionic or covalent.
- Name and write formulas for organic compounds (Alkanes/Alcohols)
- Name and write formulas for ionic compounds.
- Name and write formulas for binary covalent compounds.

DOK Level 3-

- Investigate the naming conventions for binary ionic compounds and summarize the key rules.
- Investigate the naming conventions for binary covalent compounds and summarize the key rules.

Core Activities and Corresponding Instructional Methods:

- Reference Unit 6 Folder: General Polyatomic Ion Activity, Ion Cut and Paste Activity, Ion Dice Activity (Activity Examples)
- Instructional texts
- Lecture of instructional content
- Phenomena investigation
- Collaborative learning

Assessments:

- **Diagnostic:**

    - Informal discussion
    - Introductive inquiry
    - Warmups
- **Formative:**
    - Instructor observation
    - Instructor questioning techniques
    - Homework assignments
    - Classwork assignments
    - Practice Quizzes
    - Exit Tickets
    - Quizzes
- **Summative:**
    - Unit 6 Common Assessment
    - Unit 6 Quiz 1: Counting Particles and Organic Nomenclature
    - Unit 6 Quiz 2: Covalent Compounds and Nomenclature
    - Unit 6 Quiz 3: Ionic Compounds and Nomenclature
    - Post-Lab Assessment Questions and/or Lab Reports

Extensions:

- Rigorous and/or challenging additional worksheets and activities
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Additional laboratory enrichment experiences using measurement apparatus.

Correctives:

- Additional practice worksheets
- Textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Unit 7: The Mole **Time/Days: 26 days**

- **Standards:**
  - PA Steels Standards
    3.2.9-12.G
  - PA Academic Standards
    3.2.C.A1, 3.2.C.A2, 3.2.C.A4, 3.2.10.A5, 3.2.10.A6, 3.2.C.A6, 3.2.12.A6
- **Anchors:**
  - CHEM.A.1.2, CHEM.B.1.1, CHEM.B.1.2
- **Eligible Content:**
  - 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.1.1.1: Apply the mole concept to representative particles (e.g., counting, determining mass of atoms, ions, molecules, and/or formula units).
  - CHEM.B.1.2.1: 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.

Objectives: Students will be able to
DOK Level 1-

- Define the concept of the mole.
- Calculate Molar Mass.
- Define Avogadro's Number.
- Identify units of Molar Mass and Avogadro's number.

DOK Level 2-

- Interpret and/or employ various scientific measurement instruments.
- Demonstrate basic laboratory safety practices in carrying out laboratory procedures.
- Compare molar mass to atomic mass.
- Determine the molecular formula given the empirical formula and molar mass.

DOK Level 3-

- Investigate how the mole concept is used in chemistry to relate mass to the number of particles.
- Formulate and draw conclusions from a method to determine the percent composition of compounds.
- Formulate and draw conclusions from a method to determine moles given mass or particles.
- Draw conclusions about the relationship between molar mass and percent composition in a chemical compound.
- Construct the empirical formula of a compound given percent composition or mass of individual elements.

DOK Level 4-

- Analyze a chemical compound and determine the molar ratio between atoms and molecules.

Core Activities and Corresponding Instructional Methods:

- Reference Unit 7 Folder: Chem S. Tree molecular formula activity, Mole Map, Composition of Hydrate Lab (Activity Examples)
- Instructional texts
- Lecture of instructional content
- Phenomena investigation
- Collaborative learning

Assessments:

- **Diagnostic:**
  - Informal discussion
  - Introductive inquiry
  - Warmups
- **Formative:**
  - Instructor observation
  - Instructor questioning techniques
  - Homework assignments
  - Classwork assignments
  - Practice Quizzes
  - Exit Tickets
  - Quizzes
- **Summative:**
  - Unit 7 Common Assessment
  - Unit 7 Quiz 1: Mole Conversions
  - Unit 7 Quiz 2: Percent Composition
  - Unit 7 Quiz 3: Empirical and Molecular Formulas
  - Post-Lab Assessment Questions and/or Lab Reports

Extensions:

- Rigorous and/or challenging additional worksheets and activities
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Additional laboratory enrichment experiences using measurement apparatus.

Correctives:

- Additional practice worksheets
- Textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Unit 8: Stoichiometry **Time/Days: 15 days**

- **Standards:**
  - PA Steels Standards
    3.2.9-12.G
  - PA Academic Standards
    3.2.C.A2, 3.2.C.A4, 3.2.10.A4, 3.2.10.A5, 3.2.10.A6., 3.2.C.A6., 3.2.12.A6
- **Anchors:**
  - CHEM.A.1.2, CHEM.B.1.1, CHEM.B.1.2, CHEM.B.2.1
- **Eligible Content:**
  - 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.1.1.1: Apply the mole concept to representative particles (e.g., counting, determining mass of atoms, ions, molecules, and/or formula units).
  - CHEM.B.1.2.1: 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.2.1.1: 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.2.1.5: Balance chemical equations by applying the Law of Conservation of Matter.

Objectives: Students will be able to
DOK Level 1-

- Define a limiting reactant in a chemical reaction.
- List the steps involved in stoichiometry calculations.
- Identify the excess reactant in a given chemical reaction.

DOK Level 2-

- Interpret and/or employ various scientific measurement instruments.
- Demonstrate basic laboratory safety practices in carrying out laboratory procedures.
- Assess the impact of using incorrect coefficients when balancing a chemical equation on the final result of a reaction.
- Compare and contrast the concepts of limiting reactant and excess reactant in stoichiometry.
- Predict results quantitatively of a chemical reaction.
- Determine theoretical yield of a chemical reaction given stoichiometric amounts of reactants.
- Estimate the amount of a product produced in a chemical reaction based on the given reactants.

- Determine the molecular formula given the empirical formula and molar mass.

DOK Level 3-

- Formulate and draw conclusions from a method to determine the percent yield of chemical reactions.
- Formulate and draw conclusions from balanced chemical equations to demonstrate relationships between reactants and products.
- Investigate how the stoichiometry of a chemical reaction can be affected by varying amounts of reactants.

DOK Level 4-

- Analyze a chemical equation that includes both limiting and excess reactants and calculate the theoretical yield of a product.
- Critique the efficiency of a chemical reaction based on the stoichiometry calculations and the amount of actual product obtained.

Core Activities and Corresponding Instructional Methods:

- Reference Unit 8 Folder: Sodium Bicarbonate and Acetic Acid Limiting Reactant Lab (Activity Examples)
- Instructional texts
- Lecture of instructional content
- Phenomena investigation
- Collaborative learning

Assessments:

- **Diagnostic:**
  - Informal discussion
  - Introductive inquiry
  - Warmups
- **Formative:**
  - Instructor observation
  - Instructor questioning techniques
  - Homework assignments
  - Classwork assignments
  - Practice Quizzes
  - Exit Tickets
  - Quizzes
- **Summative:**
  - Unit 8 Common Assessment
  - Unit 8 Quiz 1: Balancing Chemical Reactions
  - Unit 8 Quiz 2: Stoichiometry and Percent Yield
  - Unit 8 Quiz 3: Limiting and Excess Reactants
  - Post-Lab Assessment Questions and/or Lab Reports

Extensions:

- Rigorous and/or challenging additional worksheets and activities
- Rigorous and challenging data sets/calculations

- In-depth online video resources
- Additional laboratory enrichment experiences using measurement apparatus.

Correctives:

- Additional practice worksheets
- Textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Unit 9: Types of Chemical Reactions **Time/Days: 7 days**

- **Standards:**
  - PA Steels Standards
    3.2.9-12.C, 3.2.9-12.G
  - PA Academic Standards
    3.2.C.A2, 3.2.C.A4, 3.2.10.A4, 3.2.10.A5, 3.2.10.A6., 3.2.C.A6., 3.2.12.A6
- **Anchors:**
  - CHEM.A.1.2, CHEM.B.1.1, CHEM.B.1.2, CHEM.B.2.1
- **Eligible Content:**
  - 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.1.1.1: Apply the mole concept to representative particles (e.g., counting, determining mass of atoms, ions, molecules, and/or formula units).
  - CHEM.B.1.2.1: 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.2.1.1: 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.2.1.3: 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.

Objectives: Students will be able to
DOK Level 1-

- Identify the types of reactions (syntheses, decomposition, single-replacement, double-replacement, and combustion reactions).

DOK Level 2-

- Interpret and/or employ various scientific measurement instruments.
- Demonstrate basic laboratory safety practices in carrying out laboratory procedures.
- Classify various types of reactions based on reactants and products.

DOK Level 3-

- Predict products of a chemical reaction.
- Formulate a hypothesis on the outcome of various types of reactions.

DOK Level 4-

- Critique the effectiveness of balancing chemical equations in predicting the products of a reaction.
- Analyze a real-world scenario where different types of chemical reactions are involved and explain the significance of each reaction.

Core Activities and Corresponding Instructional Methods:

- Reference Unit 9 Folder: Types of Chemical Reactions Lab (Activity Examples)
- Instructional texts
- Lecture of instructional content
- Phenomena investigation
- Collaborative learning

Assessments:

- **Diagnostic:**
  - Informal discussion
  - Introductive inquiry
  - Warmups
- **Formative:**
  - Instructor observation
  - Instructor questioning techniques
  - Homework assignments
  - Classwork assignments
  - Practice Quizzes
  - Exit Tickets
  - Quizzes
- **Summative:**
  - Unit 9 Common Assessment
  - Post-Lab Assessment Questions and/or Lab Reports

Extensions:

- Rigorous and/or challenging additional worksheets and activities
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Additional laboratory enrichment experiences using measurement apparatus.

Correctives:

- Additional practice worksheets
- Textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Unit 10: Atomic Emissions **Time/Days: 23 days**

- **Standards:**
  - PA Steels Standards
    3.2.9-12.T, 3.2.9-12.V
  - PA Academic Standards
    3.3.10.B2., 3.3.10.B3., 3.2.10.B5., 3.2.10.A6., 3.2.C.A6., 3.2.12.A6
- **Anchors:**
  - CHEM.A.2.2
- **Eligible Content:**
  - CHEM.A.2.2.4: Relate the existence of quantized energy levels to atomic emission spectra.

Objectives: Students will be able to

DOK Level 1-

- Define "wavelength" and “amplitude” in the context of the electromagnetic spectrum.
- Rank the types of electromagnetic radiation based on energy.

DOK Level 2-

- Interpret and/or employ various scientific measurement instruments.
- Demonstrate basic laboratory safety practices in carrying out laboratory procedures.
- Classify different regions of the electromagnetic spectrum based on their wavelengths.
- Summarize the relationship between frequency and energy of electromagnetic radiation.

DOK Level 3-

- Investigate how the photoelectric effect supports the idea of quantization of energy.
- Draw conclusions about the behavior of electrons in an atom based on atomic emission spectroscopy results.
- Formulate and draw conclusions from a method to determine wavelength, energy and frequency.

DOK Level 4-

- Analyze the implications of Planck's constant on the quantization of energy in atomic systems.
- Critique the use of atomic emission spectroscopy as a technique for identifying unknown elements.
- Create a model demonstrating the relationship between wavelength, frequency, and energy in electromagnetic radiation.

Core Activities and Corresponding Instructional Methods:

- Reference Unit 10 Folder: Atomic Emissions Activity, Flame Test Lab, Electron Energy and Light POGIL (Activity Examples)
- Instructional texts
- Lecture of instructional content

- Phenomena investigation
- Collaborative learning

Assessments:

- **Diagnostic:**
  - Informal discussion
  - Introductive inquiry
  - Warm ups
- **Formative:**
  - Instructor observation
  - Instructor questioning techniques
  - Homework assignments
  - Classwork assignments
  - Practice Quizzes
  - Exit Tickets
  - Quizzes
- **Summative:**
  - Unit 10 Common Assessment
  - Post-Lab Assessment Questions and/or Lab Reports

Extensions:

- Rigorous and/or challenging additional worksheets and activities
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Additional laboratory enrichment experiences using measurement apparatus.

Correctives:

- Additional practice worksheets
- Textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Appendix

(Click the link to reference all course example materials: General Chemistry Curriculum Activities)