DELAWARE VALLEY SCHOOL DISTRICT

PLANNED INSTRUCTION

A PLANNED COURSE FOR:

General Chemistry

Grade Level: 10, 11, 12

Date of Board Approval: _____2019________________

Planned Instruction

Title of Planned Instruction: General Chemistry

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

Course Description:

This course is designed to introduce students to the study of the chemical and physical properties of matter and interactions within the physical world. Laboratory and mathematical principles will be stressed, along with problem solving and data analysis. Topics to be covered include states of matter, scientific measurement, atomic structure, the Periodic Table and Periodic Law, chemical nomenclature, the mole concept, stoichiometry, reaction types and bonding, atomic emission spectroscopy, gases, and acid/base chemistry. It is intended for academic students who plan on pursuing a college education.

Time/Credit for the Course:

FULL YEAR, 1 CREDIT

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Curriculum Map

1. **Marking Period One:**
   Unit 1: Introduction to Chemistry and Matter
   Unit 2: Scientific Measurement
   Unit 3: Atomic Structure

Overview based on 45 days:
- Introduce the various types of chemistry, the states and properties of matter and changes, means of scientific measurement, data collection, evaluation, and explore the historical evolution of atomic structure and the discovery of subatomic particles.

Goals:
- Identify and describe the various types of chemistry and their uses/applications today
- Connect the concept of matter, its interactions, and changes to the physical world
- Identify and describe specific types of matter and how they combine to form compounds and mixtures
- Identify means of taking and using scientific measurements
- Master and convert between units in the SI system of measurements
- Identify what makes a measurement both accurate and precise
- Express values in scientific notation using the correct number of significant digits
- Calculate density and percent error
- Gain an appreciation for the historical evolution of atomic theory
- Identify and describe the subatomic particles that combine to form matter
- Describe an isotope of an element and calculate average atomic mass from relative abundance

2. **Marking Period Two:**
   Unit 4: Electrons in Atoms
   Unit 5: The Periodic Table
   Unit 6: Chemical Formulas and Nomenclature

Overview based on 45 days:
- Introduce exploring how electrons occupy space around the nucleus and are involved in chemical interactions and bonding, explore the origins of the periodic table and why it is a useful tool to chemists, relate an elements location on the periodic table and its properties to its electron configuration, learn how to name and write formulas for a variety of chemical compounds commonly encountered in both the chemistry lab and everyday life.

Goals:
- Familiarize students with both the Bohr and Quantum Mechanical models of the atom
- Gain an understanding for energy levels, orbitals, and probable electron locations within the most current understanding of atomic structure

- Determine electron configurations for common elements using orbital filling diagrams while obeying the Aufbau principle, Pauli Exclusion Principle, and Hund's Rule.
- Describe Periodic Law as it relates to the Periodic Table of Elements
- Connect element location to group, element type, and common properties
- Predict properties of elements using common periodic trends
- Name chemical compounds when given the corresponding formula
- Determine the formula for a compound when provided with the compound name

3. Marking Period Three:

Unit 7: The Mole
Unit 8: Stoichiometry
Unit 9: Molarity

Overview based on 45 days:

- Introduce methods of evaluating data and introduce qualitative and quantitative relationships in matter. Develop the understanding of the how moles are used to connect number of particles on the macroscopic level. Develop understanding of stoichiometry, limiting reactants, and solubility rules.

Goals:

- Conversions between moles, mass, molecules, and atoms
- Calculations of percent composition, empirical formulas, and molecular formulas
- 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 form when two solutions containing ionic compounds are mixed
- Develop the necessary analysis to determine chemical identity from solubility

4. Marking Period Four:

Unit 10: Types of Reactions
Unit 11: Atomic Emission
Unit 12: Electron Geometry
Unit 13: Acids and Bases
Unit 14: Gas Laws

Overview based on 45 days:

- Develop methods for evaluating qualitative relationships in matter. Develop periodic trends, their contributing factors, and gain a deep understanding of energy calculations with the electromagnetic spectrum. Introduce basic and advanced concepts of periodic law, atomic structure, and molecular geometry. Introduce basic concepts of kinetic molecular theory, gas laws, and acids and bases.

Goals:

- Evaluate the reactant chemicals in a chemical reaction for reaction type, synthesis, combustion, single replacement, double replacement or oxidation-reduction
- 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
- 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

Curriculum Plan

Unit 1: Introduction to Chemistry and Matter
Marking Period: 1
Time Range: 15 Days

Standard(s): PA Academic Standards, PACS Reading and Writing for Science and Technology http://www.corestandards.org/ELA-Literacy/RST/11-12/#CCSS.ELA-Literacy.RST.11-12.1, https://www.pdesas.org/Standard/View#, http://static.pdesas.org/content/documents/Chemistry_Keystone_Assessment_Anchors_and_Eligible_Content.pdf

3.2.10.A1., 3.2.C.A1., 3.2.10.A2., 3.2.C.A3., 3.2.C.A4., 3.2.C.A6., CC.3.5.9-10.B, CC.3.5.9-10.C, CC.3.5.9-10.G, CC.3.5.11-12.C, 3.2.C.B7., 3.4.10.C3., 3.2.C.A2, 3.2.C.A3, CC.2.4.HS.B., CC.2.4.HS.B.5, CC.3.5.11-12.C, CC.3.5.11-12.D, CC.3.5.11-12.F

Anchor(s):
CHEM.A.1.1, CHEM.A.1.1.1, CHEM.A.1.1.4, CHEM.A.1.2, CHEM.A.1.2.2, CHEM.B.1.2.2, CHEM.A.1.1.2, CHEM.A.1.1.3

Big Idea #1:
- Chemistry is the study of the composition, properties, and interactions of matter.

Essential Questions:
- What are the types of chemistry?

Concepts:
- The field of chemistry is broken down into various types including inorganic, organic, analytical, physical, and biochemistry.
- Each type may either be pure or applied, with pure being the pursuit of knowledge for its own sake and applied seeking to define and solve a specific problem.

Competencies:
- Students should be able to define the scope of the field of chemistry and identify examples of each type while being able to differentiate between pure and applied chemistry.

Big Idea #2:
- Chemistry is the study of matter and the changes it undergoes.

Essential Questions:
- What are the different types of matter and how can one tell the difference between them?
- What are the properties of matter and what types of changes can matter undergo?
- What does "conservation" mean as it relates to mass, matter, and energy? How does conservation apply to chemical changes?

Concepts:

- Matter can be classified into pure substances and mixtures.
- Pure substances entail elements and compounds, while mixtures can be classified as either homogenous or heterogeneous.
- Matter and energy are neither created nor destroyed.

Competencies:

- Students will differentiate between the various types of matter, be able to identify each type, and provide examples of each.
- State both the Law of Conservation of Mass and the Law of Conservation of Energy.
- Apply both laws to chemical reactions to predict amounts of products or net energy balance.

Overview:
Students will define, compare, and contrast the various types of chemistry before beginning to discuss the classification and properties of different types of matter. States of matter will be explored as a product of energy contained within the matter, with conservation of both mass and energy being discussed. Students will use the Celsius, Kelvin, and Fahrenheit temperature scales to relate amount of energy in matter, and will convert between scales. Students will conduct a separation of mixtures lab after learning about classifications of matter, substances, and mixtures.

Goals:

- Identify and describe the various types of chemistry and their uses/applications today
- Connect the concept of matter, its interactions, and changes to the physical world
- Identify and describe specific types of matter and how they combine to form compounds and mixtures
- Calculate density and percent error

Objectives: Students will:

- Demonstrate basic laboratory safety practices in carrying out laboratory procedures (DOK – Level 2)
- Identify the various types of chemistry (DOK – Level 1)
- Describe types of matter (DOK – Level 2)
- Define matter (DOK – Level 1)
- Connect its existence to the world around them (DOK – Level 4)
- Compare and contrast pure substances and mixtures. (DOK – Level 3)
- Provide real-world examples of each and defend choices. (DOK – Level 4)
- Describe the four states of matter (DOK – Level 1)
- Identify examples of the states of matter (DOK – Level 2)
- Relate temperature to the amount of energy within a sample of matter (DOK – Level 1)
- Convert between Celsius, Kelvin, and Fahrenheit temperature values (DOK – Level 2)
- Describe chemical and physical properties of matter (DOK – Level 1)
- Differentiate between properties of matter (DOK – Level 2)
- Describe chemical and physical changes (DOK – Level 1)

- Differentiate between changes in matter (DOK – Level 2)
- State the Laws of Conservation of Mass/Energy (DOK – Level 1)
- Apply the Laws of conservation of Mass/Energy to chemical changes (DOK – Level 3)
- Compare and contrast elements, compounds, heterogeneous mixtures, and homogenous mixtures. (DOK – Level 3)
- Provide real-world examples of each and justify choices. (DOK – Level 4)
- Separate a homogenous mixture using a variety of laboratory separation techniques (DOK – Level 2)

Core Activities and Corresponding Instructional Methods:

- Complete a graphic organizer/concept map of the different states and types of matter after in-class discussion (See Appendix)
- Observe various types of matter and distinguish between samples. Enable students to provide their own examples of each from their everyday lives.
- Observe and identify chemical and physical changes. Facilitate class discussion that compares and contrasts the two.
- Perform, observe, and develop a conservation of mass laboratory experiment. (See Appendix)
- Perform and evaluate a separation of a homogenous mixture using physical properties of the constituents and common laboratory separation techniques.

Assessments:

Diagnostic:

- Algebra I and Biology Keystone Exams
- Informal discussion, introductory questions, warm up questioning

Formative:

- Daily Warm-ups
- Informal Questioning
- Teacher Observation
- Homework assignments/Classwork
- Exit tickets/Mini-quizzes
- In-class assignments
- Quizzes

Summative:

- Common Unit Assessment
- Quizzes
- Post-lab assessment questions and/or lab report

Extensions:

- Rigorous and/or challenging additional worksheets
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Production of a written dichotomous key differentiating types of matter

- Additional laboratory enrichment experiences using measurement apparatus

Correctives:
- Additional practice worksheets
- Pearson textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Materials and Resources:
- Chemistry textbook
- SMART notebook/PowerPoint
- Smartboard
- Class Notes
- Practice worksheets
- Homework worksheets
- Graphic organizers/Flowcharts
- Laptop computers/Chromebooks
- Sand
- Iron
- Salt
- Hot plates
- Funnels
- Filter paper
- Magnets
- Electronic balances

Unit 2: Scientific Measurement
Marking Period: 1
Time Range: 17 Days

Standard(s): PA Academic Standards, PACS Reading and Writing for Science and Technology http://www.corestandards.org/ELA-Literacy/RST/11-12/#CCSS.ELA-Literacy.RST.11-12.1, https://www.pdesas.org/Standard/View#, http://static.pdesas.org/content/documents/Chemistry_Keystone_Assessment_Anchors_and_Eligible_Content.pdf

3.2.10.A1., 3.2.C.A1., 3.2.10.A2., 3.2.C.A3., 3.2.C.A4., 3.2.C.A6., CC.3.5.9-10.B, CC.3.5.9-10.C, CC.3.5.9-10.G, CC.3.5.11-12.C, 3.2.C.B7., 3.4.10.C3., 3.2.C.A2, 3.2.C.A3, CC.2.4.HS.B., CC.2.4.HS.B.5, CC.3.5.11-12.C, CC.3.5.11-12.D, CC.3.5.11-12.F

Anchor(s):
CHEM.A.1.1, CHEM.A.1.1.1, CHEM.A.1.1.4, CHEM.A.1.2, CHEM.A.1.2.2, CHEM.B.1.2.2, CHEM.A.1.1.2, CHEM.A.1.1.3

Big Idea #1:
- In chemistry, the SI system of measurements is used to express values.

Essential Questions:
- How are amounts of materials expressed in chemistry?

Concepts:
- A measurement is a quantity with both a value and a unit. In chemistry, the system of measurements used to convey this is the SI, or metric, system.
- Metric units may be combined to express derived values like density.

Competencies:
- Take and read measurements using the SI-units.
- Convert between SI values using the prefix system.
- Solve problems using the dimensional analysis method.
- Perform density and percent error calculations.

Big Idea #2:
- Every measured value contains a degree of uncertainty

Essential Questions:
- How is uncertainty in measurements expressed?

Concepts:
- In every measurement, the last value is the estimated or uncertain value.
- The amount of decimal places present in a numerical value is a product of the precision of the measuring tool being utilized.

- When measured values are combined or used in calculations, the correct number of significant digits must be used.

Competencies:
- Distinguish between accuracy and precision.
- Identify certain and uncertain values in measurements.
- Record calculated values to the correct number of significant digits.

Big Idea #3:
- Occasionally in chemistry, extremely large or small values will be encountered.

Essential Questions:
- How are inconveniently large or small values made more manageable?

Concepts:
- Scientific notation is used in chemistry to make very large or very small values easier to work with.

Competencies:
- Convert from standard to scientific notation and vice versa. Add, subtract, multiply, and divide values expressed in scientific notation.

Overview:
Students will make distinctions between quantitative and qualitative measurements before beginning to read, record, manipulate, and use SI measurements. Unit conversions and dimensional analysis will be utilized to perform calculations, while accuracy and precision are compared and contrasted. Students will use scientific notation to record values and will use significant digits to express the level of precision in those values. Microsoft Excel will be used to determine density from a linear regression model, and percent error will be calculated.

Goals:
- Identify and describe the various types of chemistry and their uses/applications today
- Connect the concept of matter, its interactions, and changes to the physical world
- Identify and describe specific types of matter and how they combine to form compounds and mixtures
- Become familiar with means of taking and using scientific measurements
- Master the conversion between units in the SI system of measurements
- Identify what makes a measurement both accurate and precise
- Express values in scientific notation using the correct number of significant digits
- Calculate density and percent error

Objectives: Students will:
- Identify standard international units of measurement. (DOK – Level 1)
- Utilize SI units of measurement (DOK – Level 2)
- Interpret and employ various lab scientific measurement instruments (DOK – Level 2)

- Assess which lab measurement would be best to employ in a given scenario. (DOK - Level 3)
- Compare and contrast accuracy and precision. (DOK – Level 3)
- Identify sources of uncertainty. (DOK – Level 1)
- Explain potential sources of uncertainty (DOK – Level 2)
- Define significant digits (DOK – Level 1)
- Apply significant digits to measurements and calculations (DOK – Level 2)
- Calculate density. (DOK – Level 2)
- Calculate percent error. (DOK – Level 3)
- Determine the density of pennies using mass, volume displacement, and Microsoft Excel to fit a regression line to volume v. mass graph. (DOK – Level 3)
- Cite lab evidence to determine the identity of an unknown metal sample (DOK – Level 3)

Core Activities and Corresponding Instructional Methods:

- Use and read a variety of laboratory measurement equipment including analytical balances, graduated cylinders, thermometers, etc.
- Complete a beanbag toss activity to compare and contrast accuracy and precision
- Express values in standard and scientific notation. Convert between the two as needed.
- Represent calculated values using the correct number of significant digits.
- Complete an interactive lab experiment focusing on accuracy and precision correlating to lab data (See Appendix).
- Complete a lab experience (like the density of pennies lab) that results in the calculation of a derived unit with an accompanying percent error calculation.

Assessments:

Diagnostic:

- Algebra I and Biology Keystone Exams
- Informal discussion, introductory questions, warm up questioning

Formative:

- Daily Warm-ups
- Informal Questioning
- Teacher Observation
- Homework assignments/Classwork
- Exit tickets/Mini-quizzes
- In-class assignments
- Quizzes

Summative:

- Common Unit Assessment
- Quizzes
- Post-lab assessment questions and/or lab report

Extensions:

- Rigorous and/or challenging additional worksheets

- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Production of a written dichotomous key differentiating types of matter
- Additional laboratory enrichment experiences using measurement apparatus

Correctives:
- Additional practice worksheets
- Pearson textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Materials and Resources:
- Chemistry textbook
- SMART notebook/PowerPoint
- Smartboard
- Class Notes
- Practice worksheets
- Homework worksheets
- Graphic organizers/Flowcharts
- Laptop computers/Chromebooks
- Water
- Internet
- Pennies
- Electronic balances

Unit 3: Atomic Structure
Marking Period: 1
Time Range: 13 Days

Standard(s): PA Academic Standards, PACS Reading and Writing for Science and Technology
http://www.corestandards.org/ELA-Literacy/RST/11-12/#CCSS.ELA-Literacy.RST.11-12.1,
https://www.pdesas.org/Standard/View#,
http://static.pdesas.org/content/documents/Chemistry_Keystone_Assessment_Anchors_and_Eligible_Content.pdf

3.2.10.A1, 3.2.C.A1, 3.2.10.A5, 3.2.C.A5, 3.2.C.A2, 3.2.10.A4, 3.2.C.A5, 3.2.C.A6., 3.2.12.A2., CC.3.5.9-10.B, CC.3.5.11-12.B, CC.3.5.11-12.H

Anchor(s):
CHEM.A.1.1.4, CHEM.A.2.1, CHEM.A.2.1.1, CHEM.A.2.1.2

Big Idea #1:
- The atom is the most basic unit of matter that retains its unique properties

Essential Questions:
- How are atoms of one element different from atoms of another element?
- What components make up atoms?

Concepts:
- All elements are composed of atoms, which are unique to that element.
- Atoms can combine in constant, whole number ratios to form compounds, which may have entirely different properties than the atoms that comprise them.
- There are three subatomic particles: the proton, neutron, and electron, which combine to form atoms.
- Isotopes of elements are atoms with differing number of neutrons, and therefore, mass numbers.
- Our understanding of atomic structure has evolved over time, and has been represented by a progression of atomic models.

Competencies:
- Elements, ions, and isotopes will be differentiated based on the differing numbers of subatomic particles contained within them.
- Average atomic mass will be calculated from isotope mass numbers and relative abundances.
- The relative mass unit AMU will be related to the isotope carbon-12.

Big Idea #2:
- Our understanding of atomic structure is constantly under revision.

Essential Questions:

- How has our understanding of atomic structure changed over time?

Concepts:
- As technology has improved, our understanding of atomic structure has changed, as well.
- Through the years, there has been a historical progression of atomic models that have been supported by experimentation and mathematical modeling.
- It should be expected that our understanding of matter on the atomic scale would continue to evolve, even in our lifetime.

Competencies:
- Models will be utilized to show the progression from the earliest understanding of the atom through Rutherford's nuclear model.

Overview:
Students will explore the historical basis of chemistry as a field while focusing on notable contributions of major scientists along the way. Subatomic particles will be discussed, along with the relative-mass concept of the atomic mass unit. Atomic number, mass number, neutrons, and protons will be calculated. Isotopes and relative abundance will be used to calculate average atomic mass, which will be contrasted with mass number.

Goals:
- Gain an appreciation for the historical evolution of atomic theory
- Identify and describe the subatomic particles that combine to form matter
- Describe an isotope of an element and calculate average atomic mass from relative abundance

Objectives: Students will:
- Define an atom (DOK – Level 1)
- Identify notable scientists Democritus, Dalton, Thompson, Rutherford, etc. (DOK – Level 1)
- Summarize the contributions notable scientists to the development of the modern atomic theory (Level – 2)
- Identify the three subatomic particles. (DOK – Level 1)
- Compare their relative masses in AMU's and explain their contributions to atomic mass. (DOK – Level 2)
- Relate electrons to electricity (DOK – Level 3)
- Define an ion (DOK – Level 1)
- Determine the electrical charge of various ions (DOK - Level 2)
- Calculate the number of protons, neutrons, and electrons in an atom or ion (DOK – Level 2)
- Define atomic number, atomic mass, and isotopes (DOK – Level 1)
- Determine an isotopes relative abundance (DOK – Level 1)
- Calculate average atomic mass using mass number and relative abundance (DOK – Level 2)

Core Activities and Corresponding Instructional Methods:

- View and evaluate an in-depth film or online video on the historical development of the field of chemistry and the evolution of atomic structure from Democritus to present day.
- View and manipulate an online simulation of Rutherford's gold foil experiment
- Model and evaluate the gold foil experiment with an in-class activity such as the marble lab (See Appendix).
- Develop and calculate the atomic number, mass number, neutron, and electron numbers of 25 elements on the periodic table
- Calculate atomic mass from the mass number and relative abundance of isotopes
- Model average atomic mass calculations using a manipulative in class activity like the Candy-um Lab.

Assessments:

Diagnostic:

- Algebra I and Biology Keystone Exams
- Informal discussion, introductory questions, warm up questioning

Formative:

- Daily Warm-ups
- Informal Questioning
- Teacher Observation
- Homework assignments/Classwork
- Exit tickets/Mini-quizzes
- In-class assignments
- Quizzes

Summative:

- Common Unit Assessment
- Quizzes
- Post-lab assessment questions and/or lab report

Extensions:

- Rigorous and/or challenging additional worksheets
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Construction of an Atomic Theory Timeline

Correctives:

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

Materials and Resources:

- Chemistry textbook

- SMART notebook/PowerPoint
- Smartboard
- Class Notes
- Practice worksheets
- Homework worksheets
- Graphic organizers/Flowcharts
- Laptop computers/Chromebooks
- History of chemistry film/video
- Marbles

Unit 4: Electrons in Atoms
Marking Period: 2
Time Range: 12 Days

Standard(s): PA Academic Standards, PACS Reading and Writing for Science and Technology http://www.corestandards.org/ELA-Literacy/RST/11-12/#CCSS.ELA-Literacy.RST.11-12.1, https://www.pdesas.org/Standard/View#, http://static.pdesas.org/content/documents/Chemistry_Keystone_Assessment_Anchors_and_Eligible_Content.pdf

3.2.10.A5, 3.2.C.A1, 3.2.C.A2, 3.2.12.A2, 3.2.C.A6., 3.2.C.A4, CC.3.5.11-12.I, CC.3.5.11-12.H, CC.3.5.11-12.D, CC.2.4.HS.B.4 , CC.2.4.HS.B.5

Anchor(s):
CHEM.A.2.2 , CHEM.A.2.2.1, CHEM.A.2.2.2, CHEM.A.2.2.3, CHEM.A.2.2.4, CHEM.A.2.3, CHEM.A.2.3.1, CHEM.A.2.3.2, CHEM.A.1.1.5

Big Idea #1:
- Elements are composed of atoms, and every atom contains at least one or more electrons.

Essential Questions:
- How do the Bohr and Quantum Mechanical Models describe the arrangement of electrons in atoms?

Concepts:
- In the Bohr Model of the atom, electrons are located in neat, concentric rings around the nucleus, which Rutherford et al. found to house the protons and neutrons. In the Bohr model, it was hypothesized that the electrons, in their "shells," explained chemical behavior of atoms in bonding. The Quantum Mechanical Model was an improvement on the Bohr Model, which stopped treating electrons as having specific locations, but probabilities of where around the nucleus they might be found.

Competencies:
- Draw Bohr models of atoms after determining the number of electrons contained, explain quantum mechanical energy levels and orbitals and discuss the probability of finding an electron within a given orbital.
- Construct orbital filling diagrams and electron configurations for a given element based on the Quantum Mechanical Model.

Big Idea #2:
- Electrons may be quantized

Essential Questions:
- What happens when electrons in atoms gain or release energy?

Concepts:

- An electron may absorb a quantum of energy. In doing so, it may move up an energy level into a different orbital around the nucleus.
- When an electron loses energy and returns to its ground state, it releases the quantum of energy as visible light.

Competencies:
- Predict what will happen when an electron gains or releases energy.
- Explain why stable atoms spend the majority of time in their ground state.

Overview:
Develop of the Bohr model of the atom before leading into the Quantum Mechanical Model and the electron cloud. Electron configurations and orbital filling diagrams are explored, along with the Aufbau Principle, Pauli Exclusion Principle, and Hund's Rule. Ultimately, students will be able to correlate an elements electron configuration with its location on the periodic table.

Goals:
- Familiarize students with both the Bohr and Quantum Mechanical models of the atom
- Gain an understanding for energy levels, orbitals, and probable electron locations within the most current understanding of atomic structure
- Determine electron configurations for common elements using orbital filling diagrams while obeying the Aufbau principle, Pauli exclusion principle, and Hund's Rule.

Objectives: Students will:
- Compare and contrast the Bohr and Quantum Mechanical Models of the atom (DOK – Level 2)
- Describe atomic orbitals in terms of their size, shape, and relative energy values (DOK – DOK – Level 1)
- Determine electron configurations for elements using the principles of orbital energy (Aufbau Principle), electron spin (Pauli Exclusion Principle), & orbital capacity (Hund's Rule). (DOK – Level 3)
- Compare electron configurations for elements with their location on the periodic table (DOK – Level 2)
- Describe the relationship between electron configurations and the properties of elements. (DOK – Level 2)
- Use electron configuration to predict element behavior (DOK – Level 3)
- Classify the elements based on electron configuration stability. (DOK – Level 2)
- Predict which elements will be more/less stable based on their electron configurations. (DOK – Level 3)

Core Activities and Corresponding Instructional Methods:
- Draw and evaluate Bohr Model diagrams of atoms for 20 elements on the periodic table

- Compare, develop, and evaluate orbital shapes to manipulative objects (balls, dumb bells, clover leaves, flowers, etc.) in correlation to the Bohr and Quantum Mechanical Models of the atom
- Model and evaluate the electron cloud and electron location probability through and in-class activity (See Appendix)
- Develop, calculate, and complete orbital filling diagrams, electron configurations, and noble gas configurations for 25 elements on the periodic table being sure to include copper as a special case.

Assessments:

Diagnostic:
- Algebra I and Biology Keystone Exams
- Informal discussion, introductory questions

Formative:
- Daily Warm-ups
- Informal Questioning
- Teacher Observation
- Homework assignments/Classwork
- Exit tickets/Mini-quizzes
- In-class assignments
- Quizzes

Summative:
- Common Unit Assessment
- Quizzes
- Post-lab assessment questions and/or lab report

Extensions:
- Rigorous and/or challenging additional worksheets
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Construction of an Atomic Theory Timeline
- Exploration of the telluric hex and other primitive periodic tables
- Exploration of hydrates through a laboratory setting

Correctives:
- Additional practice worksheets
- Pearson textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Materials and Resources:
- Chemistry textbook
- SMART notebook/PowerPoint

- Smartboard
- Class Notes
- Practice worksheets
- Homework worksheets
- Graphic organizers/Flowcharts
- Laptop computers/Chromebooks

Unit 5: The Periodic Table
Marking Period: 2
Time Range: 17 Days

Standard(s): PA Academic Standards, PACS Reading and Writing for Science and Technology http://www.corestandards.org/ELA-Literacy/RST/11-12/#CCSS.ELA-Literacy.RST.11-12.1, https://www.pdesas.org/Standard/View#, http://static.pdesas.org/content/documents/Chemistry_Keystone_Assessment_Anchors_and_Eligible_Content.pdf

3.2.10.A5, 3.2.C.A1, 3.2.C.A2, 3.2.12.A2, 3.2.C.A6., 3.2.C.A4, CC.3.5.11-12.I, CC.3.5.11-12.H, CC.3.5.11-12.D, CC.2.4.HS.B.4 , CC.2.4.HS.B.5

Anchor(s):
CHEM.A.2.2 , CHEM.A.2.2.1, CHEM.A.2.2.2, CHEM.A.2.2.3, CHEM.A.2.2.4, CHEM.A.2.3, CHEM.A.2.3.1, CHEM.A.2.3.2, CHEM.A.1.1.5

Big Idea #1:
- The periodic table is a useful tool used to organize the elements

Essential Questions:
- What information does the periodic table provide?

Concepts:
- The periodic table is organized by increasing atomic number with each row ending with a stable electron configuration at a noble gas.
- Within each period (row), there is a repeating pattern of similar physical and chemical properties of the elements.
- Within a group (column) all of the elements share common physical and chemical properties, as well as similar valence electron configurations.

Competencies:
- State Periodic Law and use it to predict physical and chemical properties of elements.
- Determine element locations on the periodic table based on a description of physical and chemical properties.

Big Idea #2:
- Periodic trends in the properties of elements allow for the prediction of their physical and chemical properties.

Essential Questions:
- How does the periodic table help to predict these trends?

Concepts:
- Periodic patterns of chemical properties are the basis of the arrangement of the periodic table.

- This results in identifiable trends as one reads from left-to-right and top-to-bottom along the table.

Competencies:
- Students will be able to identify and illustrate common periodic trends found on the periodic table of the elements.

Overview:
The contributions of Mendeleev will be revisited, along with a review of his periodic table, before discussing Periodic Law and the repeating pattern of properties on the modern periodic table. Distinctions will be made between metals, nonmetals, and metalloids, and the properties of each group will be explored. Periods and groups will be compared and contrasted, and the common properties of different groups will be discussed. Finally, periodic trends in atomic radius, ionization energy, and electronegativity will be investigated.

Goals:
- Describe Periodic Law as it relates to the Periodic Table of Elements
- Connect element location to group, element type, and common properties
- Predict properties of elements using common periodic trends

Objectives: Students will:
- Define Periodic Law (DOK – Level 1)
- Summarize the contributions of Mendeleev and others (Dobereinier, Chancourtois, Moseley, Seaborg, etc.) to the development of the modern periodic table (DOK – Level 2)
- Compare the contributions of notable scientists to the format of current and previous periodic tables (DOK – Level 3)
- Categorize the elements by group on the periodic table (DOK – Level 3
- Connect the locations of elements on the table with the repeating pattern of properties (DOK – Level 4)
- Differentiate between metals, nonmetals, metalloids (DOK – Level 3)
- Synthesis examples of metals, nonmetals, and metalloids (DOK – Level 4)
- Identify notable groups on the periodic table (alkali metals, alkaline earth metals, transition metals, actinides, lanthanides, halogens, and noble gases) (DOK – Level 1)
- Distinguish between their properties (DOK – Level 2)
- Identify the four blocks of the periodic table (DOK – Level 1)
- Connect their location to electron configuration (DOK – Level 4)
- Observe the chemical and physical properties and changes of various samples (DOK – Level 2)
- Assess the chemical and physical properties and changes of various samples (DOK – Level 3)
- Compare laboratory observations of metal samples (DOK – Level 2)
- Relate them to their electron configurations. (DOK – Level 3)
- Define Periodic trends (DOK – Level 1)

- Identify and describe trends for atomic radius, ionization energy, and electronegativity (DOK – Level 1)
- Correlate the three trends to electron configuration. (DOK – Level 3)

Core Activities and Corresponding Instructional Methods:
- Complete a research project on one of the elements on the periodic table (See Appendix)
- Use physical and chemical properties of unknown elements to determine position on the periodic table (See Appendix)
- Color-code/annotate a blank periodic table with groups and trends
- Explore the chemical and physical properties of common metals in a laboratory setting

Assessments:

Diagnostic:
- Algebra I and Biology Keystone Exams
- Informal discussion, introductory questions, warm up questioning

Formative:
- Daily Warm-ups
- Informal Questioning
- Teacher Observation
- Homework assignments/Classwork
- Exit tickets/Mini-quizzes
- In-class assignments
- Quizzes

Summative:
- Common Unit Assessment
- Quizzes
- Post-lab assessment questions and/or lab report

Extensions:
- Rigorous and/or challenging additional worksheets
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Construction of an Atomic Theory Timeline
- Exploration of the telluric hex and other primitive periodic tables
- Exploration of hydrates through a laboratory setting

Correctives:
- Additional practice worksheets
- Pearson textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Materials and Resources:

- Chemistry textbook
- SMART notebook/PowerPoint
- Smartboard
- Class Notes
- History of chemistry film/videos
- Practice worksheets
- Homework worksheets
- Graphic organizers/Flowcharts
- Laptop computers/Chromebooks

Unit 6: Chemical Formulas and Nomenclature
Marking Period: 2
Time Range: 13 Days

Standard(s): PA Academic Standards, PACS Reading and Writing for Science and Technology http://www.corestandards.org/ELA-Literacy/RST/11-12/#CCSS.ELA-Literacy.RST.11-12.1, https://www.pdesas.org/Standard/View#, http://static.pdesas.org/content/documents/Chemistry_Keystone_Assessment_Anchors_and_Eligible_Content.pdf

3.2.10.A5, 3.2.C.A1, 3.2.C.A2, 3.2.12.A2, 3.2.C.A6., 3.2.C.A4, CC.3.5.11-12.I, CC.3.5.11-12.H, CC.3.5.11-12.D, CC.2.4.HS.B.4 , CC.2.4.HS.B.5

Anchor(s):
CHEM.A.2.2 , CHEM.A.2.2.1, CHEM.A.2.2.2, CHEM.A.2.2.3, CHEM.A.2.2.4, CHEM.A.2.3, CHEM.A.2.3.1, CHEM.A.2.3.2, CHEM.A.1.1.5

Big Idea #1:
- Chemical compounds are formed from constant, whole number ratios of atoms

Essential Questions:
- How can chemical compounds be named and formulas be written to ensure that they are consistent across the world?

Concepts:
- The IUPAC has provided a systemic set of rules that ensure that naming conventions are consistent wherever chemistry is being taught.
- This employs Greek prefixes for molecular compounds and roman numeral for transition metal compound names, and ensures that ionic compounds are charge-balanced.

Competencies:
- Names and formulas can be provided for a variety of molecular, ionic, polyatomic, and transition metal compounds, as well as alkanes and alcohols.

Overview:
This unit covers basic chemical formula writing conventions, introduces diatomic molecules, and discusses chemical bond types. Atom numbers within molecules will be determined. Students will then name and write formulas for a variety of chemical compound types, both organic and inorganic.

Goals:
- Name chemical compounds when given the corresponding formula
- Determine the formula for a compound when provided with the compound name

Objectives: Students will:
- Memorize common polyatomic ions (DOK – Level 1)
- Memorize the seven diatomic molecules (DOK - Level 1)

- Compare and contrast ionic and covalent bonding (DOK – Level 2)
- Determine the number of atoms in a given sample of molecules (DOK – Level 2)
- Name and write the formulas for covalent compounds, hydrates, and hydrides (DOK – Level 2)
- Name and write formulas for ionic compounds (DOK – Level 2)
- Name and write formulas for ionic compounds containing transition metals and/or polyatomic ions (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)

Core Activities and Corresponding Instructional Methods:

- Memorize, develop, and utilize common polyatomic ions
- Label/color-code and evaluate the seven diatomic molecules
- Build, develop, and evaluate molecules using model kits
- Complete and evaluate an in-class activity on the balancing of electrical charges and writing ionic compound formulas.
- Develop, research, and present a in-depth presentation on a compound (See Appendix)

Assessments:

Diagnostic:

- Algebra I and Biology Keystone Exams
- Informal discussion, introductory questions, warm up questioning

Formative:

- Daily Warm-ups
- Informal Questioning
- Teacher Observation
- Homework assignments/Classwork
- Exit tickets/Mini-quizzes
- In-class assignments
- Quizzes

Summative:

- Common Unit Assessment
- Quizzes
- Post-lab assessment questions and/or lab report

Extensions:

- Rigorous and/or challenging additional worksheets
- Rigorous and challenging data sets/calculations
- In-depth online video resources

- Exploration and evaluation of the telluric hex and other primitive periodic tables
- Exploration, calculation, and evaluation of hydrates through a laboratory setting

Correctives:
- Additional practice worksheets
- Pearson textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Materials and Resources:
- Chemistry textbook
- SMART notebook/PowerPoint
- Smartboard
- Class Notes
- Practice worksheets
- Homework worksheets
- Graphic organizers/Flowcharts
- Laptop computers/Chromebooks
- Hotplates
- Hydrates
- Evaporating dishes
- Wire gauze
- Gloves
- Digital balances

Unit 7: The Mole
Marking Period: 3
Time Range: 17 days

Standard(s): PA Academic Standards, PACS Reading and Writing for Science and Technology http://www.corestandards.org/ELA-Literacy/RST/11-12/#CCSS.ELA-Literacy.RST.11-12.1, https://www.pdesas.org/Standard/View#, http://static.pdesas.org/content/documents/Chemistry_Keystone_Assessment_Anchors_and_Eligible_Content.pdf

3.2.C.A1, 3.2.C.A2, 3.2.C.A4., 3.2.10.A5, 3.2.12.A6., CC.3.5.11-12.A, CC.3.5.11-12.B, CC.3.5.11-12.C, CC.3.5.11-12.D, CC.3.5.11-12.E, CC.3.5.11-12.F, CC.3.5.11-12.G, CC.3.5.11-12.I, CC.3.5.11-12.J

Anchor(s):
CHEM.B.1.1, CHEM.B.1.2, CHEM.B.1.2.1, CHEM.B.1.2.2, CHEM.B.1.2.3

Big Idea #1:
- 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.

Overview:
Methods of evaluating data and introducing qualitative and quantitative relationships in matter as presented. Develop the understanding of the how moles are used to connect number of particles on the macroscopic level.

Goals:
- Complete mole conversions using particles, atoms, grams, and moles
- Write balanced chemical equations using whole number coefficients

Objectives: Students will:

- 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)
- 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)

Core Activities and Corresponding Instructional Methods:
- Compare and calculate the idea of the mole to scientific principles
- Develop ad calculate Avogadro's number through in class activity
- Compare and calculate empirical and molecular formulas to a known value given unknown compositions in a laboratory setting (See Appendix).
- Complete, calculate and evaluate mathematical problems involving moles, atoms, particles, and grams

Assessments:

Diagnostic:
- Algebra I and Biology Keystone Exams
- Informal discussion, introductory questions, warm up questioning

Formative:
- Daily Warm-ups
- Informal Questioning
- Teacher Observation
- Homework assignments/Classwork
- Exit tickets/Mini-quizzes
- In-class assignments
- Quizzes

Summative:
- Common Unit Assessment
- Quizzes
- Post-lab assessment questions and/or lab report

Extensions:
- Rigorous and/or challenging additional worksheets
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Explore the idea of hydrates
- Explore limiting and excess reactants though a laboratory setting

Correctives:

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

Materials and Resources:

- Chemistry textbook
- Microsoft Office Suite
- SMART Notebook
- Media Player
- Smartboard
- Practice worksheets
- Graphing calculator
- Laptop computers
- Digital balances
- Sulfur
- Copper
- Lentil beans
- Kidney beans
- Navy beans
- Lima beans
- Beaker

Unit 8: Stoichiometry
Marking Period: 3
Time Range: 16 days

Standard(s): PA Academic Standards, PACS Reading and Writing for Science and Technology http://www.corestandards.org/ELA-Literacy/RST/11-12/#CCSS.ELA-Literacy.RST.11-12.1, https://www.pdesas.org/Standard/View#, http://static.pdesas.org/content/documents/Chemistry_Keystone_Assessment_Anchors_and_Eligible_Content.pdf

3.2.C.A1, 3.2.C.A2, 3.2.C.A4., 3.2.10.A5, 3.2.12.A6., CC.3.5.11-12.A, CC.3.5.11-12.B, CC.3.5.11-12.C, CC.3.5.11-12.D, CC.3.5.11-12.E, CC.3.5.11-12.F, CC.3.5.11-12.G, CC.3.5.11-12.I, CC.3.5.11-12.J

Anchor(s):
CHEM.B.1.1, CHEM.B.1.2, CHEM.B.1.2.1, CHEM.B.1.2.2, CHEM.B.1.2.3

Big Idea #1:
- 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.

Big Idea #2:
- Chemical reactions are predictable

Essential Questions:
- How do stoichiometric ratios relate reactant to products in a chemical equation?
- What factors identify the type 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.
- Students can connect the number of particles, moles, mass, and volume of substances to one 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.

Overview:
Develop understanding of stoichiometry, balancing reactions, limiting reactants, excess reactants, percent yield.

Goals:
- Complete mole conversions
- Write balanced chemical equations
- Predict the yield for a variety of chemical reactions
- Analyze data from experiments to understand the relationships in conversions from moles to grams to atoms
- Determine, calculate, and evaluate the theoretical outcome of chemical reactions using conversion methods (See Appendix).

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

Core Activities and Corresponding Instructional Methods:
- Predict the number of products and remaining reactants though in class laboratory activity (See Appendix).
- Compare and contrast various methods utilized in obtaining solutions

Assessments:

Diagnostic:
- Algebra I and Biology Keystone Exams
- Informal discussion, introductory questions

Formative:

- Daily Warm-ups
- Informal Questioning
- Teacher Observation
- Homework assignments/Classwork
- Exit tickets/Mini-quizzes
- In-class assignments
- Quizzes

Summative:

- Common Unit Assessment
- Quizzes
- Post-lab assessment questions and/or lab report

Extensions:

- Rigorous and/or challenging additional worksheets
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Explore the idea of hydrates
- Explore limiting and excess reactants though a laboratory setting

Correctives:

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

Materials and Resources

- Chemistry textbook
- Microsoft Office Suite
- SMART Notebook
- Media Player
- Smartboard
- Practice worksheets
- Graphing calculator
- Laptop computers
- Digital balances
- Beakers
- Silver nitrate
- Filter paper

Unit 9: Molarity
Marking Period: 3
Time Range: 12 days

Standard(s): PA Academic Standards, PACS Reading and Writing for Science and Technology
http://www.corestandards.org/ELA-Literacy/RST/11-12/#CCSS.ELA-Literacy.RST.11-12.1,
https://www.pdesas.org/Standard/View#,
http://static.pdesas.org/content/documents/Chemistry_Keystone_Assessment_Anchors_and_Eligible_Content.pdf

3.2.C.A1, 3.2.C.A2, 3.2.C.A4., 3.2.10.A5, 3.2.12.A6., CC.3.5.11-12.A, CC.3.5.11-12.B, CC.3.5.11-12.C, CC.3.5.11-12.D, CC.3.5.11-12.E, CC.3.5.11-12.F, CC.3.5.11-12.G, CC.3.5.11-12.I, CC.3.5.11-12.J

Anchor(s):
CHEM.B.1.1, CHEM.B.1.2, CHEM.B.1.2.1, CHEM.B.1.2.2, CHEM.B.1.2.3

Big Idea #1:
- 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.

Big Idea #2:
- Chemical reactions are predictable

Essential Questions:
- How do stoichiometric ratios relate reactant to products in a chemical equation?
- What factors identify the type 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.
- Students can connect the number of particles, moles, mass, and volume of substances to one 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.

Overview:
Develop understanding of stoichiometry, limiting reactants, solubility rules, molarity of ions in solution.

Goals:
- Complete mole conversions
- Write balanced chemical equations
- Predict the yield for a variety of chemical reactions
- Analyze reactants reagents in solution to learn the principles of solubility
- Analyze data from experiments to understand the relationships in conversions from moles to grams to atoms

Objectives: Students will:
- Memorize, develop, and evaluate solubility rules. (DOK – Level 1)
- Design solutions of a specific molarity. (DOK – Level 2)
- Write equations for the reactions of acids and bases. (DOK – Level 3)

Core Activities and Corresponding Instructional Methods:
- Compare and contrast at least three various methods utilized in obtaining solutions
- Explore the idea of molarity using laboratory experiments
- Identify, develop, and utilize solubility rules
- Identify develop, and evaluate net ionic and ionic equations given double replacement reactions.
- Develop, evaluate, and calculate in relation to a calibration curve to common household drinks the concentration in of FDA Blue #1 Dye through an in-depth laboratory setting

Assessments:

Diagnostic:

- Algebra I and Biology Keystone Exams
- Informal discussion, introductory questions, warm up questioning

Formative:
- Daily Warm-ups
- Informal Questioning
- Teacher Observation
- Homework assignments/Classwork
- Exit tickets/Mini-quizzes
- In-class assignments
- Quizzes

Summative:
- Common Unit Assessment
- Quizzes
- Post-lab assessment questions and/or lab report

Extensions:
- Rigorous and/or challenging additional worksheets
- Rigorous and challenging data sets/calculations
- In-depth online video resources
- Explore limiting and excess reactants though a laboratory setting

Correctives:
- Additional practice worksheets
- Pearson textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Materials and Resources:

- Chemistry textbook
- Microsoft Office Suite
- SMART Notebook
- Media Player
- Smartboard
- Practice worksheets
- Graphing calculator
- Laptop computers
- Digital balances
- Spec20
- Burettes
- FDA Blue #1 Food Dye

Unit 10: Types of Reactions
Marking Period: 4
Time Range: 8 days

Standard(s): PA Academic Standards, PACS Reading and Writing for Science and Technology
http://www.corestandards.org/ELA-Literacy/RST/11-12/#CCSS.ELA-Literacy.RST.11-12.1,
https://www.pdesas.org/Standard/View#,
http://static.pdesas.org/content/documents/Chemistry_Keystone_Assessment_Anchors_and_Eligible_Content.pdf

3.2.10.A1, 3.2.C.A1, 3.2.10.A2, 3.2.C.A2, 3.2.10.A3, 3.2.10.A4, 3.2.10.A5, 3.2.C.A4, 3.2.12.A2, 3.2.12.A4, 3.2.12.A5, 3.2.12.A6., CC.3.5.11-12.A, CC.3.5.11-12.B, CC.3.5.11-12.C, CC.3.5.11-12.D, CC.3.5.11-12.E, CC.3.5.11-12.F, CC.3.5.11-12.G, CC.3.5.11-12.I, CC.3.5.11-12.J

Anchor(s):
CHEM.A.1.2.1, CHEM.A.1.2.2 , CHEM.A.1.2.3 , CHEM.A.1.2.4, CHEM.A.1.2.5, CHEM.A.2.2.4

Big Idea #1:
- 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 reactions classified as synthesis, decomposition, single replacement, double replacement, and combustion?

Concepts:
- Identify synthesis, decomposition, single replacement, double replacement, and combustion reactions

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

Overview:
- Introduce and develop basic and advanced concepts relating to synthesis, decomposition, single replacement, double replacement, and combustion reactions.

Goals:
- Write balanced equations and correctly predict products
- Predict types of reactions
- Create reactions developing a firm understanding of the five types of reactions.

Objectives: Students will:

- Write chemical equations for the combustion of a given alkane or alcohol. (DOK – Level 2)
- Predict results quantitatively of a chemical reaction. (DOK – Level 4)

Core Activities and Corresponding Instructional Methods:

- Identify, develop, and evaluate the five main types of chemical reactions through an in-depth laboratory experiment (See Appendix)
- Predict and evaluate chemical reactions given only the identity of the reactants

Assessments:

Diagnostic:

- Algebra I and Biology Keystone Exams
- Informal discussion, introductory questions, warm up questioning

Formative:

- Daily Warm-ups
- Informal Questioning
- Teacher Observation
- Homework assignments/Classwork
- Exit tickets/Mini-quizzes
- In-class assignments
- Quizzes

Summative:

- Common Unit Assessment
- Quizzes
- Post-lab assessment questions and/or lab report

Extensions:

- Rigorous and/or challenging additional worksheets
- Rigorous and challenging data sets/calculations
- Develop a laboratory experiment
-

Correctives:

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

Materials and Resources:

- Chemistry textbook
- Microsoft Office Suite

- SMART Notebook
- Media Player
- Smartboard
- Practice worksheets
- Graphing calculator
- Laptop computers
- Digital balances
- Rulers
- Graduated cylinders
- Beakers
- Copper
- Bunsen burner
- Magnesium
- Forceps
- Calcium oxide
- Copper (II) carbonate
- Hydrogen peroxide
- Zinc metal
- Hydrochloric acid
- Lead (II) nitrate
- Cooper (II) sulfate
- Potassium Iodide
- Potassium hydroxide
- Methane
- Wooden splint
- Ethanol
- Plastic pipettes

Unit 11: Atomic Emission
Marking Period: 4
Time Range: 9 days

Standard(s): PA Academic Standards, PACS Reading and Writing for Science and Technology
http://www.corestandards.org/ELA-Literacy/RST/11-12/#CCSS.ELA-Literacy.RST.11-12.1,
https://www.pdesas.org/Standard/View#,
http://static.pdesas.org/content/documents/Chemistry_Keystone_Assessment_Anchors_and_Eligible_Content.pdf

3.2.10.A1, 3.2.C.A1, 3.2.10.A2, 3.2.C.A2, 3.2.10.A3, 3.2.10.A4, 3.2.10.A5, 3.2.C.A4, 3.2.12.A2, 3.2.12.A4, 3.2.12.A5, 3.2.12.A6., CC.3.5.11-12.A, CC.3.5.11-12.B, CC.3.5.11-12.C, CC.3.5.11-12.D, CC.3.5.11-12.E, CC.3.5.11-12.F, CC.3.5.11-12.G, CC.3.5.11-12.I, CC.3.5.11-12.J

Anchor(s):
CHEM.A.1.2.1, CHEM.A.1.2.2 , CHEM.A.1.2.3 , CHEM.A.1.2.4, CHEM.A.1.2.5, CHEM.A.2.2.4

Big Idea #1:
- Elements are composed of atoms, and every atom contains at least one or more electrons.

Essential Questions:
- How do the Bohr and Quantum Mechanical Models describe the arrangement of electrons in atoms?

Concepts:
- In the Bohr Model of the atom, electrons are located in neat, concentric rings around the nucleus, which Rutherford et al. found to house the protons and neutrons. In the Bohr model, it was hypothesized that the electrons, in their "shells," explained chemical behavior of atoms in bonding. The Quantum Mechanical Model was an improvement on the Bohr Model, which stopped treating electrons as having specific locations, but probabilities of where around the nucleus they might be found.

Competencies:
- Draw Bohr models of atoms after determining the number of electrons contained, explain quantum mechanical energy levels and orbitals and discuss the probability of finding an electron within a given orbital.
- Construct orbital filling diagrams and electron configurations for a given element based on the Quantum Mechanical Model.

Big Idea #2:
- Electrons may be quantized

Essential Questions:
- What happens when electrons in atoms gain or release energy?

Concepts:

- An electron may absorb a quantum of energy. In doing so, it may move up an energy level into a different orbital around the nucleus.
- When an electron loses energy and returns to its ground state, it releases the quantum of energy as visible light.

Competencies:

- Predict what will happen when an electron gains or releases energy.
- Explain why stable atoms spend the majority of time in their ground state.

Overview:
Develop of the Bohr model of the atom before leading into the Quantum Mechanical Model and the electron cloud. Electron configurations and orbital filling diagrams are explored, along with the Aufbau Principle, Pauli Exclusion Principle, and Hund's Rule. Ultimately, students will be able to correlate an elements electron configuration with its location on the periodic table.

Goals:

- Familiarize students with both the Bohr and Quantum Mechanical models of the atom
- Gain an understanding for energy levels, orbitals, and probable electron locations within the most current understanding of atomic structure in correlation with the release and absorption of energy.
- Develop and calculate the wavelengths and frequencies of electromagnetic radiation as energy is released in the form of radiation.
- Determine and evaluate energy expulsion and absorption between energy levels in an element.

Objectives: Students will:

- 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 quantum numbers for electrons within atoms. (DOK – Level 3)
- Use shielding, Coulomb’s Law and stability principles to explain trends of periodic properties. (DOK – Level 4)

Core Activities and Corresponding Instructional Methods:

- Draw, develop, and evaluate the Bohr Model diagrams of atoms in correlation to the movement of photons in energy levels
- Compare orbital shapes to manipulative objects (balls, dumb bells, clover leaves, flowers, etc.) in relation to their orientation around the Quantum mechanical model of the atom

- Identify, develop, and evaluate the connection between the Bohr model and atomic emission spectrum though laboratory experiments
- Compare and contrast the expulsion of energy in gas energy tubes when excited through a laboratory activity (See Appendix).
- Develop, evaluate, and calculate the emission spectrum of hydrogen given diffraction gradients, meter sticks, hydrogen gas tubes in a in-depth laboratory experiment.

Assessments:

Diagnostic:
- Algebra I and Biology Keystone Exams
- Informal discussion, introductory questions, warm up questioning

Formative:
- Daily Warm-ups
- Informal Questioning
- Teacher Observation
- Homework assignments/Classwork
- Exit tickets/Mini-quizzes
- In-class assignments
- Quizzes

Summative:
- Common Unit Assessment
- Quizzes
- Post-lab assessment questions and/or lab report

Extensions:
- Rigorous and/or challenging additional worksheets
- Rigorous and challenging data sets/calculations
- In-depth online video resources

Correctives:
- Additional practice worksheets
- Pearson textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Materials and Resources:

- Chemistry textbook
- Microsoft Office Suite
- SMART Notebook
- Media Player
- Smartboard
- Practice worksheets

- Graphing calculator
- Laptop computers
- Digital balances
- Rulers
- Graduated cylinders
- Spec20 instrument
- Hydrogen, nitrogen, argon, neon, krypton glass tubes
- Diffraction gradients
- Bunsen burners
- Strikers
- Assorted metal solutions
- Ethanol

Unit 12: Electron Geometry
Marking Period: 4
Time Frame- 10 days

Standard(s): PA Academic Standards, PACS Reading and Writing for Science and Technology http://www.corestandards.org/ELA-Literacy/RST/11-12/#CCSS.ELA-Literacy.RST.11-12.1, https://www.pdesas.org/Standard/View#, http://static.pdesas.org/content/documents/Chemistry_Keystone_Assessment_Anchors_and_Eligible_Content.pdf

3.2.10.A1, 3.2.C.A1, 3.2.10.A2, 3.2.C.A2, 3.2.10.A3, 3.2.10.A4, 3.2.10.A5, 3.2.C.A4, 3.2.12.A2, 3.2.12.A4, 3.2.12.A5, 3.2.12.A6., CC.3.5.11-12.A, CC.3.5.11-12.B, CC.3.5.11-12.C, CC.3.5.11-12.D, CC.3.5.11-12.E, CC.3.5.11-12.F, CC.3.5.11-12.G, CC.3.5.11-12.I, CC.3.5.11-12.J

Anchor(s):
CHEM.A.1.2.1, CHEM.A.1.2.2 , CHEM.A.1.2.3 , CHEM.A.1.2.4, CHEM.A.1.2.5, CHEM.A.2.2.4

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.

Overview:
Introduce basic and advanced concepts of periodic law, atomic structure, and molecular geometry.

Goals:
- Predict the shape of molecules using valence electrons, Lewis diagrams and bonding theory
- Analyze data from experiments 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

Objectives: Students will:
- 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)

Core Activities and Corresponding Instructional Methods:
- Draw and evaluate Lewis dot structures
- Identify and develop the connection between electron configurations and valence electrons
- Build, develop, and evaluate molecules using model kits.
- Indicate resonance structures when necessary for at least seven compounds/molecules
- Use valence shell electron pair repulsion theory (VSEPR) to predict geometry of molecules for at least 25 compounds/molecules
- Use bond polarity and molecular geometry to determine polarity of a molecular structure

Assessments:

Diagnostic:
- Algebra I and Biology Keystone Exams
- Informal discussion, introductory questions, warm up questioning

Formative:
- Daily Warm-ups
- Informal Questioning
- Teacher Observation
- Homework assignments/Classwork

- Exit tickets/Mini-quizzes
- In-class assignments
- Quizzes

Summative:
- Common Unit Assessment
- Quizzes
- Post-lab assessment questions and/or lab report

Extensions:
- Rigorous and/or challenging additional worksheets
- Rigorous and challenging data sets/calculations
- In-depth online video resources

Correctives:
- Additional practice worksheets
- Pearson textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Materials and Resources:

- Chemistry textbook
- Microsoft Office Suite
- SMART Notebook
- Media Player
- Smartboard
- Practice worksheets
- Graphing calculator
- Laptop computers
- Digital balances
- Rulers
- Graduated cylinders
- Model kits
- Marshmallows
- Toothpicks

Unit 13: Acids and Bases
Marking Period: 4
Times Range: 9 days

Standard(s): PA Academic Standards, PACS Reading and Writing for Science and Technology http://www.corestandards.org/ELA-Literacy/RST/11-12/#CCSS.ELA-Literacy.RST.11-12.1, https://www.pdesas.org/Standard/View#, http://static.pdesas.org/content/documents/Chemistry_Keystone_Assessment_Anchors_and_Eligible_Content.pdf

3.2.10.A1, 3.2.C.A1, 3.2.10.A2, 3.2.C.A2, 3.2.10.A3, 3.2.10.A4, 3.2.10.A5, 3.2.C.A4, 3.2.12.A2, 3.2.12.A4, 3.2.12.A5, 3.2.12.A6., CC.3.5.11-12.A, CC.3.5.11-12.B, CC.3.5.11-12.C, CC.3.5.11-12.D, CC.3.5.11-12.E, CC.3.5.11-12.F, CC.3.5.11-12.G, CC.3.5.11-12.I, CC.3.5.11-12.J

Anchor(s):
CHEM.A.1.2.1, CHEM.A.1.2.2 , CHEM.A.1.2.3 , CHEM.A.1.2.4, CHEM.A.1.2.5, CHEM.A.2.2.4

Big Idea #1:
- 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:
- Acids and bases will be defined according to the Arrhenius and Bronsted-Lowry definitions

Competencies:
- Complete an acid base titration and use the concept of molarity to determine the concentration of a titration reaction.
- Chemical changes are represented by a balanced chemical equation that identifies the ratios with which reactants react and products form.

Overview:
Introduce the basic concepts of acids and bases in correlation to titrations and neutralizations.

Goals:
- Explain that many reactions involve the transfer of hydrogen ions
- Discuss and compare ionization of strong and weak acids and bases

Objectives: Students will:

- Identify a substance as a potential Lewis acid or base. (DOK – Level 1)
- Distinguish between strong acids and weak acids. (DOK – Level 2)
- Distinguish between strong bases and weak bases. (DOK – Level 2)
- Predict the direction of the reaction to reach equilibrium (DOK -Level 3)
- Describe weak acid–bases as conjugate pairs. (DOK – Level 3)
- Identify the pH of a salt using its conjugate acid. (DOK – Level 3)
- Describe weak acid–bases 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 molar mass of a solid acid from titration data (DOK – Level 3)

Core Activities and Corresponding Instructional Methods:

- Identify and evaluate a substance as a potential Lewis acid or base
- Distinguish between strong and weak acids and bases
- Identify and calculate pH and pOH given hydrogen and hydroxide concentrations for at least five examples
- Evaluate the pH and pOH at the equivalence point of a titration during a laboratory setting

Assessments:

Diagnostic:

- Algebra I and Biology Keystone Exams
- Informal discussion, introductory questions, warm up questioning

Formative:

- Daily Warm-ups
- Informal Questioning
- Teacher Observation
- Homework assignments/Classwork
- Exit tickets/Mini-quizzes
- In-class assignments
- Quizzes

Summative:

- Common Unit Assessment
- Quizzes
- Post-lab assessment questions and/or lab report

Extensions:

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

- In-depth online video resources

Correctives:
- Additional practice worksheets
- Pearson textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Materials and Resources:

- Chemistry textbook
- Microsoft Office Suite
- SMART Notebook
- Media Player
- Smartboard
- Practice worksheets
- Graphing calculator
- Laptop computers
- Digital balances
- Rulers
- Solid acids (at least three different types)
- Sodium hydroxide
- Burette
- Ring stand
- Burette clamp
- Funnel
- Beaker
- Graduated cylinder
- Weigh boats

Unit 14: Gas Laws
Marking Period: 4
Time Range: 9 days

Standard(s): PA Academic Standards, PACS Reading and Writing for Science and Technology
http://www.corestandards.org/ELA-Literacy/RST/11-12/#CCSS.ELA-Literacy.RST.11-12.1,
https://www.pdesas.org/Standard/View#,
http://static.pdesas.org/content/documents/Chemistry_Keystone_Assessment_Anchors_and_Eligible_Content.pdf

3.2.10.A1, 3.2.C.A1, 3.2.10.A2, 3.2.C.A2, 3.2.10.A3, 3.2.10.A4, 3.2.10.A5, 3.2.C.A4, 3.2.12.A2, 3.2.12.A4, 3.2.12.A5, 3.2.12.A6., CC.3.5.11-12.A, CC.3.5.11-12.B, CC.3.5.11-12.C, CC.3.5.11-12.D, CC.3.5.11-12.E, CC.3.5.11-12.F, CC.3.5.11-12.G, CC.3.5.11-12.I, CC.3.5.11-12.J

Anchor(s):
CHEM.A.1.2.1, CHEM.A.1.2.2 , CHEM.A.1.2.3 , CHEM.A.1.2.4, CHEM.A.1.2.5, CHEM.A.2.2.4

Big Idea #1:
- 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?

Concepts:
- Identify lone pairs in molecules to help determine chemical bond and formation according to the VSEPR Theory

Competencies:
- 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

Overview:
Introduce basic concepts of gas laws in correlation to the ideal gas law, Charles's Law and Boyle's Law.

Goals:
- Write balanced equations and correctly predict products
- Analyze data from experiments 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

Objectives: Students will:

- 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)

Core Activities and Corresponding Instructional Methods:

- Use ideal gas law, Charles's Law and Boyle's Law to evaluate pressure, volume and temperature changes on a gas sample in a laboratory setting
- Apply the principles of stoichiometry to gas reactions.

Assessments:

Diagnostic:

- Algebra I and Biology Keystone Exams
- Informal discussion, introductory questions, warm up questioning

Formative:

- Daily Warm-ups
- Informal Questioning
- Teacher Observation
- Homework assignments/Classwork
- Exit tickets/Mini-quizzes
- In-class assignments
- Quizzes

Summative:

- Common Unit Assessment
- Quizzes
- Post-lab assessment questions and/or lab report

Extensions:

- Rigorous and/or challenging additional worksheets
- Rigorous and challenging data sets/calculations
- In-depth online video resources

Correctives:

- Additional practice worksheets

- Pearson textbook resources/chapter summaries
- Online video resources
- Textbook provided PowerPoints/Notes

Materials and Resources:

- Chemistry textbook
- Microsoft Office Suite
- SMART Notebook
- Media Player
- Smartboard
- Practice worksheets
- Graphing calculator
- Laptop computers
- Digital balances
- Rulers
- Graduated cylinders
- Plastic tubing
- Plastic syringe with plunger

Primary Textbook(s) Used for this Course of Instruction

Name of Textbook: Pearson Chemistry

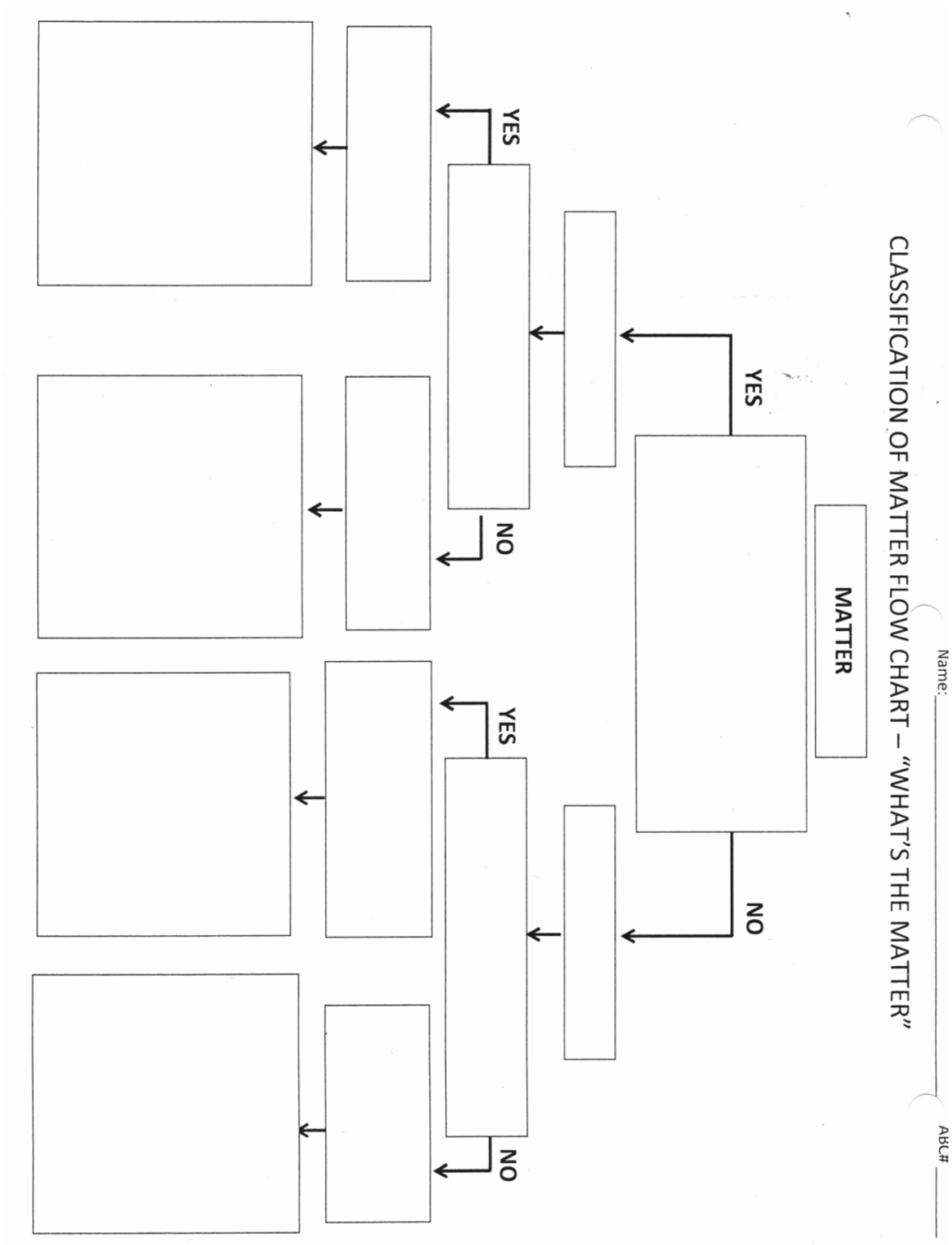
Textbook ISBN #: 978-0-13-252582-4

Textbook Publisher &Year of Publication: Pearson Education, Inc. 2012

Curriculum Textbook is utilized in (title of course): General Chemistry

Appendix

(See included worksheets as follow)


CLASSIFICATION OF MATTER FLOW CHART – "WHAT'S THE MATTER"
Name:
MATTER
YES
NO
YES
NO
YES
NO

[illegible]

Conservation of Mass Lab

Pre-Lab:

[illegible]

[illegible]

[illegible]

Purpose: To experimentally verify & observe the Law of Conservation of Mass in action

Part 1: Sodium Bicarbonate and Acetic Acid

Materials:

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

Data Table 1: Open System
Initial mass: ________________
Final mass: __________
Change in mass: _____
Data Table 2: Closed System
Initial mass: ________________
Final mass: _________________
Change in mass: ____________________

Procedure:

<u>Open System:</u>

[illegible]

[illegible] tared [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

<u>Closed System:</u>

[illegible]

[illegible]

3. Add sodium bicarbonate to the Ziploc bag. Carefully place the beaker of acetic acid in the bag and seal. Be sure to remove as much excess air as possible.
4. Mass sealed Ziploc bag and contents. Record as "initial mass" in data table 2.
5. **CAREFULLY** invert beaker inside sealed bag, allowing acetic acid and sodium bicarbonate to react. Do not shake. Allow reaction to occur.
6. When reaction has ceased, mass sealed Ziploc bag and contents. Record as "final mass" in data table 1.
7. Subtract the initial mass from the final mass and record as "change in mass" in Data Table 1.

Part 2: Alka-Seltzer and Water

Materials:

- Balance
- 125 ml Erlenmeyer Flasks (x2)
- 50 ml Water (x2)
- Alka-Seltzer Tablet (x2)
- Balloon
- Tape (optional)

Data Table 3: Open System
Initial mass: ______________
Final mass: ________________
Change in mass:

Data Table 4: Closed System
Initial mass: ________________
Final mass: _________________
Change in mass:

____

Procedure:

Open System:

7. Dispense 50 ml water and add to 125 ml Erlenmeyer Flask.
8. Mass Erlenmeyer flask and Alka-Seltzer tab. Record as "initial mass" in Data Table 3.
9. Add Alka-Seltzer tab to flask and allow reaction to occur for three (3) minutes.
10. When reaction has ceased, mass flask and products. Record as "final mass" in Data Table 3.
11. Subtract the initial mass from the final mass and record as "change in mass" in Data Table 3.

Closed System:

8. Dispense 50 ml water and add to 125 ml E. Flask.
9. Place Alka-Seltzer tab into balloon. Use open end of balloon to seal top of flask. **BE SURE NOT TO DROP THE ALKA-SELTZER BEFORE THE FLASK IS SEALED.** Secure balloon with tape, if desired.
10. Mass Erlenmeyer flask, balloon, and Alka-Seltzer tab. Record as "initial mass" in data table 4.
11. Lift balloon to drop Alka-Seltzer tab into the water. Allow reaction to occur for three (3) minutes.
12. When reaction has ceased, mass flask, balloon and products. Record as "final mass" in Data Table 4.
13. Subtract the initial mass from the final mass and record as "change in mass" in Data Table 4.

Analysis:

1. Using your data to justify your conclusion, did this lab serve to validate the Law of Conservation of Mass? How do you know?

2. Compare and contrast the results of the open system vs. the closed system for both Parts 1 and 2. Was mass always conserved in the system? If not, where did it go, and why?

Rainbow Lab
Teacher Notes

Introduction

This lab is a perfect first day of class activity! It's a wonderful way to promote cooperative learning, communication, and teamwork. It requires students to practice their skills in taking measurements, following directions and using proper lab techniques. Best of all, it can be customized for a variety of age levels and abilities. Plus, it's easy to evaluate whether students correctly followed the instructions—no laborious grading of papers or quizzes.

Preparation:

You will need red, yellow, and blue food coloring and enough large plastic trays (such as cafeteria trays) so that every group of 4 students has its own tray.

Before class, mix up three large containers of colored water using the food coloring in these proportions for each 2-quart pitcher of water:

- ✓ 12 drops of red
- ✓ 8 drops of blue
- ✓ 60 drops of yellow

Prepare one tray for each team of 4 students with these items:

- ✓ 6 test tubes
- ✓ 1 test tube rack
- ✓ 3 pipettes
- ✓ 50 or 100 mL beaker with 40 mL of RED liquid
- ✓ 50 or 100 mL beaker with 40 mL of YELLOW liquid
- ✓ 50 or 100 mL beaker with 40 mL of BLUE liquid
- ✓ 2 - 25 mL graduated cylinders
- ✓ 2 - 10 mL graduated cylinders
- ✓ 2 empty beakers
- ✓ 1 wax pencil
- ✓ 4 pairs of safety goggles
- ✓ 4 aprons

Rainbow Lab
Teacher Notes

Teacher Tips

Use this lab to emphasize the importance of safety procedures when using chemicals. Students do not need to know that the three liquids are merely colored water. This is a chance to stress the need for caution during all future labs.

Remind students to rinse out their graduated cylinders and test tubes between measurements to avoid contamination.

Some teachers complete this lab in a single class period but it more commonly requires almost two full classes.

Be sure to have plenty of test tubes racks available so students can store their work until Day 2. Also, consider placing stoppers over the test tubes at the end of class so that no water evaporates, changing the results.

At the end of the lab, students should have 63 mL of liquid. Spillage, incorrect measurements, and excess water from rinsing are all factors that might change their total.

Once you set up the materials for students, the rest is a breeze! Be available to answer students' questions, but do not correct them if their measurements are inaccurate. You'll have a chance to determine which students work well together and assess which students may need additional time and/or help with lab technique.

Time period: 1 ½ to 2 classes (45 min each)

Teacher Answer Key

With one look, you will be able to tell if students have carefully followed the instructions. You should see a rainbow with the six liquids all at the same height in their test tubes.

Test Tube	Color of Water	Total mL of Water
A	Red	10
B	Orange	11
C	Yellow	10
D	Green	11
E	Blue	10
F	Purple	11

Name: ______________________________

Rainbow Lab

Introduction:

The purpose of this lab is to help you practice safe use of lab materials. You must follow the directions exactly, so make sure you read them carefully.

Safety:

- ✓ GOGGLES must be worn at all times when using glassware, chemicals, or fire.
- ✓ Make sure your backpacks, binders, jackets etc. are all stowed away before you begin.
- ✓ When mixing chemicals, remember to avoid cross contamination by cleaning your equipment every time you use a new chemical.
- ✓ Always carry lab equipment with two hands, to avoid accidentally dropping it.

Objectives:

- ✓ to develop your skills measuring chemicals with a graduated cylinder.
- ✓ to practice using the metric system.
- ✓ to test precision and your ability to follow directions.
- ✓ to practice lab safety procedures.

Materials:

- ✓ 6 test tubes
- ✓ 1 test tube rack
- ✓ 3 pipettes
- ✓ 1 beaker with RED liquid
- ✓ 1 beaker with YELLOW liquid
- ✓ 1 beaker with BLUE liquid
- ✓ 2 - 10 mL graduated cylinders
- ✓ 1 - 25 mL graduated cylinder
- ✓ safety goggles
- ✓ aprons

Name: ______________________________

Rainbow Lab

Procedure:

Part 1:

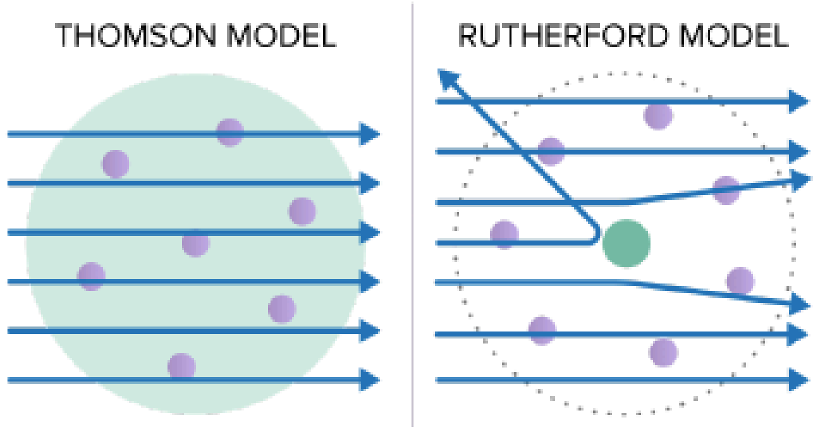
1. Label the six test tubes in order: A, B, C, D, E, and F.
2. Fill one of the empty beakers half full with water. Use this beaker to rinse your graduated cylinder and your test tubes as needed.
3. The second empty beaker is to be used for contaminated waste water.
4. Into test tube A, measure 25 mL of **RED** liquid.
5. Into test tube C, measure 17 mL of **YELLOW** liquid.
6. Into test tube E, measure 21 mL of **BLUE** liquid.

Part 2:

1. From test tube C, measure 4 mL and pour into test tube D.
2. From test tube E, measure 7 mL and pour into test tube D. Swirl.
3. From test tube E, measure 4 mL and pour into test tube F.
4. From test tube A, measure 7 mL and pour into test tube F. Swirl.
5. From test tube A, measure 8 mL and pour into test tube B.
6. From test tube C, measure 3 mL and pour into test tube B. Swirl.
7. Save your results. Measure the contents of each test tube and record how many mL of liquid were found in each test tube.
8. Answer the Analysis/Result questions on the next page and write a Conclusion.

Name: ______________________________ Date: ______________

Simulation Rutherford's Gold Foil Experiment



Calculating the Diameter of the Nucleus of an Atom

How can we determine the diameter of the nucleus of an atom? How can we measure something we cannot see? In this lab, you will simulate the famous experiment by Ernest Rutherford. In this experiment, Rutherford shot (alpha) particles at a very thin sheet of gold foil. Behind the gold foil was a screen that would light up when a particle hit it. He noticed that most of the particles went straight through the foil and only a small percentage was deflected. He concluded that the nucleus of those gold atoms makes up only a very small part of the atom's volume. From this observation came the phrase, "Atoms are mostly empty space." You will simulate this experiment with marbles. By rolling a marble at 5 targets and counting how many times they hit, you will be able to calculate the diameter of a marble accurately.

Materials:

1) Metric ruler
2) Masking Tape
3) Pencil
4) 6 marbles that are the same size (If available five (5) of a single color and one (1) of another color)
5) Books, blocks, boards, etc (something to act as a boarder to the finish line on your marble track)

Procedure:

1) Set up your marble track. Use a piece of tape to mark your start line. The start line should be 50cm long. In a straight line (200cm away) use another piece of tape to mark the finish line. The finish line should also be 50cm long. Place a book (or whatever you have available) on either side of the finish line to act as a boarder.
2) Place five marbles on the finish line between the books. Do not worry if they are not perfectly spaced. These marbles represent the nuclei of the gold atoms in the foil.
3) Randomly place the remaining marble on the starting line. This marble represents the (alpha) particle shot at the gold foil. Roll the marble towards the finish line **100** times. Count how many times the "particle" marble hits a "gold nuclei" marble.
    a. **It is very important that you do not aim at the marbles, but just roll them randomly**. There are a few ways you can ensure randomness: You can turn around and roll the marble backwards, close your eyes when you roll the marble, or even kick the marble.
    b. The "particle" marble must go between the two books at the finish line without touching the books to count as a roll. If it hits a book it does not count. If the "particle" marble does not go between the books it does not count as a roll.
    c. You can only get up to 1 hit per roll (even if the "particle" marble hits more than 1 "gold nuclei" marble).
    d. Do not worry if you miss the "gold nuclei" marbles often. The marbles take up a small percentage of the track, so they will hit only a small percentage of the time. If each marble's diameter was 2 cm (which they are not), they would only hit 40% (or 40 out of 100) times. Marbles are smaller than that, so they will hit less often than that.
    e. After a "gold nuclei" marble gets hit, put it back on the line.

Data:

Number of Rolls	100
Number of Hits	

Data Analysis: Please answer these questions on a separate piece of paper.

1) Calculate the ratio of times that you hit versus the number of times that you rolled. Convert your answer from a fraction to a decimal. You may use a calculator.

$$\frac{\text{\# of Hits}}{\text{100 (\# of Rolls)}} = \_\_\_\_\_\_\_\_$$

2) Because you are rolling one marble at another, if they are within two diameters of each other, they will collide, so they appear to be taking up twice as much space as they really do. So divide your answer to #1 by 2. This is the proportion of the track that the marbles occupy.
3) Multiply your answer from #2 by the width of the track (50cm) to determine how much of the track's space the marbles will take up.
4) Divide your answer to #3 by five (the number of "gold nuclei" marbles) to figure out how much space each marble took up. **This is the diameter of the marbles in centimeters!**
5) Ask your teacher to measure the marbles diameter with a caliper. What is the difference between your calculated answer and the measured results? What is the percent error?

$$Calculated\ diameter - measured\ diameter = Difference$$

$$\frac{|measured\ diameter - calculated\ diameter|}{measured\ diameter} \times 100\% = Percent\ Error$$

Difference= ________________________

Percent Error= ____

Continue on to the back to complete all conclusion questions in **FULL sentences**!!

If it is not a complete sentence you are **not** getting credit!!

Conclusion: Please answer these questions in complete sentences.

1) Think about the experiment that this activity was simulating. Why was it important for you not to aim at the marbles? Please relate your answer to Rutherford's gold foil experiment.

2) Why did you have to roll the marble so many times in this investigation? How do you think rolling the "particle" marble 1000 times would affect your results?

3) How close was your calculated diameter to the measured diameter? What are **at least three** things that may have caused the difference between the two?

4) How did Rutherford's experiment lead to the common phrase, "Atoms are mostly empty space?"

5) All matter is made up of atoms. How can a solid object be made of something that is "mostly empty space?"

Name:_______________________________________Date:__________________ Period: _________

Electrons in Atoms Activity

1. Place your target on the table make sure that the target is flat.

2. Drop your marker from a height of approximately 20 cm above the target. Make sure that you aim for the center of the target repeating this ***one hundred*** times. Make sure that you do not throw the marker but let it fall freely from your hand aiming for the center of the target.

3. Once you are done, count the number of marks in each of the numbered regions of the target and record these numbers in the data table. Circle the marks with a **pencil** to avoid counting a mark twice.

Region	**Number of Marks**
1	
2	
3	
4	
5	
6	

4. If a colored mark from the marker is completely within an area, it belongs to that area. If the colored mark is on a line, it belongs to the area that the greater portion of its mark occupies. If a mark seems to be equally in two areas, it belongs to the area nearest the center.

Laboratory Questions *(Answer all questions in full sentences)*

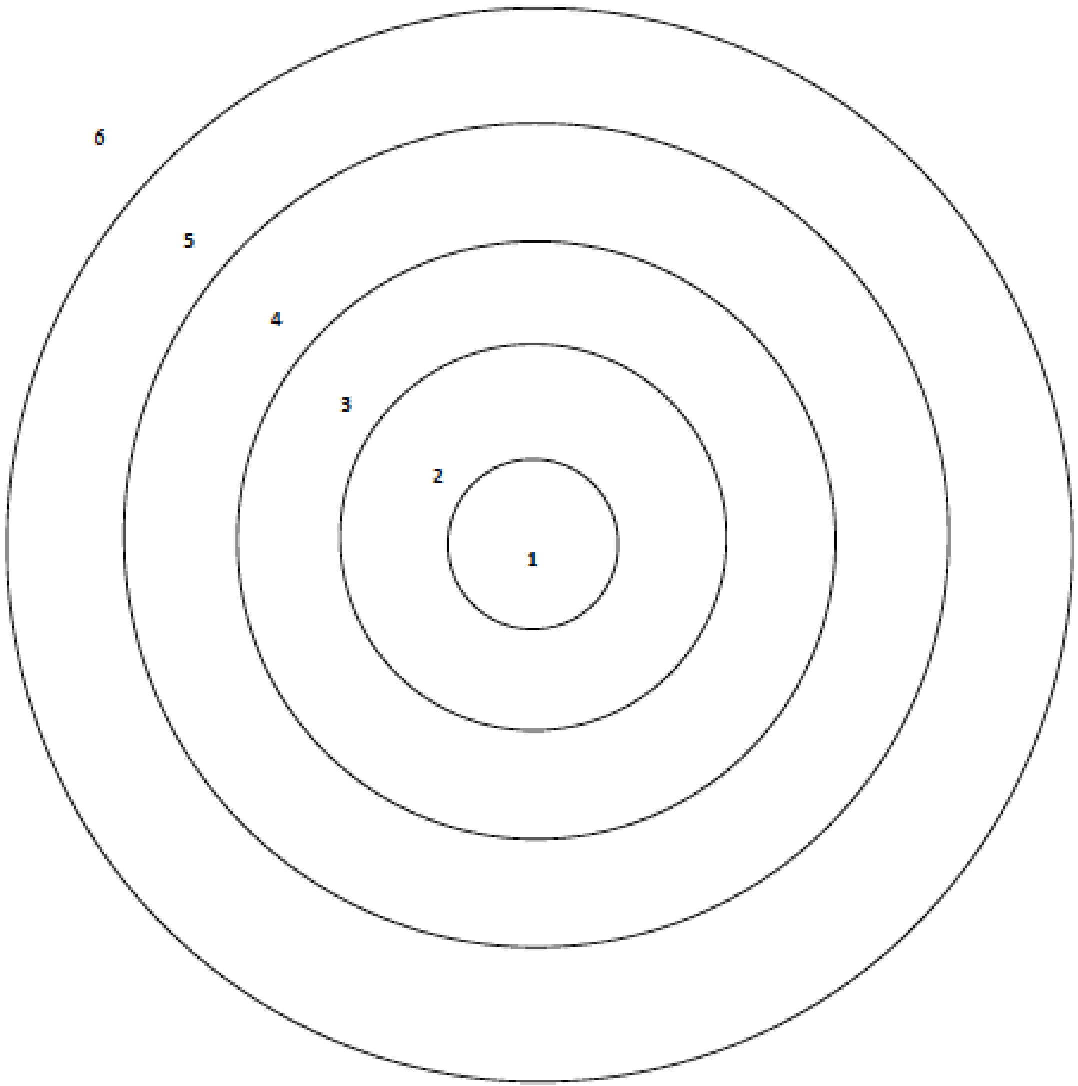
1. Explain the difference between Schrödinger's orbitals and Bohr's electron orbits.

2. Draw the shapes of the s and p orbitals:

3. In this experiment does the probability of finding an electron change as you move away from the nucleus of the atom? How **should** the probability change (HINT- think of the electron cloud)?

4. How does the distribution of dots compare from region to region?

5. Do 90% of the marks fall close to the nucleus (Rings 1 & 2) of the atom. How does this compare to Schrödinger's results?


6
5
4
3
2
1

Element Cube Project

Introduction: This is an individual project worth 50 points. This is primarily a research project where you will collect information about one element in the Periodic Table of Elements. You will be assigned an element. The information collected will be compiled on a cube for presentation. You will present your cube in class so that everyone in class may become familiar with your element. Some of the project may need to be completed at home. WE WILL PUT THE CUBE TOGETHER DURING CLASS!!

Directions: Collect data about your element using reference materials and internet sites. Construct the element cube. Place the data collected neatly on the 6 sides of the cube following instructions. You will be given time in class to work on your project. Unfinished work is homework.

Side #1 – Symbol and Name: JUST LIKE THE PERIODIC TABLE!

1. Symbol of your element (make this large on your cube).
2. Name of the element.
3. Atomic Number at the top
4. Average Atomic Mass at the bottom

My element:

Element symbol:

Side #2 – Images:
You must have at least two pictures of your element. Pictures may be printed out from the Internet, drawn by hand, or photocopied (you should make them small so they fit on the cube). Important: you must place a caption under each photo. The caption describes what is in the picture.

Two of the pictures should include a Bohr model of the element and the electron configuration (noble gas notation is okay)

Side #3 –Physical & Chemical Properties of _______________:

Color:

Odor:

State of matter at room temperature:

Texture:

Density:

Flammability:

Melting point:

Ionization Energy:

Boiling point:

Electronegativity:

Abundance on Earth:

Side #4 –about ____________:

Provide background history of your element. Who discovered and/or first identified your element? What country? When? How did the element get its name?

Where is your element found and how is it obtained?

Is it a metal, nonmetal, or metalloid?

Side #5 – Uses of ____________:

How and where is your element used? Where do you "bump into" your element in everyday life? (either in its pure form, in compound form, or in mixture form) (Include pictures if necessary) (Try to get at least three uses!)

Side #6—(opposite side #1) should be blank except for your name (first and last) and class period.

Element Cube Project Template

Everything needs to fit in these text boxes. When done, you can print this out, cut out the squares. Do not use color unless you plan on printing this at home.

Side #1

Atomic Number

Xx

Name of Element

Atomic Mass

Side #2

Pictures of Element

You must have at least two pictures of your element. One must be a Bohr model of the atom showing in electron shell levels and one must show the electron configuration (noble gas notation is okay) (Make sure to include a caption under each picture)

Side #3

Physical and Chemical Properties of Element

Color:

Ionization Energy:

State of Matter at Room Temperature:

Density:

Electronegativity:

Melting Point:

Abundance on Earth:

Boiling Point:

Odor:

Texture:

Flammability:

Side #4

Element Information

Who Discovered Your Element:

Where:

When:

How Did it Get its Name:

Where is it Found:

How is it Obtained:

Metal, Nonmetal, or Metalloid:

Group and Family Name:

Period:

Side #5

Uses of Element

How and where is your element used? Where do you "bump into" your element in everyday life? (either in its pure form, in compound form, or in mixture form) (Include pictures if necessary) (Try to get at least three uses!)

Side #6

Name:

Class Period:

Date:

Element:

Resources:

Names ____ Period ___

The Mendeleev Lab of 1869

Problem:

Use your knowledge of the periodic table to determine the identity of each of the seven unknown elements in this activity.

- The unknown elements are from the A groups on the periodic table. Each group contains at least one unknown.
- None of the known elements serve as one of the seven unknown elements.
- No radioactive elements are used during this experiment. The relevant radioactive elements include Fr, Ra, At, and Rn.
- You may not use your textbook or other reference materials. You have been provided with enough information to determine each of the unknown elements.

Procedure:

1. Separate the unknowns and set aside.
2. Inspect the properties of the known elements.
3. Arrange the cards of the known elements in a crude representation of the periodic table.
4. Once the known elements are in place, inspect the properties of the unknowns to see where their properties would best "fit" the trends of the elements of each group.
5. In your data table, assign the proper element name to each of the unknowns. Record the symbol for each of the "unknowns" in your data table.

Unknown	Identity	Evidence?
1		
2		
3		
4		
5		
6		
7		

1. What trend in size of the atom do you see as you move across a period?
____

2. What trend in size of the atom do you see as you move down a group?
____

3. What trend in ionization energy do you see as you move across a period?
____

4. What trend in ionization energy do you see as you move down a group?
____

Li

Atomic number	3
Physical State	solid
Density	0.534 g/cm^3
Conductivity	good
Melting Point	180^{o}C
Color	silver
Reactivity	very reactive
Ionization energy	5.392

Cl

Atomic number	17
Physical State	gas
Density	0.00321 g/cm^3
Conductivity	very poor
Melting Point	-101^{o}C
Color	greenish yellow
Reactivity	very reactive
Ionization energy	12.967

Se

Atomic number	34
Physical State	solid
Density	4.81 g/cm^3
Conductivity	semi-
Melting Point	221 ^{o}C
Color	gray/red/black
Ionization energy	9.752

N

Atomic number	7
Physical State	gas
Density	0.00125 g/cm^3
Conductivity	poor
Melting Point	-210^{o}C
Color	colorless
Ionization energy	14.534

He

Atomic number	2
Physical State	gas
Density	0.00018 g/cm^3
Conductivity	very poor
Melting Point	-272^{o}C
Color	colorless
Reactivity	almost none
Ionization energy	24.587

Na

Atomic number	11
Physical State	solid
Density	0.971 g/cm^3
Conductivity	good
Melting Point	98^{o}C
Color	silver
Reactivity	very reactive
Ionization energy	5.139

C

Atomic number	6
Physical State	solid
Density	2.10 g/cm^3
Conductivity	good
Melting Point	3550^{o}C
Color	black
Ionization energy	11.26

Ca

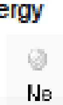
Atomic number	20
Physical State	solid
Density	1.57 g/cm^3
Conductivity	good
Melting Point	845^{o}C
Color	silvery white
Reactivity	reactive
Ionization energy	6.113

Be

Atomic number	4
Physical State	solid
Density	1.85 g/cm^3
Conductivity	excellent
Melting Point	1287^{o}C
Color	gray
Reactivity	reactive
Ionization energy	9.322

Ne

Atomic number	10
Physical State	gas
Density	0.00090 g/cm^3
Conductivity	very poor
Melting Point	-249^{o}C
Color	colorless
Reactivity	almost none
Ionization energy	21.564



Br

Atomic number	35
Physical State	gas
Density	3.12 g/cm^3
Conductivity	very poor
Melting Point	-7.2^{o}C
Color	reddish brown
Reactivity	very reactive
Ionization energy	11.814

Sn

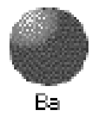
Atomic number	50
Physical State	solid
Density	7.31 g/cm^3
Conductivity	good
Melting Point	232^{o}C
Color	silver
Ionization energy	7.344

In

Atomic number	49
Physical State	solid
Density	7.31 g/cm^3
Conductivity	medium
Melting Point	157°C
Color	silvery white
Ionization energy	5.786

Ba

Atomic number	56
Physical State	solid
Density	3.6 g/cm^3
Conductivity	good
Melting Point	710°C
Color	silvery white
Reactivity	reactive



K

Atomic number	19
Physical State	solid
Density	0.86 g/cm^3
Conductivity	good
Melting Point	63°C
Color	silver
Reactivity	very reactive
Ionization energy	4.341

Ar

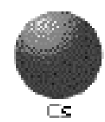
Atomic number	18
Physical State	gas
Density	0.00178 g/cm^3
Conductivity	very poor
Melting Point	-189.2°C
Color	colorless
Reactivity	almost none
Ionization energy	15.759

Ga

Atomic number	31
Physical State	solid
Density	5.904 g/cm^3
Conductivity	medium
Melting Point	30°C
Color	silvery
Ionization energy	5.999

Cs

Atomic number	55
Physical State	solid
Density	1.87 g/cm^3
Conductivity	good
Melting Point	29°C
Color	silvery white
Reactivity	very reactive



O

Atomic number	8
Physical State	gas
Density	0.0013 g/cm^3
Conductivity	poor
Melting Point	-219°C
Color	colorless
Reactivity	reactive
Ionization energy	13.618

P

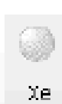
Atomic number	15
Physical State	solid
Density	1.823 g/cm^3
Conductivity	poor
Melting Point	44.2 °C
Color	white
Ionization energy	10.486

As

Atomic number	33
Physical State	solid
Density	5.776 g/cm^3
Conductivity	poor
Melting Point	817 °C
Color	gray
Ionization energy	9.81

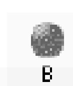
Xe

Atomic number	54
Physical State	gas
Density	0.00585 g/cm^3
Conductivity	very poor
Melting Point	-119.9°C
Color	colorless
Reactivity	almost none
Ionization energy	12.13



B

Atomic number	5
Physical State	solid
Density	2.34 g/cm^3
Conductivity	poor at r.t.
Melting Point	2076°C
Color	brown
Ionization energy	8.298



I

Atomic number	53
Physical State	solid
Density	4.93 g/cm^3
Conductivity	very poor
Melting Point	113.5°C
Color	blue-black
Reactivity	very reactive
Ionization energy	10.451

Si

Atomic number	14
Physical State	solid
Density	2.33 g/cm^3
Conductivity	intermediate
Melting Point	1410°C
Color	gray
Ionization energy	8.151

Si

Unknown #6

Atomic number	?
Physical State	gas
Density	0.00170 g/cm^3
Conductivity	very poor
Melting Point	-219.6°C
Color	pale yellow
Reactivity	very reactive
Ionization energy	17.422

Unknown #5

Atomic number	?
Physical State	solid
Density	1.53 g/cm^3
Conductivity	good
Melting Point	39°C
Color	silvery white
Reactivity	very reactive
Ionization energy	4.177

Unknown #4

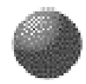
Atomic number	?
Physical State	gas
Density	0.00374 g/cm^3
Conductivity	very poor
Melting Point	-156.6°C
Color	colorless
Reactivity	almost none
Ionization energy	13.999

Unknown #3

Atomic number	?
Physical State	solid
Density	1.96 g/cm^3
Conductivity	poor
Melting Point	115 °C
Color	yellow
Reactivity	reactive
Ionization energy	10.36

Sr

Atomic number	38
Physical State	solid
Density	2.54 g/cm^3
Conductivity	good
Melting Point	769°C
Color	silvery white
Reactivity	reactive
Ionization energy	5.695



Sr

Unknown #1

Atomic number	?
Physical State	solid
Density	5.32 g/cm^3
Conductivity	fair to poor
Melting Point	937°C
Color	gray
Ionization energy	7.899

Al

Atomic number	13
Physical State	solid
Density	2.7 g/cm^3
Conductivity	medium
Melting Point	303°C
Color	silvery white
Ionization energy	5.986

Al

Unknown #7

Atomic number	?
Physical State	solid
Density	1.74 g/cm^3
Conductivity	good
Melting Point	651°C
Color	silvery white
Reactivity	reactive
Ionization energy	7.646

Unknown #2

Atomic number	?
Physical State	solid
Density	6.69 g/cm^3
Conductivity	poor
Melting Point	631 °C
Color	bluish-white
Ionization energy	8.641

Tellurium

Atomic number	52
Physical State	solid
Density	6.24 g/cm^3
Conductivity	varies
Melting Point	450°C
Color	silvery gray
Ionization energy	9.009

Te

Teacher's Instructions

Answers for Unknowns

1. Magnesium (Mg)
2. Fluorine (F)
3. Rubidium (Rb)
4. Krypton (Kr)
5. Sulfur (S)
6. Antimony (Sb)
7. Germanium (Ge)

Name: ______________________________ Date:________________ Period: ______

Chemistry Research Project: Chemical Compounds

Background:

- We have learned to write formulas for a variety of chemical compounds and we have also learned to evaluate compounds for their composition.
- The discovery and use of many different chemical compounds has made a large impact in our world from fighting battles, to fighting diseases.
- Their importance spans all aspects of our lives including what we eat, how we dress and care for ourselves, our transportation, and even the way we communicate.
- There would be no cell phones without the understanding of chemistry!

Objective: to research a chemical that has made a **significant** impact in the world.

Requirements:

- Research a molecule that has a significant impact on our world.
- Prepare a poster to "showcase" this molecule and its importance.
- Present the information that you learned about your chemical compound.
- Items that need to be presented are listed below:

Required Information:

For your selected compound:

- Identify the chemical formula for the compound and a structural diagram of the molecule.
    - List all the elements in this compound and calculate the percent composition of each element in the compound.
- Identify where this compound is found and how it can be prepared.
- Include a picture of the molecule.
- Include a picture of how the compound is prepared and where it could be found naturally.
- Provide a historical understanding of the molecule.
- Identify its unique physical and chemical properties.
- Identify useful applications of the molecule.
- Explain how this molecule has made an impact on our world.

Suggested Compounds (common name):

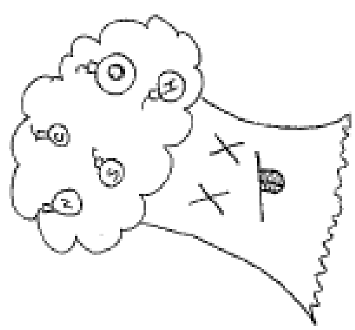
You are not restricted to pick a chemical from this list.
You must talk to me about ANY other chemical that you wish to do that is not on the list.

Penicillin
Acetaminophen
Aspirin
Cholesterol
Caffeine
Chlorophyll
Nicotine
MDMA
Saccharin
DDT
Serotonin
Sulfapyridine (sulfadrug)
Capsaicin (hot pepper)
Benzoic Acid
Morphine
Teflon
TNT
Monosodium glutamate (MSG)
Sucrose
Ascorbic Acid
Dopamine
Serotonin
Vanillin (vanilla)
Glycerin Tocopherol
Laughing gas
Kevlar
Zinc oxide
Sodium lauryl sulfate
Potassium nitrate (saltpeter)
Glycerin
Hydrogen peroxide
Sodium hydroxide
Benzene
Opium
Nylon
Lysergic acid
Diethylamine
Methamphetamine
Tetrahydrocannabinol
Salicylic Acid
Rubber
Sodium stearate
Polyvinyl Chloride
Polyethylene
Glyphosate
Acetone
Bleach
Ammonia
Sodium bicarbonate
Ethylene glycol
Calcium sulfate monohydrate
Iron pyrite (fool's gold)
Agent orange
2,4-Dichlorophenoxyacetic acid
2,4,5-Trichlorophenoxyacetic acid
MAOI
SSRI
Silicon dioxide
Aluminium oxide
Octane
Arsenic
Cetaine
Petroleum Jelly
Steel
Borosilicate
Triclosan
Calcium carbonate
Sodium lauryl sulfate
Sorbitol
Aspartame
Potassium benzoate
Phenylalanine
Sucralose
Tartaric acid
Potassium sorbate
Malic Acid
Sodium caseinate
Disodium inosinate
Disodium Guanylate

CSI: Herbicide

There's been a murder and the local forensics team needs your help to solve it! Chem S. Tree, a noble and wise member of the chemical community, has been poisoned. The forensics team has compiled an autopsy report along with the information on widely used herbicides that are often used to kill plants. Four suspects have been taken into custody, and it's up to you to determine who-done-it.

The Autopsy Report



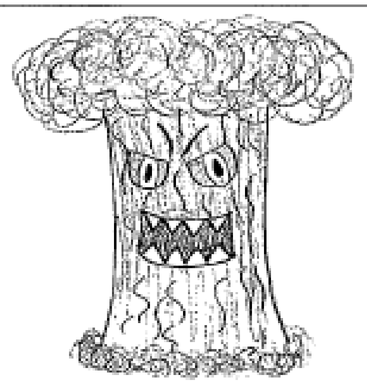
Victim:	Chem S. Tree
Age:	283 yrs
Height:	152.3 ft
Girth:	9.7 ft
Cause Of Death:	Poisoning
Unusual Toxicity:	Foreign substance found inside victim's sap-stream contained the following:

Element	Mass
Carbon	62.464 g
Hydrogen	5.215 g
Chlorine	20.512 g
Oxygen	27.697 g

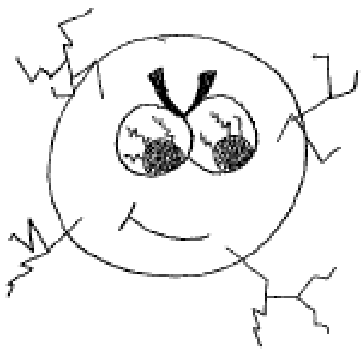
The Common Herbicides

Chemical Name	Abbreviation	Chemical Formula
2,4-Dichlorophenoxyacetic acid	2,4-D_I	$C_8H_6Cl_2O_3$
Methylchlorophenoxypropinoic acid	MCPP	$C_{10}H_{11}ClO_3$
2,3,7,8-Tetrachlorodibenzodioxin	TCDD	$C_{12}H_4Cl_4O_2$
4-(2,4-dichlorophenoxy)butyric acid	2,4-DB	$C_{10}H_{10}Cl_2O_3$
2,4,5-Trichlorophenoxyacetic acid	2,4,5-T	$C_8H_5Cl_3O_3$
2-methyl-4-chlorophenoxyacetic acid	MCPA	$C_9H_9ClO_3$
(R)-2-(2,4-dichlorophenoxy)propanoic acid	2,4-D_{II}	$C_9H_8Cl_2O_3$

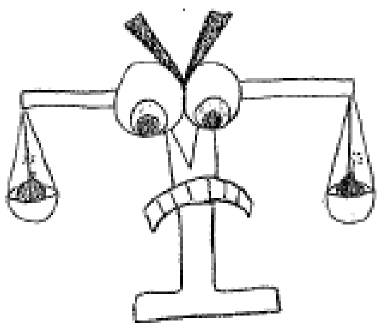
The Suspects



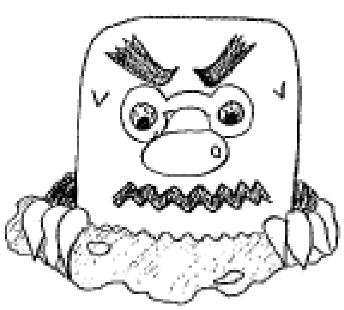
Name	Adam Icbomb	
Motive:	Unquenchable thirst for total destruction	
Suspicious Behavior:	• Green leaves found stuck to bottom of shoe • Suspicious residue found on gloves	
Chemical Make-up of suspicious residue:	**Element**	**Amount**
	Carbon	43.5% C
	Hydrogen	2.7% H
	Chlorine	32.1% Cl
	Oxygen	21.7% O



Name	Elle-Ectro Negativity	
Motive:	Chem S. Tree's branches were blocking the power lines	
Suspicious Behavior:	• Smell of burnt sugar coming off suspect • Unlabeled spray bottle in suspect's pocket	
Chemical Make-up of Solution in Spray Bottle:	**Element**	**Amount**
	Carbon	37.6% C
	Hydrogen	2.0% H
	Chlorine	41.6% Cl
	Oxygen	18.8% O



Name	U.N. Balanced	
Motive:	Has a chemical imbalance that gives him the urge to destroy	
Suspicious Behavior:	• Bark pieces covered in sticky liquid found in weighing trays	
Chemical Make-up of the Sticky Liquid:	**Element**	**Amount**
	Carbon	53.9% C
	Hydrogen	4.5% H
	Chlorine	17.7% Cl
	Oxygen	23.9% O



Name	Mortimer Mole	
Motive:	Wanted to dig tunnels under Chem S. Tree's roots	
Suspicious Behavior:	• Sap found under claws • Broken ornament covered in residue found in tunnel	
Chemical Make-up of suspicious residue:	**Element**	**Amount**
	Carbon	44.8% C
	Hydrogen	1.3% H
	Chlorine	44.0% Cl
	Oxygen	9.9% O

Your Report

Fill in the following table:

Person	Herbicide
Adam Icbomb	
Elle-Ectro Negativity	
U.N. Balanced	
Mortimer Mole	
Chem S. Tree	

The police department needs clear evidence to convict one of the suspects, so you need to **SHOW ALL OF YOUR WORK** and make sure that it is clear enough that they can follow it!!!! You need to calculate the empirical formula of the herbicide for each suspect and the victim.

After you have determined who the killer is, you need to write a paragraph report for the police stating the following:

- What pesticide killed Chem S. Tree
- Who killed Chem S. Tree
- How you know/can prove that your chosen suspect was the killer

CSI: Herbicide Answer Key

Character	Empirical Formula	Pesticide
Chem S. Tree	$C_9H_9ClO_3$	MCPA
Adam Icbomb	$C_8H_6Cl_2O_3$	2,4-D_1
Elle-Ectro Negativity	$C_8H_5Cl_3O_3$	2,4,5-T
U.N. Balnanced	$C_9H_9ClO_3$	MCPA
Mortimer Mole	$C_6H_2Cl_2O$	TCDD

U.N. Balanced with MCPA

Name: ______________________________ **Date:** ________________ **Period:** _________

Copper-Silver Nitrate Reaction

Purpose: In this experiment, you will weigh a piece of coiled copper wire, place it into a silver nitrate solution and observe its behavior. By weighing the copper wire at the end of the experiment, you will be able to determine the amount of copper that reacted. Using these and other measurements, you will be able to determine a quantitative relationship between reactants and products.

Reaction: Copper + silver nitrate →

Pre-lab questions:

1.) Write a balanced equation for the reaction above (you must predict the products).

2.) What type of reaction is occurring? (Synthesis, decomposition, single-replacement, double-replacement, or combustion.)

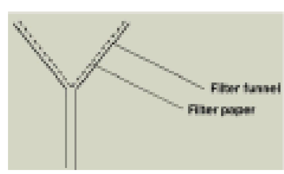
3.) What is deionized water and why is it important that it is used throughout this experiment?

Procedure:

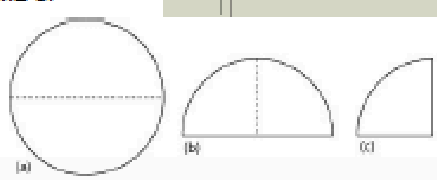
1. Obtain an empty 50, 100, or 150 mL beaker and put your names on it.
2. Obtain a piece of copper wire and coil it with one end sticking up.
3. Weigh the coiled copper wire and **record its mass.**
4. Place the copper wire in the beaker.
5. Take observations of the copper and silver nitrate before completing the next step.
6. Raise your hand, and ask the teacher to add **silver nitrate** to the test tube. Use extreme CAUTION when handling the silver nitrate (strong oxidizer). Be careful not to shake or disturb the test tube. Allow the reaction to continue for 30 minutes *(until next class period)*.
7. With your extra time, calculate the theoretical yield of silver (question #1).

---

8. Obtain a piece of filter paper, record your names on the edge, and **record its mass.**
9. Obtain a beaker of any size and place about 30 mL of deionized water. Also obtain a pipette.
10. Shake the silver crystals from the copper wire into the solution using forceps (tweezers). If some silver still remains, using a pipette, rinse the silver off the wire into the beaker. Keep the copper wire off to the side- do NOT dispose. Dry copper wire with a paper towel and weigh the copper wire and **record its mass.**



11. Set up a filter (Refer to pictures right) and filter out the silver onto the filter paper wash the silver 3 or 4 times using ~10 mL of deionized water each time.
12. After the final washing, give the filter paper with silver to your teacher to dry overnight. During the next class period weigh the watch glass, filter paper, and silver.



Data Table:

Mass of coiled copper wire before reaction (g)	
Mass of coiled copper wire after reaction (g)	
Mass of filter paper (g)	
Mass of watch glass (g)	
Mass of filter paper, watch glass, and silver (g)	
Mass of silver (g)	

Processing the Data:

1.) Calculate the theoretical yield of silver based on the initial mass of copper. (Stoichiometry and a balanced reaction are necessary)

2.) How many grams of copper wire were lost during the experiment?

3.) Now calculate the actual yield of silver based on the actual amount of copper used (from question 2).

4.) Why is there a difference between numbers 1 and 3? Which calculation is more accurate for the actual yield of silver collected? Why?

5.) Calculate the percent yield of silver from both the answer to numbers 1 and 3. (actual/ theoretical) x 100%.

6.) If your percent yield from question number 3 was not 100, give an explanation why (with sources of error).

7.) Calculate moles of copper reacted and moles of silver produced. What is this ratio of silver to copper? (Round to whole numbers) Did you get good data? How do you know?

8.) What caused the color in the solution to appear as the reaction proceeded? What color was the solution after the reaction?

Name: ______________________________ Date:______________ Period: ________

Limiting Reactant

A cake recipe calls for:

2 cups water	4 eggs
4 cups sugar	8 oz butter
4 cups flour	8 squares of chocolate

These are the ingredients that you have in your kitchen:

Lots of water	6 eggs
4 cups sugar	16 oz butter
5 cups flour	12 squares of chocolate

Questions:

1. According to the model above, how much of each ingredient is necessary to make a cake?

Water	Flour	Chocolate	Sugar	Butter	Eggs

2. If you follow the recipe, using only the ingredients on hand in the model, how much of each ingredient would be left over after you have prepared the cake?

Water	Flour	Chocolate	Sugar	Butter	Eggs

3. Which ingredients on hand were in excess of the quantities necessary for the recipe(i.e. Which ingredients were there extra of)?

4. Which ingredient on hand was completely consumed when making the cake?

5. Which ingredient preliminary limits or prevents you from making another cake?

Name: ____ Date:__________________ Period: _________

6. If only two eggs are available to use when making a cake, fill in the chart to indicate the quantity of each of the other ingredients will be used in order to maintain the same ratio between all of the components in the cake.

Water	Flour	Chocolate	Sugar	Butter	Eggs

7. If the cake is made with the ingredients as shown in question six, how will the size of the cake compare to the cake made with the ingredients shown in question one?

8. Based on information presented in the model, what is meant by the term limiting reactant (ingredient or reagent) (HINT: See question five)

Practice Problems

9. You want to make 10 dozen standard-size cookies as directed in a recipe that requires: 16 oz butter, 4 eggs, 3 cups flour, and 4 cups sugar. Inside your kitchen cabinets you find that you have 16 oz butter, 6 eggs, 3 cups flour, and 3 cups of sugar.
    a. Which ingredient will limit the number of cookies you can make?
    b. How many standard size cookies could you make?

10. You have 100 bolts, 150 nuts, and 150 washers. You assemble a nut/bolt/washer set using the following equation: 2 washers + 1 bolt + 1 nut = 1 set. How many full and complete sets can you make?

11. 150 H_2 molecules and 100 O_2 molecules are reacted to produce water. This reaction is shown in the following equation: $2\ H_2 + O_2 \rightarrow 2\ H_2O$
    a. How many water molecules can you make from the supply of hydrogen gas and oxygen gas given in the problem?
    b. Which is the limiting reactant?

Name: ______________________________________ Date:_________________ Period: _________

12. If you had 100 molecules of H_2 instead of 150 molecules of H_2, but still has 100 molecules of O_2, how many water molecules could you make? Which element; if any is left over?

13. If you had 500 molecules of H_2 and 1000 molecules of O_2, how many water molecules could you make? Which element; if any is left over?

14. If you had 500 molecules of H_2, how many O_2 molecules would you need to react all of the H_2 molecules?

15. *Solve the following problem.* 500 g of hydrogen gas and 1000 g of oxygen gas are placed in a reaction vessel. How many grams of dihydrogen monoxide (water) could be produced? (HINT: Find the limiting reactant first!)

Name: ______________________________________ Date:________________ Period:________

Types of Reactions Lab Experiment

Pre-Lab Discussion

There are many kinds of chemical reactions and several ways to classify them. One useful method classifies reactions into four major types. These are:

1. Synthesis (combination)
2. Decomposition
3. Single replacement
4. Double replacement
5. Combustion

Not all reactions can be put into one of these categories. Many, however, can.

Synthesis: In a synthesis reaction, two or more substances (elements or compounds) combine to form a more complex substance. Equations for synthesis reactions have the general form **A + B → AB**.
For example, the formation of water from hydrogen and oxygen is written $2H_2 + O_2 \rightarrow 2H_2O$.

Decomposition: In a decomposition reaction is the opposite of a synthesis reaction. In decomposition, a compound breaks down into two or more simpler substances (elements or compounds). Equations for decomposition reactions have the form **AB → A + B**. The breakdown of water into its elements is an example of such a reactions: $2H_2O \rightarrow 2H_2 + O_2$.

Single Replacement: In a single replacement reaction, one substance in a compound is replaced by another, more active, substance (an element). Equations for single replacement reactions have two general forms.

1. In reactions in which one metal replaces another metal, the general equation is **A + BC → AC + B**.
   Zinc metal replaces copper (II) ion:
   $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$
2. In those in which one nonmetal replaces another nonmetal, the general form is **A + BC → BA + C**.
   Chlorine (a nonmetal) replaces bromide ions:
   $Cl_2(g) + 2KBr(aq) \rightarrow 2KCl(aq) + Br_2(l)$

Double Replacement: In a double replacement reaction, the metal ions of two different ionic compounds can be thought of as "replacing one another."
Equations for this type of reaction have the general form **AB + CD → AD + CB**.

Most replacement reactions, both single and double, take place in aqueous solutions containing free ions. In a double replacement reaction, one of the products is a **precipitate**, an insoluble gas, or water.
An example is the reaction between silver nitrate and sodium chloride in which the precipitate silver chloride is formed: $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$

Combustion: In combustion reactions typically an hydrocarbon compound (a compound primarily containing carbon and hydrogen) is destroyed ("burned") with oxygen gas always producing carbon dioxide and dihydrogen monoxide (water). The generic equation is: $C_xH_y + O_2 \rightarrow CO_2 + H_2O$ or for a compound containing oxygen as well (typically an alcohol) C_xH_yOH ($C_xH_yO_z$) $+ O_2 \rightarrow CO_2 + H_2O$

Name: ______________________________ Date:______________ Period:________

All of the types of reactions discussed here may be represented by **balanced** chemical equations. Reactions involving ion exchanges me be represented by ionic equations also (net ionic and ionic equations).

Remember: In this lab you will be concerned only with chemical formulas and equations. In a balanced equation, the number of atoms of any given element must be the same on both sides of the equation. Multiplying the coefficient and the subscript of an element must yield the same result on both sides of the balanced equation.

In this investigation you will observe examples of the four types of reactions described above. You will be expected to balance the equations representing the observed reactions.

For each of the reactions below, follow all directions and make observations about what you see. Then write a complete and balanced equation for the reaction. Your equations should include as much information as possible, including states of matter, catalysts, coefficients, etc.

Part 1: Synthesis (Combination) Reactions $A + B \rightarrow AB$

Reaction 1: Copper wool combines with oxygen

1. Remove a small piece of copper wool and form it into a loose ball
2. Use crucible tongs to hold the copper wool in the Bunsen burner flame for 1-2 minutes.
3. Examine the wire before and after.

Record observations of the copper wire before and after below.

Before: After:

Write the complete balanced equation for this reaction in the space below. (Cu will form a +1 charge)

Reaction 2: Magnesium combines with oxygen

1. Obtain a small piece of magnesium ribbon and evaporating dish from your teacher.
2. Use crucible tongs to hold the magnesium in the Bunsen Burner flame.
   DO NOT STARE DIRECTLY AT THIS REACTION!!!!
3. Hold the burning magnesium away from you and over the evaporating dish. When it stops burning place the remaining substance in the evaporating dish.

Record observations of the magnesium before and after the reaction below.

Before: After:

Write the complete balanced equation for this reaction below.

Name: ______________________________ Date:______________ Period:_______

Before Going Further... A side note

The general rule for chemical reactions like reaction three and four are the following is:

- A metal oxide and water produces a base
- a nonmetal oxide and water produces and acid.

Acids usually begin with an "H" and bases usually end in "OH"

Use this rule to write equations for the following:

1. Aluminum oxide and water →

2. Sulfur trioxide and water →

Reaction 3: Combination of calcium oxide and water

1. Place a small amount of calcium oxide into a test tube (about 1-2 cm)
2. Half-fill the test tube with distilled water and tap/swirl the tube to mix the reactants.
3. Add 3 drops of Bromothymol blue indicator, and mix by tapping/swirling. Bromothymol blue is yellow in acidic and blue in basic solutions.

What color were the contents of the test tube after the indicator was added? ______________________

Does this color indicate an acid or base? Why? ____

Write a complete balanced equation for this reaction below.

Reaction 4: Combination of carbon dioxide and water.

1. Pour 50 mL of distilled water into an Erlenmeyer flask. Place the flask on white paper.
2. Add 3 drops of bromothymol blue indicator to the flask.
3. Use a straw to blow bubbles into the water indicator mixture.

What color did the mixture turn?Why? ____

Name the acidic product from this combination reaction. ________________________________

Write a complete balanced equation for this reaction below.

Part 2: Decomposition Reactions AB → A+B

Reaction 5: Decomposition of Copper (II) carbonate.

1. Place 1 heaping spatula of copper (II) carbonate in a clean, dry test tube. Note the appearance of the sample. Record your observations below.
2. Using a Bunsen burner, heat the sample strongly for about 3 minutes. Hold a burning wood splint directly above the test tube. If carbon dioxide gas is present, it will put the flame out.

Name: ____ Date:__________________ Period:_________

Describe what happened during the reaction and the appearance of the residue before and after.

Before: After:

Write a complete balanced equation for this reaction.

Reaction 6: Decomposition of hydrogen peroxide (H_20_2)

1. Place 1-2 cm of hydrogen peroxide into a test tube. Use a test tube holder.
2. Using a scoopula, add a pinch of Manganese (IV) oxide as a catalyst for the reaction. Remember, a catalyst is NOT used up in the reaction, and its formula is written above the arrow.
3. Place your thumb over the mouth of the test tube to trap the gas. Wait a few minutes.
4. Test the gas that is being given off by placing a glowing splint into the tube. (Light a wooden splint, blow the flame out. If when you place the glowing splint into the tube the flame returns, the presence of oxygen is indicated.)

Described what happened in this reaction. Be specific in your descriptions.

Write a complete and balanced equation for this reaction below.

Part 3: Single Replacement Reactions A + BC → AC + B or A + BC → BA + C

Reaction 7: Reaction of zinc and hydrochloric acid

1. Fill a test tube ¼ full with aqueous hydrochloric acid. (Use 3M concentration and a test tube holder.) .
2. Add a piece of zinc.
3. Using a test tube holder, invert a second test tube over the mouth of the test tube in which the reaction is taking place.
4. Remove the inverted tube after about 30 seconds and quickly insert a burning wood splint into the mouth of the tube. (A "pop" indicates the presence of hydrogen gas.)

Describe what happens during each phase of this reaction.

Before: During: After:

Write a complete balanced equation for this reaction below.

Name: ______________________________ Date:______________ Period:_______

Reaction 8: Reaction of zinc and lead (II) nitrate.

1. Place 15 drops of aqueous 1M lead (II) nitrate into a test tube.
2. Drop a piece of zinc into the solution; observe any changes you see over five minutes.
3. Check the activity series to see if zinc will replace lead in a reaction.
4. Check the reaction in 10 minutes and determine if any reactivity has occurred.

Write you observations in the space below. Was this reaction able to occur after 5 minutes? After 15 minutes?

Write a complete and balanced equation for this reaction below.

Reaction 9: Reaction of zinc and copper (II) sulfate

1. Add about 5 mL of 1 M copper (II) sulfate solution to a clean, dry test tube.
2. Place a small amount of zinc in the solution.
3. After 5 minutes check to see if zinc will replace copper in this reaction. Then after another 5 minutes check the reaction again.

Write you observations in the space below. Was this reaction able to occur after 5 minutes? After 10 minutes?

Write a complete and balanced equation for this reaction below.

Part 4: Double Replacement Reactions AB + CD → AD + CB

Reaction 10: Lead (II) nitrate reacts with potassium iodide

1. Add 15 drops of 0.1 M lead (II) nitrate solution to a test tube.
2. Add 15 drops of 0.1 M potassium iodide solution to the tube.

Record your observations about this reaction below.

Write a complete and balanced equation for this reaction. Check the solubility table to identify the insoluble product. Make sure to identify the products in your equation.

Reaction 11: Copper (II) sulfate reacts with potassium hydroxide

1. Add about 2 mL of 0.1 M copper (II) sulfate solution to a clean dry test tube.
2. Add about 2 mL of 0.1 M potassium hydroxide solution to the test tube.

Record your observations about this reaction below.

Name: ________________________________ Date:_______________ Period:________

Write a complete and balanced equation for this reaction. Check the solubility table to identify the insoluble product. Make sure to identify this products in your equation.

Part 5: Complete Combustion of Hydrocarbons

Reaction 12: The Combustion of Methane

1. The gas you are burning in the Bunsen burner is methane gas, CH_4.
2. Light the burner.

Record a description of the flame for your observation.

Write a complete and balanced equation for this reaction.

Reaction 13: The Combustion of Ethanol

1. Place 15 drops of ethanol (C_2H_5OH) onto a watch glass.
2. Light a wooden splint and place it near the ethanol.

Record your observations in the space below.

Write a complete and balanced equation for this reaction.

Post Lab Problems

Balance the equations below using the smallest whole number coefficients. Identify the type of reaction represented by each equation.

a. _____$AgNO_3$ (aq) + _____Cu (s) → _____$Cu(NO_3)_2$ (aq) + _____Ag (s) Type: ___________

b. _____$BaCl_2$ (aq) + _____Na_2SO_4 (aq) → _____$BaSO_4$ (s) + _____NaCl (aq) Type: ___________

c. _____Cl_2 (g) + _____NaBr (aq) → _____NaCl (aq) + _____Br_2 (l) Type: ___________

d. _____$KClO_3$ (s) → _____KCl (s) + _____O_2 (g) Type: ___________

e. _____$AlCl_3$ (aq) + _____NH_4OH (aq) → _____NH_4Cl (aq) + _____$Al(OH)_3$ (s) Type: ___________

f. _____H_2 (g) + _____O_2 (g) → _____H_2O (g) Type: ___________

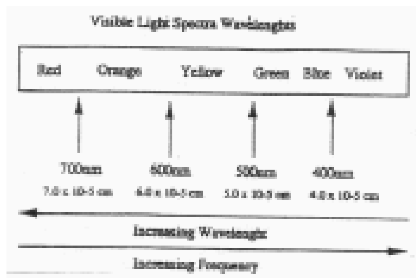
Name: ______________________________ Date:________________ Period: ______

Atomic Emission Spectrum Lab Activity

Background: Each element has its own line spectrum. When an element is excited the electrons move into higher energy levels. As the electrons move back into their ground state photons of energy are emitted. When these energy levels fall into the visible portion of the electromagnetic spectrum they have distinct wavelengths and can be viewed as individual lines using a diffraction grating film. If you look at sunlight or any "white" light you will see a continuous spectrum of light or a rainbow.
Directions: Look through the spectroscope at each of the supplied gas tubes. As best as you can draw the lines you see appear from each of the glass tubes in the diagrams below. When you are done compare your data to know acceptable data from the board.

Wavelength and frequency are inversely related.
$c=\lambda\nu$
c =speed of light
λ=wavelength
ν=frequency

Energy is directly related to frequency.
$E=h\nu$
E =energy
h=Planck's constant
ν=frequency



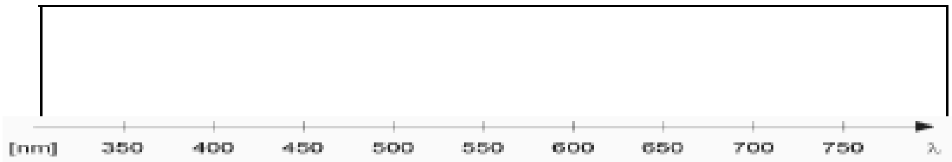
1. Draw the continuous spectrum for "white" light.

2. Element name: __________ Color: __________

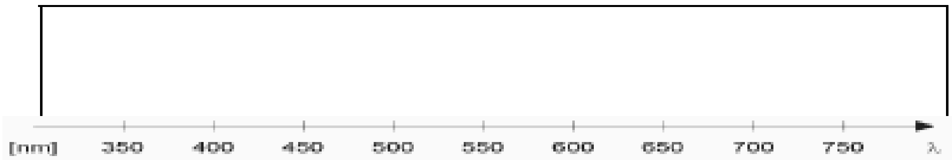
3. Element name__________ Color__________

Name: ______________________________ Date:________________ Period: ______

4. Element name___________ Color___________



5. Element name___________ Color___________



6. Element name___________ Color___________

Post-Lab questions:

1. How is an atomic emission spectra different from a continuous light spectrum?

2. Which color has the most energy? Use the equation relationships from the background to explain your answer.

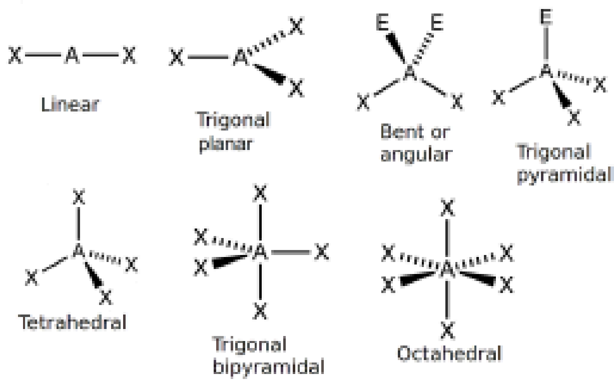
3. When wavelength increases what happens to the frequency given that the speed of light is a constant? Use the equations from the background to explain your answer.

4. What type of non-visible energy could be given off that has a shorter wavelength than violet light?

5. What type of non-visible energy could be given off that has a lower frequency than red light?

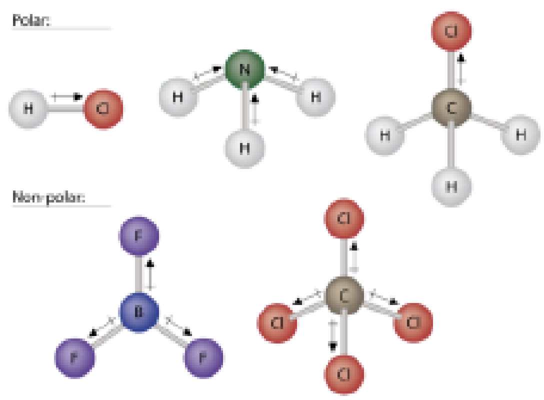
Name: ______________________________ Date:________________ Period: ______

Molecular Bonding, Polar and Nonpolar Molecules Worksheet



Using the information that you have learned in class and the model kits determine if each molecule below is polar or nonpolar. Remember to be **polar** a molecule must:

- Have polar bonds within it
- Not be symmetrical (both in shape and in elements) (see photo below)



Oxygen gas, O_2			
Electronegativities: O ____ O _____ Difference _____ Polar or Nonpolar bond? _____________			
Electron Dot Diagram (Lewis Structure)	Structural Formula	Shape (Both electron geometry and molecular geometry)	Polar or Nonpolar Molecule?

Name: ________________________________ Date:________________ Period: ______

H_2CS			
Electronegativities: C ____ H _____ Difference _____ Polar or Nonpolar bond? _____________			
Electronegativities: C ____ S _____ Difference _____ Polar or Nonpolar bond? _____________			
Electron Dot Diagram (Lewis Structure)	Structural Formula	Shape (Both electron geometry and molecular geometry)	Polar or Nonpolar Molecule?
Ammonia, NH_3			
Electronegativities: N ____ H _____ Difference _____ Polar or Nonpolar bond? _____________			
Electron Dot Diagram (Lewis Structure)	Structural Formula	Shape (Both electron geometry and molecular geometry)	Polar or Nonpolar Molecule?
Selenium dichloride, $SeCl_2$			
Electronegativities: Se ____ Cl _____ Difference _____ Polar or Nonpolar bond? _____________			
Electron Dot Diagram (Lewis Structure)	Structural Formula	Shape (Both electron geometry and molecular geometry)	Polar or Nonpolar Molecule?

Name: ________________________________ Date:_________________ Period: ______

Water, H_2O			
Electronegativities: H _____ O _____ Difference _____ Polar or Nonpolar bond? _____________			
Electron Dot Diagram (Lewis Structure)	Structural Formula	Shape (Both electron geometry and molecular geometry)	Polar or Nonpolar Molecule?

Aluminium trichloride, $AlCl_3$			
Electronegativities: Al _____ Cl _____ Difference _____ Polar or Nonpolar bond? _____________			
Electron Dot Diagram (Lewis Structure)	Structural Formula	Shape (Both electron geometry and molecular geometry)	Polar or Nonpolar Molecule?

Ammonium ion, NH_4^+			
Electronegativities: N _____ H _____ Difference _____ Polar or Nonpolar bond? _____________			
Electron Dot Diagram (Lewis Structure)	Structural Formula	Shape (Both electron geometry and molecular geometry)	Polar or Nonpolar Molecule?

Name: ______________________________ Date:________________ Period: ______

Fluorine gas, F_2			
Electronegativities: F ____ F _____ Difference _____ Polar or Nonpolar bond? _____________			
Electron Dot Diagram (Lewis Structure)	Structural Formula	Shape (Both electron geometry and molecular geometry)	Polar or Nonpolar Molecule?
Dichloromethane, CCl_2H_2			
Electronegativities: C ____ Cl _____ Difference _____ Polar or Nonpolar bond? _____________			
Electronegativities: C ____ H _____ Difference _____ Polar or Nonpolar bond? _____________			
Electron Dot Diagram (Lewis Structure)	Structural Formula	Shape (Both electron geometry and molecular geometry)	Polar or Nonpolar Molecule?
Carbon disulfide, CS_2			
Electronegativities: C ____ S _____ Difference _____ Polar or Nonpolar bond? _____________			
Electron Dot Diagram (Lewis Structure)	Structural Formula	Shape (Both electron geometry and molecular geometry)	Polar or Nonpolar Molecule?