Pequea Valley School District
Science

Unit: 3- Atomic History and Laws **Course: Chemistry I** **Grade: 9-12**

Planning the Focus Based on the Desired Result
What do you want all students to know, understand and do by the end of the unit?

Unit Essential Question(s):
How have discoveries and developments about the atom impacted our current understanding of matter?

Keystone Eligible Content/PA Core Standard
3.4.10.A - Apply concepts about the structure and properties of matter.
3.2.10.C - Apply the elements of scientific inquiry to solve problems.
3.2.10.B - Apply knowledge and understanding about the nature of scientific and technological knowledge.

Pacing: Approximate number of class sessions per unit:
- 20

Tier 3 Vocabulary (Content specific vocabulary)
Atomic Mass
Atomic Theory
Phlogiston Theory
Data
Conclusions
Lavoisier
Dalton
Proust
Isotopes
Conservation of Mass
Multiple Proportions
Definite Proportions

Know - What do learners need to **know** in order to be able to do and understand? ***List concepts, such as facts, formulas, key vocabulary and knowledge "nuggets".***
- Know the scientist and associated discovery and law.
- Know what evidence was used to reach the conclusions about the atom.
- Know the experiment techniques used to establish each law or theory.

Understand - What do learners need to **understand**? What is the **big idea**? ***List broad concepts or "big ideas" in a statement of enduring understanding.***

- Understand Dalton's atomic theory and law of multiple proportions.
- Understand Lavoisier's law of conservation of mass.
- Understand Proust's law of definite proportions.

Learning Outcome - What do learners need to be able to **accomplish** by the unit's end? ***List skills and competencies.***

- Perform a steel wool lab to prove the law of conservation of mass.
- Use a simulation called Dalton's Playhouse to show laws of conservation of mass and multiple proportions.
- Read and interpret a story called Travels with C to show understanding of conservation of mass.
- Construct an authentic learning project (either electronic brochure, book or video).
- Unit learning assessments (2 quizzes, 1 unit test, 2 labs, 1 formal lab report).

Literature:

Active Chemistry Textbook

Software/Resources:

Vision Learning Website, YouTube videos

Pequea Valley School District
Science

Unit: 1- Properties of Elements **Course: Chemistry I** **Grade: 9-12**

Planning the Focus Based on the Desired Result
What do you want all students to know, understand and do by the end of the unit?

Unit Essential Question(s):
How are the elements classified and organized?

Keystone Eligible Content/PA Core Standard
3.4.10.A: Explain the repeating pattern of chemical properties by using the repeating patterns of atomic structure within the periodic table.
3.4.10.A: Apply knowledge of mixtures to appropriate separation techniques.

Pacing: Approximate number of class sessions per unit:
- 20

Tier 3 Vocabulary (Content specific vocabulary)

Matter	Malleability	Density
Element	Metal	Mass
Compound	Nonmetal	Volume
Homogeneous mixture	Metalloid	
Heterogenous mixture	Group	
Conductivity	Period	
Reactivity	Ductility	

Know - What do learners need to **know** in order to be able to do and understand? ***List concepts, such as facts, formulas, key vocabulary and knowledge "nuggets".***
- Classify matter into elements, compounds, heterogeneous and homogeneous mixtures.
- Understand the chemical and physical properties of metals and nonmetals.
- Understand the organization of the periodic table in families and periods.

Understand - What do learners need to **understand**? What is the **big idea**? ***List broad concepts or "big ideas" in a statement of enduring understanding.***
- Know the classification scheme of the ordering of matter from most general to most specific.
- Know the properties of an element and relate it to being a metal, nonmetal or metalloid.

- Using Mendeleev as an example, understand the logic of organizing a periodic table.

Learning Outcome - What do learners need to be able to **accomplish** by the unit's end? ***List skills and competencies.***

- Complete a classification lab of real-world forms of matter.
- Test metals, nonmetals and metalloids for chemical and physical properties.
- Create a periodic table using organizational strategies and properties of chemical families.
- Know the names and symbols of the first 20 elements on the periodic table.
- End of unit learning assessment (2 quizzes, 1 test).

Literature:

Active Chemistry Textbook

Software/Resources:

Mysteries of Matter Web Site, Explorelearning Gizmos

Pequea Valley School District
Science

Unit: 2- Labs, Safety and Equipment **Course: Chemistry I** **Grade: 9-12**

Planning the Focus Based on the Desired Result
What do you want all students to know, understand and do by the end of the unit?

Unit Essential Question(s):
How is following procedure and properly using equipment important in establishing a safe work environment?

Keystone Eligible Content/PA Core Standard
3.2.10.C - Apply the elements of scientific inquiry to solve problems.
3.4.12.A - Apply concepts about the structure and properties of matter.

Pacing: Approximate number of class sessions per unit:
- 20

Tier 3 Vocabulary (Content specific vocabulary)

Hypothesis	Precipitate	Buret
Theory	Solid	Evaporating dish
Data	Liquid	Test tubes
Conclusions	Gas	Ring stand
Volatile	Beaker	Bunsen burner
Caustic	Graduated cylinder	
Corrosive	Erlenmeyer flask	
Neutralize	Striker	
Microscale	Mortar and Pestle	
Qualitative	Crucible tongs	
Quantitative	Spatula	

Know - What do learners need to **know** in order to be able to do and understand? ***List concepts, such as facts, formulas, key vocabulary and knowledge "nuggets".***
- Know the names and uses of lab and safety equipment.
- Know what to see when looking for evidence of a chemical reaction.
- Use descriptive words such as volatile, corrosive, caustic, neutralize when describing lab and safety scenarios.

Understand - What do learners need to **understand**? What is the **big idea**? ***List broad concepts or "big ideas" in a statement of enduring understanding.***

- Understand the proper procedures and safety for conducting a lab experiment.
- Understand how to write a proper lab report.
- Understand and demonstrate the proper use of lab techniques, equipment and safety.

Learning Outcome - What do learners need to be able to **accomplish** by the unit's end? ***List skills and competencies.***

- Complete a microscale lab using household products with chemical names.
- Demonstrate lab and safety skills in a lab practical format.
- Complete safety certification by demonstrating knowledge and use of lab and safety equipment.
- Unit learning assessments (1 written quiz, 1 lab practical, 1 formal lab report).

Literature:

Flinn Scientific Lab Safety Contract and Right-to-know

Software/Resources:

Video-Accident at Jefferson High

Safety and Equipment PowerPoints

Pequea Valley School District
Science

Unit: 4- Subatomic Particles and Models of the Atom **Course: Chemistry 1** **Grade: 9-12**

Planning the Focus Based on the Desired Result
What do you want all students to know, understand and do by the end of the unit?

Unit Essential Question(s):
How has evidence about subatomic particles been developed and applied to our real world and everyday life?

Keystone Eligible Content/PA Core Standard
3.4.10.A - Apply concepts about the structure and properties of matter.
3.2.10.C - Apply the elements of scientific inquiry to solve problems.
3.2.10.B - Apply knowledge and understanding about the nature of scientific and technological knowledge.

Pacing: Approximate number of class sessions per unit:
- 20

Tier 3 Vocabulary (Content specific vocabulary)

Thomson	cathode ray tube experiment	electron	plum pudding model
Rutherford	gold foil experiment	proton	planetary model
Millikan	oil drop experiment	neutron	Bohr model
Bohr	electromagnetic spectrum	ROYGBIV	atomic number
Chadwick	isotopes	ions	mass number
Planck	photoelectric effect	solar cells	LEDs
electrochemistry	electroplating	batteries	

Know - What do learners need to **know** in order to be able to do and understand? ***List concepts, such as facts, formulas, key vocabulary and knowledge "nuggets".***
- Know the scientist, experiment and associated atomic model.
- Know what evidence was used to reach the conclusions about the atom.
- Know the applications of this technology in our modern world.
- Know how to calculate atomic number, mass number and overall charge of the atom.

Understand - What do learners need to **understand**? What is the **big idea**? ***List broad concepts or "big ideas" in a statement of enduring understanding.***

- Understand Thomson's cathode ray tube experiment and the plum pudding model.
- Understand Rutherford's gold foil experiment and the planetary model.
- Understand Millikan's oil drop experiment.
- Understand how the subatomic particles interact to form atoms.

Learning Outcome - What do learners need to be able to **accomplish** by the unit's end? ***List skills and competencies.***

- Perform a sticky tape lab to show evidence for electrons and the plum pudding model.
- Evaluate 3 experiments (cathode ray, gold foil and oil drop) to prove the nature of the 3 subatomic particles (proton, neutron, electron).
- Perform Battleship game simulation and analyze results to provide evidence for the planetary model of the atom.
- Complete element builder Gizmo to show comprehension of atomic number, mass number, isotopes and ions.
- Perform Bunsen burner flame tests using spectroscopes to show comprehension of the electromagnetic spectrum and the Bohr model.
- Evaluate the photoelectric effect experiment and equation to show knowledge of the relationship of light and particles.
- Unit learning assessments (2 quizzes, 1 unit test, 2 labs, 3 Gizmos).

Literature:

Active Chemistry Textbook

Software/Resources:

Explore Learning Gizmos, YouTube videos (Tyler DeWitt), Khan academy.

Pequea Valley School District
Science

Unit: 5- Ionization Energy and Orbitals **Course: Chemistry 1** **Grade: 9-12**

Planning the Focus Based on the Desired Result
What do you want all students to know, understand and do by the end of the unit?

Unit Essential Question(s):
How is light used to reveal signatures of an atom's identity?
How is electron structure applied to real world scenarios involving ions?

Keystone Eligible Content/PA Core Standard
3.4.10.A - Apply concepts about the structure and properties of matter.
3.2.10.C - Apply the elements of scientific inquiry to solve problems.
3.2.10.B - Apply knowledge and understanding about the nature of scientific and technological knowledge.

Pacing: Approximate number of class sessions per unit:
- 20

Tier 3 Vocabulary (Content specific vocabulary)

Bohr model	Aufbau principle	frequency
valence electrons	Pauli exclusion principle	orbitals
Electron configuration	Hund's rule	
Orbital notation	ionization energy	
Noble Gas configuration	electronegativity	
Atomic radius	anion	
Ionic radius	cation	
Periodic trends	wavelength	

Know - What do learners need to **know** in order to be able to do and understand? ***List concepts, such as facts, formulas, key vocabulary and knowledge "nuggets".***
- Know the rules and design of the Bohr model of the atom.
- Know how to write an electron, orbital and Noble Gas configuration.
- Know the major periodic trends (atomic and ionic radius, electronegativity and ionization energy.
- Know the differences between anions and cations and how they combine to form compounds.

Understand - What do learners need to **understand**? What is the **big idea**? ***List broad concepts or "big ideas" in a statement of enduring understanding.***

- Understand how the rules and electron structure govern the way an atom or ion behaves.
- Understand how the trends can be used to predict the patterns of atomic interactions.
- Understand how cations and ions combine to form everyday substances.

Learning Outcome - What do learners need to be able to **accomplish** by the unit's end? ***List skills and competencies.***

- Perform a spectroscopy lab to show how this technology is used in today's world.
- Evaluate the Bohr model and be able to use the 3 rules and the periodic table to draw these diagrams for any atom.
- Complete electron configuration Gizmo to show comprehension of all 3 methods of writing these out.
- Complete an authentic learning project on either designing a periodic table or researching 1 element.
- Unit learning assessments (1 quiz, 1 unit test, 1 lab, 1 Gizmo, 1 project).

Literature:

Active Chemistry Textbook

Software/Resources:

Explore Learning Gizmos, World of Chemistry videos, NASA website.

Pequea Valley School District
Science

Unit: 6- Chemical Behavior and Bonding **Course: Chemistry I** **Grade: 9-12**

Planning the Focus Based on the Desired Result
What do you want all students to know, understand and do by the end of the unit?

Unit Essential Question(s):

How do atoms use electrons to form different bond types?
How do the differently bonded compounds behave and interact with each other?

Keystone Eligible Content/PA Core Standard

3.4.10.A - Apply concepts about the structure and properties of matter.
3.2.10.C - Apply the elements of scientific inquiry to solve problems.
3.2.10.B - Apply knowledge and understanding about the nature of scientific and technological knowledge.

Pacing: Approximate number of class sessions per unit:

- 25

Tier 3 Vocabulary (Content specific vocabulary)

Valence electrons
Electronegativity
Ionic bonds
Cations
Anions
Covalent bonds
Polar
Nonpolar
Intermolecular force
Conductivity
Electrolytes
Solubility
Crystal lattice structure
Lewis dot structure
Single, double, triple bonds

Know - What do learners need to **know** in order to be able to do and understand? ***List concepts, such as facts, formulas, key vocabulary and knowledge "nuggets".***

- Know how atoms can give, take or share electrons to form chemical bonds.
- Know how to draw a Venn diagram and line bond structure showing electron arrangement.

- Know that properties such as odor, solubility, conductivity, melting point provide clues to help elicit bond types.

Understand - What do learners need to **understand**? What is the **big idea**? ***List broad concepts or "big ideas" in a statement of enduring understanding.***

- Understand how the electronegativity and polarity govern the way a compound behaves.
- Understand how properties like solubility help predict the categories of chemical compounds.
- Understand how compounds are found and interact in everyday substances.

Learning Outcome - What do learners need to be able to **accomplish** by the unit's end? ***List skills and competencies.***

- Engage in a Schoology post and discussion to describe ionic bonding.
- Perform a scavenger hunt as review and formative assessment of bonding concepts and vocabulary.
- Draw, build and evaluate the Venn diagrams, model kits and line bond structures of various compounds.
- Complete ionic and/or covalent bonding Gizmo to show comprehension of the 2 major types of bonding.
- Complete a class laboratory and review of major properties of ionic, polar covalent and nonpolar covalent substances.
- Unit learning assessments (2 quizzes, 1 unit test, 1 lab, 2 Gizmos).

Literature:

Active Chemistry Textbook

Software/Resources:

Explore Learning Gizmos, World of Chemistry videos, QUIA review games, Schoology forum board.

Pequea Valley School District
Science

Unit: 7- The Mole **Course: Chemistry I** **Grade: 9-12**

Planning the Focus Based on the Desired Result
What do you want all students to know, understand and do by the end of the unit?

Unit Essential Question(s):
How is the mole used and considered "central" in chemistry?
How are mole conversion, empirical and molecular problems solved?

Keystone Eligible Content/PA Core Standard
3.4.10.A - Apply concepts about the structure and properties of matter.
3.2.10.C - Apply the elements of scientific inquiry to solve problems.
3.2.10.B - Apply knowledge and understanding about the nature of scientific and technological knowledge.

Pacing: Approximate number of class sessions per unit:
- 15

Tier 3 Vocabulary (Content specific vocabulary)
- Mole
- Formula and/or Molar mass
- Grams per mole
- Conversion factor
- Factor-label
- Dimensional analysis
- Avogadro's number
- Molar volume
- Hydrate
- Empirical formula
- Molecular formula

Know - What do learners need to **know** in order to be able to do and understand? ***List concepts, such as facts, formulas, key vocabulary and knowledge "nuggets".***
- Know how the mole is central to calculations in chemistry.

- Know how techniques like factor-label method can use units to help solve conversion problems.
- Know how empirical and molecular formulas are related and can be calculated from mole values with the help of the periodic table and Avogadro's number.

Understand - What do learners need to **understand**? What is the **big idea**? ***List broad concepts or "big ideas" in a statement of enduring understanding.***

- Understand how the mole road map summarizes the different kinds of conversion that can be performed using the mole.
- Understand how the periodic table, Avogadro's number and the mole are all interrelated.
- Understand how empirical and molecular formulas are derived using mole concepts.

Learning Outcome - What do learners need to be able to **accomplish** by the unit's end? ***List skills and competencies.***

1) Use textbook chem-to-go and checking up exercises to practice mole conversions.
2) Perform practice exercises using a wide variety of learner selected sources like on-line activities, pencil and paper, peer critiques and Gizmos.
3) Refine knowledge of mole and conversion problems by watching help videos and completing group problems.
4) Unit learning assessments (1 quiz, 1 group activity, 1 Gizmo).

Literature:

Active Chemistry Textbook

Software/Resources:

Sciencegeek.net, Mole Road Map, Online PowerPoints, Tyler DeWitt Help videos.

Pequea Valley School District
Science

Unit: 8- Chemical Equations **Course: Chemistry I** **Grade: 9-12**

Planning the Focus Based on the Desired Result
What do you want all students to know, understand and do by the end of the unit?

Unit Essential Question(s):
How are chemical equations written, balanced and used?
What is the definition and use of the activity series?

Keystone Eligible Content/PA Core Standard
3.4.10.A - Apply concepts about the structure and properties of matter.
3.2.10.C - Apply the elements of scientific inquiry to solve problems.
3.2.10.B - Apply knowledge and understanding about the nature of scientific and technological knowledge.

Pacing: Approximate number of class sessions per unit:
- 15

Tier 3 Vocabulary (Content specific vocabulary)

Chemical reaction	Combustion
Balanced equation	Activity Series
Coefficient	Redox reactions
Reactants	Precipitation reaction
Products	
Aqueous	
HOFBrINCl	
Synthesis	
Decomposition	
Single Replacement	
Double Replacement	

Know - What do learners need to **know** in order to be able to do and understand? ***List concepts, such as facts, formulas, key vocabulary and knowledge "nuggets".***
- Know how to balance chemical reactions/equations using coefficients.

- Know techniques like the inspection method for use in balancing the 5 major types of chemical equations- Synthesis, Decomposition, single replacement, double replacement and combustion.
- Know how the activity series was determined and used to predict single replacement reactions.

Understand - What do learners need to **understand**? What is the **big idea**? ***List broad concepts or "big ideas" in a statement of enduring understanding.***

- Understand how to use coefficients and various inspection techniques to complete 7 levels of problems with increasing difficulty.
- Understand how to convert word equations to formula equations and then balance.
- Understand and apply the activity series is used to predict which single replacement reaction work or not

Learning Outcome - What do learners need to be able to **accomplish** by the unit's end? ***List skills and competencies.***

- Use textbook chem-to-go and checking up exercises to practice balancing equations.
- Perform practice exercises using a wide variety of learner selected sources like on-line activities, pencil and paper, peer critiques and Gizmos.
- Refine knowledge of activity series and balancing problems by watching help videos, completing group problems and completing an individual packet of 7 levels of various balancing problems.
- Perform and analyze activity series lab and simulation.
- Unit learning assessments (2 quizzes, 1 group activity, 1 or 2 Gizmos, 1 lab activity, 1 lab simulation).

Literature:

Active Chemistry Textbook

Software/Resources:

Sciencegeek.net,Activity Series Chart, Online PowerPoints, Tyler DeWitt Help videos, Gizmos, Balancing packet, World of Chemistry Video on Metals.

Pequea Valley School District
Science

Unit: 9- Nuclear Chemistry **Course: Chemistry I** **Grade: 9-12**

Planning the Focus Based on the Desired Result
What do you want all students to know, understand and do by the end of the unit?

Unit Essential Question(s):
What limits and determines an atom's mass?
What are the processes of nuclear fission, fusion and decay?
What are the major types and particles associated with nuclear reactions?
What are isotopes?

Keystone Eligible Content/PA Core Standard
3.4.10.A-Apply concepts about the structure and properties of matter.
3.2.10.C-Apply the elements of scientific inquiry to solve problems.
3.2.10.B-Apply knowledge and understanding about the nature of scientific and technological knowledge.
3.2.12.D-Analyze and use the technological design process to solve problems.

Pacing: Approximate number of class sessions per unit:
- 20

Tier 3 Vocabulary (Content specific vocabulary)

Nucleus	Nuclear decay
Proton, neutron, electron	Radioactivity
Atomic mass	Positron
Atomic number	Half-life
Alpha particle	Relative abundance
Beta particle	Strong force
Gamma radiation	Geiger counter
Daughter product	Carbon dating
Isotope	

Know - What do learners need to **know** in order to be able to do and understand? ***List concepts, such as facts, formulas, key vocabulary and knowledge "nuggets".***
- Know how nuclear fission, fusion and decay are related to the nucleus.

- Know how emission of various subatomic particles affects the nuclear mass and identity.
- Know the various types of nuclear reactions and associated particles.
- Know the definition of an isotope are formed and how atomic mass is a weighted average of all existing isotopes of an element..
- Know the real-world applications of nuclear experiments and discoveries including the carbon dating, the atomic bomb and nuclear power.

Understand - What do learners need to **understand**? What is the **big idea**? ***List broad concepts or "big ideas" in a statement of enduring understanding.***

- Understand the processes of nuclear fission, fusion and decay.
- Understand how emission of various subatomic particles affects the nuclear mass and identity.
- Understand how nuclear reactions are classified and written.
- Understand how isotopes are formed and atomic mass is calculated.
- Understand how historical events and experiments led to nuclear discoveries including the carbon dating, the atomic bomb, nuclear power and the continued expansion of the periodic table.

Learning Outcome - What do learners need to be able to **accomplish** by the unit's end? ***List skills and competencies.***

- Depict the processes of nuclear fission, fusion and decay using Gizmo simulations and written practice.
- Review videos, powerpoints, and Gizmos to show how various subatomic particles determine nuclear mass and identity.
- Demonstrate how nuclear reactions are classified and written.
- Perform calculations on how isotopes are formed and atomic mass is calculated.
- Analyze how historical events and experiments led to nuclear discoveries including the carbon dating, the atomic bomb, nuclear power and the continued expansion of the periodic table.
- Unit learning assessments (2 quizzes, 1 powerpoint activity, 2 Gizmos, 1 lab activity, 1 lab simulation and 1 group presentation).

Literature:

Active Chemistry Textbook

Software/Resources:

Mysteries of Matter website, Online PowerPoints, Gizmo Simulations, Online Help videos including Bozeman and School Tube.