SUBJECT: Principles of Science	GRADE: 9
Unit Title: Nature of Science	Time Frame: 3.5 weeks
UNI	Γ OVERVIEW
This unit will refresh students on the scientific method, lab safety, and introduce measurement conversions.	
LRG SKILLS AND DISPOSITIONS	PA STANDARDS
Critical thinking and problem solving	• K-12 Science and Engineering Practices: 1) Asking questions and defining problems. 2) Planning and carrying out investigations. 3) Analyzing and interpreting data. 4) Using mathematics and computational thinking 5) Obtaining, evaluating, and communicating information.
COMPETENCIES	LEARNING TARGETS
I can effectively design, display and explain the nature of science.	Lab Safety- I can apply lab safety rules and procedures when performing labs in the classroom.  Scientific Method- I can solve problems using scientific method, identify dependent and independent variables, controls and experimental groups.  Measurements- I can measure correctly and complete mathematical operations.  Conversions- I understand SI units and able to convert them using factor label method.  Density- I understand density and can calculate density.

Graphing- I can read, interpret and graph data.

SUBJECT: Principles of Science	GRADE: 9
Unit Title: Matter and Solutions	Time Frame: 5 weeks
UNI	Γ OVERVIEW
This unit will cover the different types of matter, and states, and types of changes that matter undergoes, both physical and chemical.	
LRG SKILLS AND DISPOSITIONS	PA STANDARDS
Collaboration and Teamwork (Physical and Chemical Properties and changes sorting activity)	<ul> <li>3.2.9-12.B Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.</li> <li>3.2.9-12. E Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.</li> <li>3.2.9-12.G Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.</li> </ul>
COMPETENCIES	LEARNING TARGETS
I understand the properties of matter and changes in matter depending on the law of conservation of mass.	<b>Types of matter-</b> I can recognize the differences between pure substances and mixtures and give examples.

**Identify different types of mixtures-** I can distinguish and identify solutions, suspension, and colloid, homogeneous and heterogeneous mixtures.

**Chemical reactions-** I can complete and interpret types of reaction and to see if they are chemical or physical reactions.

**Phases of matter-** I can recognize the shape and volume difference among the three phases of matter.

**Changes in Matter-** I am able to distinguish physical and chemical changes in matter.

**Properties of Matter-**I am able to distinguish physical and chemical properties in matter.

**Law of conservation of Mass-** I understand and can explain the law of conservation of mass as it applies to changes in matter.

**Saturation-** I can distinguish the differences between unsaturated, saturated and supersaturated substances.

**Solvants-** I can recognize a solvent and solute in a solution.

**Separation of Mixtures-** I understand the methods used to separate mixtures based on the properties.

**Phase Changes:** I can list phase changes and give examples.

SUBJECT: Principles of Science	GRADE: 9
Unit Title: Atomic structure and the Periodic Table	Time Frame: 5 weeks
UNIT	ΓOVERVIEW
This unit provides a more in depth look at the periodic table. This unit will include calculating average atomic mass, isotopes and subatomic particles.	
LRG SKILLS AND DISPOSITIONS	PA STANDARDS
Creativity and Innovation (adopt an element project)	3.2.9-12.A Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy levels of atoms.
	3.2.9-12.H Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion and radioactive decay.
COMPETENCIES	LEARNING TARGETS
I can describe basic atomic structure and how that relates to the organization of the periodic table.	Isotopes- I can calculate the average atomic mass of numerous isotopes.  Subatomic Particles- I am able to draw, calculate and explain subatomic particles, atomic mass, and mass number.  Bohr Models- I am able to create bohr models for basic elements.

their chemical symbol on the periodic table.  Periodic Table History- I am able to state how the periodic table has changed from the past to the present.  Research- I am able to use current research and cite sources appropriately using MLA format.
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SUBJECT: Principles of Science	GRADE: 9
Unit Title: Periodic Table Trends	Time Frame: 1.5 weeks
UNIT OVERVIEW	
This unit will dive into the history of the periodic table, how it has developed into the modern periodic table and the trends that appear on the table.	
LRG SKILLS AND DISPOSITIONS	PA STANDARDS
Creativity and Innovation (adopt an element project, continued from Atomic structure and the Periodic Table unit)	3.2.9-12.A Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy levels of atoms.
	3.2.9-12.C Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms trends in the periodic table and knowledge of the patterns of chemical properties.

COMPETENCIES	LEARNING TARGETS
I can describe the periodic table properties and trends.	Organization of the Periodic Table- I understand how the periodic table is organized based on valence electron number.  Periodic Table Families- I can name and describe families on the periodic table based on their properties.  Periodic Table Groups- I am able to differentiate among metals, metalloids and non-metals according to their properties and location.

SUBJECT: Principles of Science	GRADE: 9
Unit Title: Chemical Bonds	Time Frame: 4 weeks
UNI	ΓOVERVIEW
This unit will highlight how compounds are created through different types of bonds and how to properly name compounds.	
LRG SKILLS AND DISPOSITIONS	PA STANDARDS

	3.2.9-12.D Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
COMPETENCIES	LEARNING TARGETS
I can distinguish between types of chemical bonds.	Types of bonds- I am able to describe and give examples of all types of bonds.  Lewis Dot Diagrams- I can draw correct Lewis diagrams for any element excluding transition metals and rare earth metals.  Naming chemical compounds- I can name chemical compounds from the formula.  Writing chemical formulas- I can write the chemical formula from the names.

SUBJECT: Principles of Science	GRADE: 9
Unit Title: Chemical Reactions	Time Frame: 4 weeks
UNIT OVERVIEW	
In this unit students will apply math concepts to balance chemical equations appropriately and learn about the different types of reactions that can occur.	

LRG SKILLS AND DISPOSITIONS	PA STANDARDS
Adaptability and Flexibility Critical thinking and problem solving (both sets of LRG will be assessed using antacid tablet lab)	3.2.9-12.C Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron  3.2.9-12.D Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.  3.2.9-12.G Use mathematical representations to suppro the claim that atoms, and therefore mass, are conserved during a chemical reaction.
COMPETENCIES	LEARNING TARGETS
I can write balanced chemical reactions of various types.	Balancing equations- I can identify the parts of an equation including the reactants and products.  Balancing equations- I can identify if a chemical reaction is balanced or unbalanced according to the law of conservation of matter.  Balancing equations- I can add coefficients to a reaction in order to balance the chemical equation.  Types of chemical reactions- I can name and identify different types of chemical reactions examples (synthesis, decomposition, single and double replacement, combustion).  Types of chemical reactions- I can distinguish the difference between endothermic and exothermic reactions.

SUBJECT: Principles of Science	GRADE: 9
Unit Title: Motion and Force	Time Frame: 5 weeks

## **UNIT OVERVIEW**

In this unit students will review newtons laws and introduce the mathematical calculations used with them. Different types of physics measurements and vector will be used such as; distance, displacement, speed (average and instantaneous), momentum and acceleration.

LRG SKILLS AND DISPOSITIONS	PA STANDARDS			
Creativity and Innovation Critical thinking and Problem Solving (egg drop project)	<ul> <li>3.2.9-12.I Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.</li> <li>3.2.9-12.J Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.</li> <li>3.2.9-12.K Apply scientific and engineering ideas to design, evaluate and refine a device that minimizes the force on a macroscopic object during a collision.</li> <li>3.2.9-12.L Use mathematical representation of Newton's Law of gravitation and coulomb's law to describe and predict the gravitational and electrostatic forces between objects.</li> </ul>			
COMPETENCIES	LEARNING TARGETS			
I am able to explain and calculate motion of objects.	Displacement and Distance- I am able to distinguish between displacement and distance and calculate both.  Calculate speed and velocity- I can define and calculate speed, velocity, and acceleration.  Forces acting upon objects- I can summarize the forcing acting upon objects that are both in motion and stationary.  Newton's Laws-I can distinguish and explain all three Newton's laws of motion.  Friction- I can explain what friction is and how it affects movement.  Momentum-I can calculate momentum given certain variables.			

SUBJECT: Principles of Science	GRADE: 9				
Unit Title: Energy	Time Frame: 3 weeks				
UNIT OVERVIEW					
In this unit students will explore the different types of energy, how en	ergy can be transformed, and conserved.				
LRG SKILLS AND DISPOSITIONS	PA STANDARDS				
Collaboration and Teamwork (rollercoaster project)	3.2.9-12.P Develop and use models to illustrate that energy at the macroscop scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).				
	3.2.9-12.Q Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.				
COMPETENCIES	LEARNING TARGETS				
I am able to define energy, identify energy sources, and explain how energy is conserved and converted.	Forms of energy- I can identify forms, and examples of source energy.  Conservation of energy- I can apply the law of conservation of energy to describe how energy changes forms in a variety of situations.  How to calculate types of energy- I can identify types of energy how to calculate the types of energy.  Law of conservation of energy- I can explain how the law of conservation of energy applies to real life situations.				

SUBJECT: Principles of Science	GRADE: 9			
Unit Title: Work and Machines	Time Frame: 4 weeks			
UNIT OVERVIEW				
This unit will explain what work is, how it is done and how to make work easier.				
LRG SKILLS AND DISPOSITIONS	PA STANDARDS			
Collaboration and Teamwork (playground group project)				
COMPETENCIES	LEARNING TARGETS			
I am able to recognize work and various types of simple machines.	Work- I can distinguish when work is being done.  Mechanical Advantage- I can identify and calculate mechanical advantage.  Types of Machines- I can identify types of simple machines and compound machines.  Calculate IMA and AMA- I can calculate IMA and AMA of machines.			

SUBJECT: Principles of Science	GRADE: 9					
Unit Title: Waves and Sound	Time Frame: 2 weeks					
UNIT OVERVIEW						
In this unit students will explore how sound is generated and how it tr	avels through different mediums.					
LRG SKILLS AND DISPOSITIONS	PA STANDARDS					
Continual learning and Growth Mindset						
COMPETENCIES	LEARNING TARGETS					
I can explain how waves, light and sound behave and how they are affected by various objects.	Waves and sound- I can define terms related to the characteristics of waves (wavelength, frequency, amplitude) Waves and sound- I can explain how waves are affected as they travel through different forms of matter.  Light vs. sound- I can explain the differences among light waves and sound waves.  Light Characteristics- I can summarize the characteristics of light waves.  EM spectrum- I can describe the types of waves that make up the electromagnetic spectrum and list the characteristics and real-life use of these waves.  Light Optics- I can explain how light interacts with matter using the terms transparent, translucent, opaque.  Light Optics- I can explain how light behaves by comparing and contrasting reflection and refraction.  Lenses- I can explain how light behaves when it hits a lens, what a lens is and how they are used in real life.					