Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 1: *Use the Scientific Method, processing skills, equipment, and lab safety to solve problems.*		
A. Understand each step of the scientific method: Question or Problem, Hypothesis, Procedure, Observations, Data and Conclusion **B. Explain and emphasize that the experiment is trying to prove the established hypothesis and not proving it is still important.** **C. Students will be able to define and understand the terms control, variable, and follow an experimental model using the scientific method to answer a scientific problem.**	• Use a simple activity to demonstrate the above steps. Reiterate throughout the year during laboratory experiences. • Continue to model and introduce the creation of Data Charts and Scientific Analysis. • Model a false hypothesis and the actions taken to explain the result. • Students need to understand the difference between a scientific demonstration and a scientific experiment. • Continue to emphasize throughout the year utilizing lab experiences. • Encourage and engage in the use of Lab Reports and Lab Journals.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 2: *Atoms are made up of subatomic particles and are the basic unit of matter.*		
A. Explain the terms atom, proton, neutron, electron and element. **B. Identify atoms as the basic building blocks of matter and that elements are composed of one type of atom.**	• Expose students to the idea of an atomic model introduce Neils Bohr, John Dalton, etc. • Create a 3-D Model of an atom properly labeled including the charges of the subatomic particles. • Have student report on what they know about the above as either a survey or homework project and then present in class before betting into the formal lesson. • Choose an element on the Periodic Table. Research the element and create a model demonstrating the correct number of protons, neutrons and electrons. Include uses and history of the element in a report format.	

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Enduring Knowledge 3: *Elements are pure mater and are identified on the Periodic Table of the Elements.*		
A. Identify groups of elements that have similar properties. **B. Describe the characteristics of elements derived from the Periodic Table.** **C. Identify the 25 most common elements on the Periodic Table.**	• Predict the physical and chemical properties of elements based on their positions on the Periodic Table. • Study Dmitri Mendeleev and his contributions to chemistry. • Perform demonstrations in the laboratory setting. • Students should know the chemical symbol and name of each of these common elements. • Play the Periodic Table Song – YouTube.com	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 4: *Atoms can be combined to form molecules held together by bonds.*		
A. Differentiate between elements and compounds and atoms and molecules. Recognize some basic chemical formulas and reactions. **B. Recognize valence electrons and ions. Differentiate between ionic and covalent bonds.** **C. Identify polymers as long chains of molecules and how they interact with other substances.**	• Have students build models of molecules. • Have students write chemical formulas and basic reactions. • Students need to understand the concept of atomic structure and be able to recognize the elements within a compound and how many atoms of each are represented • Have students play "Bonding Buddies" where students are given different valence electron numbers and must "bond" with a buddy and determine what kind of bond they formed. • Demonstrate polymers using different color paper clips, one color for carbon and other colors for elements joining the long chain of carbon atoms. • Make *oobleck* and discuss uses of polymers in everyday applications.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 5: *Mixtures and Methods describe the difference between types of physical substances.*		
A. Compare and contrast pure substances and mixtures. **B. Identify 3 types of mixtures: solutions, colloids and suspensions.** **C. Explain and demonstrate the terms solute and solvent.**	• Use examples and compare characteristics. • Set up several examples and have student teams discern the type of mixture represented with subsequent discourse and applied reasoning. • Introduce Tyndall's effect. • Students will discuss and examine various types of solutes and solvents	

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Enduring Knowledge 6: *Matter has properties and can be measured*		
A. Recognize the tools to measure the volume of matter. Understand appropriate units and their conversions for volume. **B. Recognize the tools to measure mass and weight of matter. Understand appropriate units and their conversions for volume.** **C. Demonstrate density or how materials have a specific amount of mass in each unit of volume.** **D. Recognize acids and bases (pH) as a property of matter**	• Use a graduated cylinder to measure volume of regular and irregularly shaped objects (water displacement). • Convert kilograms to grams to milligrams. • Use a balance and scale to show mass and weight. • Convert kilograms to grams to milligrams. • Use a variety of materials and have students calculate the densities of each and place them in a rank order. • Use pH paper and litmus paper to determine an unknown.	

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Enduring Knowledge 7: *Matter can be changed due to physical and chemical changes.*		
A. Differentiate between a physical and chemical change. **B. Demonstrate how changes in state of matter are a physical change.** **C. Describe how reactants change into products in simple chemical reactions.** **D. Demonstrate the conservation of mass during physical and chemical changes.**	• Have students create a Venn Diagram showing the similarities and differences between a physical and chemical reaction. • Demonstrate and or engage students in a variety of reactions and their observable changes. • Demonstrate the difference between physical and chemical changes by using simple exercise such as folding a piece of paper for physical, then lighting it on fire for chemical. • Draw and label the State of Matter Continuum. Emphasize that changes in temperature create changes in state but that the atomic structure of the matter remains the same. For example the solid form of water (ice) is H_2O, the liquid form of water is H_2O, the gas form of water (water vapor) is H_2O. • Compare the properties of the reactants with the properties of the products in a chemical reaction. • Engage in experiments such as the baking soda and vinegar reaction (Neutralization Reaction.) Translate keen observations of the reactants and its product. • Show and explicate the chemical formula and chemical reaction in various experiments. For example, the chemical reaction for the experiment above is as follows: Baking soda ($NaHCO_3$) + Acetic Acid (HCH_3COO) ⇨ Sodium Acetate (CH_3COONa) + H_2O + CO_2 • Weigh the reactants before a chemical or physical change and after. Compare weights and discuss. • Note the number of atoms in a chemical reactants and the number of atoms in the chemical product of a reaction to prove the Law. Of Conservation of Mass and Matter.	

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Enduring Knowledge 8: *The Nature of Waves represents a transfer of Energy.*		
A. Identify the need to recognize waves as a force of energy transfer that travels from one place to another by a velocity (speed and direction) and is mechanical when traveling through matter and electromagnetic when traveling through empty space. **B. Identify how waves carry energy through a medium.** **C. Explore how the amplitude of a wave is related to the energy of that wave.**	• The student needs to understand the terms amplitude, wavelength, frequency and wave speed. • Students will need to draw and label the energy wave identifying crest, trough, etc. • The student needs to understand that the shorter the wavelength the higher the frequency or the greater the energy of the wave. • Calculate the speed of a wave: where v = velocity of the wave (m/s), f = frequency (Hz), and 2 = wavelength (m). • Create a diagram of various waves with varying amplitude, frequency and wavelength	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 9: *The Nature of Light Energy includes the study of the Electromagnetic Spectrum.*		
A. Recognize that light travels in waves and in a straight line until blocked or changed. **B. Demonstrate how light can be transmitted, reflected, refracted or absorbed by an object.** **C. Demonstrate that visible light is a mixture of different colors.** **D. Recognize and identify the types of radiant energy that create the Electromagnetic Spectrum.** **E. Highlight that the speed of light is fastest in a vacuum and can be slowed due to medium and temperature.**	• Explore what happens when light travels through various mediums. • Observe how and why shadows are created. • Experiment with the behavior of light using flashlights, rulers, various materials (transparent, translucent and opaque) and glasses of water. • Use prisms or spectroscopes to visualize different colors and their measurements. Introduce the unit nanometer and Angstroms. • Ensure that students understand the principles of color such as why do we see red or black or white, etc. • Research the various types of radiant energy on the Electromagnetic Spectrum. • Emphasize that the spectrum is presented from lowest frequency to highest frequency. • The student needs to understand that the shorter the wavelength the higher the frequency and the greater the energy of the light wave. • Explore and discuss various examples of this physical truth.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 10: *The Nature of Sound Energy involves the compression and rarefaction of molecules.*		
A. Know that vibrating objects make sound and that sound is produced by vibration of matter. **B. Compare the characteristics of sound as it is transmitted through different materials and mediums.** **C. Relate the rate of vibration to the pitch of the sound.** **D. Give emphasis to the fact that sounds cannot be produced in a vacuum.** **E. Introduce the concepts of decibels and pitch including the Dopplar Effect.** **F. Establish the uses of Sound Energy.**	• Explore making sound using various forces and materials. • Define and label a compression and rarefaction on a sound wave. • Design an experiment to observe sound. Research units of sound measurement. • Demonstrate that the faster the vibration, the higher the pitch, etc. • Build a shoebox guitar using various rubber bands to produce different frequencies demonstrating changes in pitch. • Define vacuum and discuss what the absence of matter means as it relates to producing sound. • The student needs to understand the meaning and difference between the terms amplitude and loudness (Decibels) and frequency and pitch (Hertz). • Students should be able to give an example of the Dopplar Effect. • Research echolocation, ultrasound, sonar, etc.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 11: *The Nature of Heat Energy includes the study of thermal energy and its behavior.*		
A. Describe the effect of heat to the particles of substances during a phase change. **B. Differentiate among convection, conduction and radiation.** **C. Understand that people use different heating methods to heat buildings.**	• Examine food color changes in hot versus cold water. • The student needs to understand and apply the terms kinetic energy, temperature, heat, mechanical energy, temperature, exothermic and endothermic and the importance of the concepts. • Relate the transfer of heat from oceans and land masses to the evolution of a hurricane. • Have students examine home heating bills and units. • Have students research more eco-friendly and more economical ways to heat a home.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 12: *The Nature of Electrical Energy is explained both as static and current electricity.*		
A. Understand there are naturally occurring forms of electricity and artificial forms of electricity. **B. Explain how electrical current is produced by the flow of electrons.** **C. Understand how basic electrical circuits work and compare series and parallel circuits.** **D. Derive Ohm's Law through investigation of voltage, current, and resistance.**	• Research different forms of electrical energy including lightning, static electricity, etc. • The student needs to understand and apply the terms atom, proton, electron, and the Law of Electron Charges. • The student needs to understand and differentiate between direct current, alternating current, conductor, and insulator. • Use simple circuits involving batteries and motors to compare and predict the current flow with different circuit arrangements. (Snap Circuits). • The student needs to understand and differentiate between open circuit, closed circuit and the parts that make the circuit work. • The student needs to understand the difference between parallel circuits and series circuits and the advantage and disadvantage of using one over the other. • Practice problems using Ohm's Law calculations: V = IR	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 13: *The production of Electrical Energy is transformed and has diverse sources.*		
A. Present that the international measurement system for energy is the Joule (J). **B. Recognize that there are seven forms of energy.** **C. Identify how one form of energy can transform into another.** **D. Describe the sources of the production of Electrical Energy.** **E. Understand that energy can be classified as renewable and non-renewable.**	• Students should research James Joule, the scientist who demonstrated the rule that work can be converted to heat. • Students should define and note examples of radiant energy, chemical energy, mechanical energy, nuclear energy, electrical energy, thermal energy and the energy of sound. • Trace the steps of electrical production in a Fossil Fuels Burning Plant versus a Nuclear Power Plant versus a Hydroelectric Power Plant • Research and Explore Nuclear Power Plants, Fossil Fuels Burning Power Plants, Wind Energy, Hydroelectric Power Plants, Geothermal, Solar production, etc. • While researching ways to conserve energy, decide if the alternative energy sources are renewable or non-renewable.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 14: *Conservation of Energy and alternative sources are available*		
A. The Law of Conservation of Energy is a law of science that states that energy cannot be created or destroyed, but only changed from one form into another or transferred from one object to another. **B. Promote awareness of energy conservation which refers to reducing energy consumption through using less energy service.**	• Provide examples to help students understand this concept. • For example, water can produce electricity. Water in a dam is directed to a waterfall which converts potential energy to kinetic energy. This energy is then changed to mechanical energy which rotates the turbine of a generator to produce electrical energy. • Perform a Conservation of Energy Lab. • Introduce and diagram The Energy Pyramid. • Research and present a variety of methods to promote the reduction of electrical energy and conservation of natural resources.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 15: *Scientific Investigations can lead to a Science Project that is collaborative or individual.*		
A. Conduct an independent experiment using the steps of the scientific method. **B. Learn to conduct scientific research utilizing a number of authoritative sources.** **C. Learn to develop a hypothesis reflective of the research.** **D. Learn to analyze data and develop a valid conclusion reflecting back to a developed hypothesis.**	• Host a school science fair using research boards or other forms of presentation, including a detailed Lab Report. Allow for development and feedback. • Have students find examples of background research and learn to cite the author, date, title and source of their research. • Students will need to utilize research in order to construct a valid hypothesis. • Create charts and graphs, as well as, gather observations in order to analyze scientific experimental results.	