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: *Everything is matter except energy. Elements consist of atoms with specific nuclear properties.*		
A. Know that matter makes up everything; has mass, volume, and density. **B. Realize that properties of matter can be observed and measured using scientific tools.** **C. Understand basic physical and chemical properties of a variety of substances. Use tools to record properties.** **D. All forms of matter are composed of one or more of the elements.** **E. Each element has a distinct atomic structure.** **F. Electrons, protons, and neutrons are parts of the atom and have measurable properties including mass and, in the case of protons and electrons, charge. A kind of force that is only evident at nuclear distances holds the particles of the nucleus together against the electrical repulsion between the protons.**	• Play a mystery box game where students have to describe and predict the identity of an object. • Introduce scientific tools used for measuring matter, include balance, scale, graduated cylinder, meter stick, thermometer, and pH indicators. • Introduce the variety of physical and chemical properties of elements and the common materials in which they can be found. • For example, metals are a class of elements that exhibit physical properties such as conductivity, and chemical properties such as producing salts when combined with nonmetals. • Have students review atomic mass and weight; make Bohr and Lewis Dot diagrams of particular elements. • Build models of individual atoms and element types. Group elements by common properties. • "Periodic Table Song" on You Tube (new one) ASAP Science • Have students write the electron configuration out for a variety of elements. • Build a periodic table using a sampling of electron configurations.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 3: *Atoms contain valence electrons that are involved in forming bonds with other atoms.*		
A. Understand that an atom's properties or valence electrons will determine what kind of chemical bond it forms. **B. Differentiate between ionic, hydrogen, polar covalent, and non-polar covalent bonding.** **C. Compounds are formed by combining two or more different elements and have properties that are different from their constituent elements.** **D. Compare/contrast physical and chemical changes in terms of products.** **E. Have basic understanding of naming products of chemical reactions and writing balanced chemical formulas.** **F. Recognize the four basic chemical reaction types: synthesis, decomposition, exchange, and reversible reactions.**	• Combine different combinations of elements and discuss chemical reaction changes and type of bond formed. Incorporate both binary and polyatomic molecules. • Provide hands-on activities that allow for safe chemical reactions. Have student groups predict, observe, and name molecules or compounds formed. • Have students practice balancing chemical equations while emphasizing conservation of mass. • Demonstrate the four basic chemical reaction types and give examples of each. • Explore the families of the Periodic Table and apply to technology and engineering problems and solutions. • Patterns on the Periodic Table; Alien Periodic Table Activity. • Perform flame tests. • Perform the flame test. Students are given unknown metal samples and use flame test to identify.	

G. Understand patterns or families of the Periodic Table and how chemical reactions may be predicted.		

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 4: *Matter can be combined and separated.*		
A. Define mixtures that are homogenous and heterogeneous. **B. Understand how to calculate percent composition of combinations; know how to calculate volume, mass and percentages of each in a mixture.** **C. Understand solutions (colloids and suspensions) as well as solutes and solvents.** **D. Discuss making and adding acids and bases together.** **E. Understand electrolytes and electrochemical cells.** **F. Compare several separation methods; filtration, chromatography, evaporation, distillation, use of magnets, or centrifugation for separating of mixtures.**	• Make mixtures. Calculate composition of components and their percentages. • When combining a solute and solvent to prepare a solution, exceeding a particular concentration of solute will lead to precipitation of the solution. • Practice by making solutions (solvent and solute) and how to determine the concentration of a solution. • Investigate solutions, colloids and suspensions with hands-on opportunities. • Explore ways to separate solutions students made. • Give examples of mixtures that are combinations of solid, liquid, or gas with a solid, liquid or gas. • Identify and label the parts of an electrolytic cell (cathode, anode) and direction of electron flow, given the reaction equation. • An electrochemical cell can be either voltaic or electrolytic. In an electrochemical cell, oxidation occurs at the anode and reduction at the cathode. • Make slime as an example of a suspension mixture.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 5: *States of matter are based on kinetic theory.*		
A. Understand that matter can be observed in different states: solid, liquid, gas, and plasma and the state depends on the motion of the particles that make matter up. **B. Be familiar with testing properties of chemicals including heat of vaporization and heat of fusion with the proper instruments and procedures.** **C. Distinguish between heat energy and temperature in terms of molecular motion and amount of matter.** **D. Understand that the kinetic molecular theory can be used to explain the relationship between pressure and volume, volume and temperature, pressure and temperature, and the number of particles in a gas sample.** **E. Know and solve for Boyle's Law.** **F. Know and solve for Charles' Law.** **G. A substance for technology and**	• Demonstrate different states and the vibrations of their molecules reiterating that repeating units of molecules make up matter. • Explore changes when substances are heated or cooled: freezing point, vaporization, sublimation and the proper temperature scales to use. • Calculate the heat involved in a phase or temperature change for a given sample of matter. • Have students interpret line graphs for a variety of elements and their phase changes. Introduce and practice converting temperature scales. • Burn a peanut and record the heat energy generated. • Research space and ocean disasters that were caused by the use of the wrong material during a temperature change.	

engineering problems and solutions may depend on how it physically changes under changing temperatures.		

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 6: *Factors affect chemical reactions.*		
A. Understand that at equilibrium, the rate of the forward reaction equals the rate of the reverse reaction; measurable quantities of reactants and products remain constant at equilibrium. **B. Recognize that chemical reactions require different amounts of activation energy; define a catalyst.** **C. The driving forces of chemical reactions are energy and entropy. Chemical reactions either release energy to the environment (exothermic) or absorb energy from the environment (endothermic).** **D. Understand that the rate of a chemical reaction depends on several factors: temperature, concentration, nature of reactants, surface area, and the presence of a catalyst.**	• Use chemical formulas and graphs to demonstrate concepts. • Demonstrate how the reaction rate of a chemical reaction changes when using a catalyst or enzyme. Explore examples of different catalysts. • Perform exothermic and endothermic reactions in the laboratory and have students predict, observe, record and make conclusions.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 7: *Nuclear Reactions can generate energy.*		
A. Define isotope. Know that a radioactive isotope has a specific mode and specific rate or half-life of decay. **B. Recognize a transmutation which can be naturally occurring or induced by the bombardment of high- energy particles.** **C. Compare and contrast fission and fusion reactions which convert very small amounts of matter into energy.** **D. Explain the benefits and risks of radioactivity.** **E. Identify specific uses of some common radioisotopes, dating geological formations, and Co-60 in treating cancer.**	• Calculate the initial amount, the fraction remaining, or the half-life of a radioactive isotope given two of the three variables. • Have students complete nuclear equations; predict missing particles from nuclear equations. • Have students research common radioactive isotopes and their uses in medicine. • Have students cite sources using author name, date, title and, source address. • Have students calculate the amount of radiation they are exposed to each year.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 8: *Chemical imbalances are generated in Earth's environment.*		
A. Human impact on our environment can lead to chemical imbalances on our planet. **B. Be familiar with Air Pollution.** **C. Be familiar with Water Pollution.**	• Explore the benefits of harnessing energy for technology as well as the cost. • Complete charts showing examples of how chemical imbalances lead to specific types of pollution, such as Acid Rain and Global Warming.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 9: *Earth is mainly covered in oceans which affect the lithosphere.*		
A. Ocean water chemistry **B. Motion of the Ocean – Tides** **C. The oceans contain living and non-living resources upon which humans depend.** **D. Be familiar with marine communities.**	• Review water cycle. • Moon's gravitational pull on Earth • Zones, estuaries and shores.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 10: *Fresh water makes up a small amount of Earth's surface.*		
A. Know that the amount of fresh water located in rivers, lakes, underground sources, and glaciers is limited and that its availability can be extended by recycling and decreasing the use of water. **B. Be familiar with aquatic or fresh water communities.** **C. Students should know the origin of the water used by their local communities.** **D. Know that water quality can be measured and what indicators of unsafe water are.**	• lakes, ponds, rivers, streams, wetlands, marshes, swamps, and bogs	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 11: *Earth's forces cause geologic events.*		
A. Explain how the rock cycle, plate tectonics, volcanoes, and earthquakes impact the lithosphere. **B. Predict the locations of volcanoes, earthquakes, and faults based on information contained in a variety of maps.** **C. Know how to determine the epicenter of an earthquake and study impacts.** **D. Understand that heat from Earth's interior reaches the surface through convection primarily.** **E. Know convection currents distribute heat in the atmosphere and oceans.** **F. Recognize that differences between pressure, heat, air movement, and humidity result in changes in weather.**	• Review layers of Earth; cold, brittle lithosphere, hot, convecting mantle, and dense, metallic core. • Review rocks and mineral formation and how scientists identify different ones. Connect composition to the Periodic Table, i.e. the major elements found in Earth's crust are oxygen, silicon, aluminum, and iron. The most abundant group of minerals is the silicates, which contain silicon and oxygen. • Review definitions of earthquakes, volcanoes, and plate movement type (convergent, divergent, and transformational). • Examine the evidence supporting the theory of Plate Tectonics; derived from the fit of continents, location of earthquakes, volcanoes and mid-ocean ridge as well as the distribution of fossils, rock types, and ancient climatic zones. • Use data that reinforces that lithospheric plates move at rates of centimeters per year in response to movements in mantle. • Research earthquakes and size with impact on a given environment. • Students build earthquake tables and test buildings for structure.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 12: *There is a continuous changing of Earth's surface*.		
A. Understand mapping: scale relates to actual distance; grid systems are used to define locations and directions on maps, globes, and charts. **B. Understand that topography is reshaped by the weathering of rock and soil and by the transport and deposition of sediment.** **C. Explain how natural actions such as weathering, erosion (wind, water and gravity), and soil formation affect Earth's surface.** **D. Infer the relative age of rocks and fossils from index fossils and the ordering of the rock layers.** **E. Recognize the relationship among the units—era, epoch, and period—into which the geologic time scale is divided.** **F. Illustrate the vast diversity of life that has been present on Earth over time by using the geologic time scale.**	• Compare topographic maps of different scales; Read and interpret maps, including legends and lines (e.g., contour and isobar), Locate points and directions on maps and globes, using latitude and longitude, Construct profiles from topographic contours, Determine distance and elevation on a map, Identify a hilltop, stream, and valley on a topographic map. • Practice reading topographic maps, air photos, and satellite images relate to actual 3-D landforms. • Describe methods people use to reduce soil erosion. • Determine if landforms were created by processes of erosion (e.g., wind, water, and/or ice) based on evidence in pictures, video, and/or maps. • Evaluate the appropriateness of increasing the human population in a region (e.g., barrier islands, Pacific Northwest, Midwest United States) based on the region's history of catastrophic events, such as volcanic eruptions, earthquakes, and floods. • Explore local Lehigh County geological resources and topography.	

G. Explain the probability of and preparation for geo- hazards such as landslides, avalanches, earthquakes, and volcanoes in a particular area based on available data.		

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 13: *The Sun is the primary source of Earth's energy.*		
A. Review the motions of Earth and the moon and the effects of these motions as they orbit the sun (including day, year, phases of the Moon, eclipses, and tides). **B. Know the sun is the major source of energy for phenomena on Earth's surface; it powers wind, ocean currents, and the water cycle.** **C. Understand that solar energy reaches Earth through radiation; mostly as visible light.** **D. Connect the conversion of light energy to chemical energy in organisms (producers and consumers) that make up biomes.** **E. Understand the relative sizes and distances between the sun and Earth.** **F. Recognize that there are layers of the sun including fusion in the core.** **G. Summarize the characteristics**	• Review Earth-sun weather relationship. • Make models to demonstrate size and scale between Earth and sun. • Explore the electromagnetic spectrum. • Define various kinds of radiation and review radioactive isotopes. • Calculate mass and rate of nuclear fusion and annual radiation exposure. • Explore how the surface features of the sun may affect Earth.	

of the surface features of the sun: photosphere, corona, sunspots, prominences, and solar flares. **H. Identify the sun as the only star and basis of our solar system.**		

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 14: *Stars can differ in type and cycle.*		
A. The life cycle of a star **B. Know the stages and types of stars.** **C. Calculate the distance measurement unit (light year) needed to identify star and galaxy locations.** **D. Patterns of motion, frame of reference, position, direction and speed**	• Investigate red shift/blue shift, light year, astronomical units, and parallax.	

Learning Standard	Ideas for Developing Investigations and Learning Experiences	Date Completed
Enduring Knowledge 15: *Earth is one part of a dynamic universe which include Solar Systems and Galaxies*		
A. Classification of objects in the solar system and galaxy include the sun, planets, moons, comets, asteroids, stars, and quasars. **B. Summarize the characteristics and movements of objects in the solar system (including planets, moons, asteroids, comets, and meteors).** **C. The solar system consists of many types of celestial bodies: two types of planets, compositions, and bodies such as comets.** **D. Recognize how gravitational forces are influenced by mass and distance.** **E. Compare the purposes of the tools and the technology that scientists use to study space (including various types of telescopes, satellites, space probes, and spectroscopes).** **F. Many people contributed to the study of space. Telescopes, probes, satellites and other**	• Make a scale model of the solar system. • Make a comet using dry ice.	

spacecraft have given us information about the universe. **G. Discuss the origin, evolution, and structure of the universe.** **H. Distinguish between several theories of origin and future predictions for the universe.** **I. Know that the universe consists of many billions of galaxies, each including billions of stars.**		