PUSD Science District Instructional Guides (Date Updated: 9/27/2019)

Grade Level: 8	**Time: Q1 Weeks/ Days?**
Unit 1: Energy Transfer and Wave Characteristics	**Cross Cutting Concepts:** Patterns**, Cause and Effect**; Scale, Proportion and Quantity; Systems and System Models**; Energy and Matter**; **Stability and Change**; Structure and function
Core Ideas for Knowing Science: P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event**.**	**Core Ideas for Using Science:** U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised. U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products.
Essential Questions: What does the law of conservation of energy state? How is energy transferred through waves?	

Learning Prrogression: Energy can be stored by lifting an object higher above the ground. When it is released and falls, this energy is stored in its motion. When an object is heated it has more energy than when it is cold. An object at a higher temperature heats the surroundings or cooler objects in contact with it until they are all at the same temperature. How quickly this happens depends on the kind of material which is heated and on the materials between them (the extent to which they are thermal insulators or conductors). The chemicals in the cells of a battery store energy which is released when the battery is connected so that an electric current flows, transferring energy to other components in the circuit and on to the environment. Energy can be transferred by radiation, as sound in air or light in air or a vacuum. Many processes and phenomena are described in terms of energy exchanges, from the growth of plants to the weather. The transfer of energy in making things happen almost always results in some energy being shared more widely, heating more atoms and molecules and spreading out by conduction or radiation. The process cannot be reversed and the energy of the random movement of particles cannot as easily be used. Thus, some energy is dissipated. A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude

Standards	Objectives (I Can)	Key Vocabulary	Resources (Activities/Lessons/Experiments)	Assessments
8.P4U1.3 **Construct an explanation** on how energy can be transferred from one energy store to another.	I can identify potential and kinetic energy. I can identify methods of transferring energy including convection, conduction, and radiation. I can apply the law of conservation of energy in the transfer of energy. I can describe how a wave moves. I can identify how waves transfer energy without transferring matter. I understand the different parts of a wave. I can explain how energy is related to waves. I can describe how a wave shows energy transfer between two different energy storage units. I can identify that waves have a repeating pattern.	Energy Motion Thermal Insulators Battery Electric Current circut Radiation Vacuum Dissipated Crest Trough Wavelength Frequency Amplitude Kinetic energy potential energy Convection Conduction	Resources for Energy Transfer and Wave Characteristics	

8.P4U1.4 **Develop and use mathematical models to explain** wave characteristics and interactions.	I can distinguish between wavelength, frequency, and amplitude. I can create line graphs, bar graphs, circle graphs etc. to describe wave data. I can describe how the amplitude of a wave is related to the energy in a wave. I can describe the relationship between the amplitude of a wave and the energy in the wave.	Wavelength Frequency Amplitude Linear relationships nonlinear relationships Rise Run Graph Slope parabola		
8.P4U2.5 **Develop a solution** to increase efficiency when transferring energy from one source to another.				

Grade Level: 8		**Time: Q1-2 Weeks/ Days?**		
Unit 2: Identifying Matter and its Interactions		**Cross Cutting Concepts:** Patterns**, Cause and Effect**; Scale, Proportion and Quantity; Systems and System Models**; Energy and Matter**; **Stability and Change**; Structure and function		
Core Ideas for Knowing Science: P1: All matter in the Universe is made of very small particles. P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event.		**Core Ideas for Using Science:** U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.		
Essential Questions: How are atoms rearranged in a chemical reaction? What are physical and chemical properties of matter? How is energy utilized in a chemical reaction?				
Learning Prrogression: All materials, anywhere in the universe, living and non-living, are made of a very large numbers of basic 'building blocks' called atoms, of which there are about 100 different kinds. Substances made of only one kind of atom are called elements. Atoms of different elements can combine together to form a very large number of compounds. Achemical reaction involves a rearrangement of the atoms in the reacting substances to form new substances, while the total amount of matter remains the same. The properties of different materials can be explained in terms of the behavior of the atoms and groups of atoms of which they are made.				
Standards	**Objectives (I Can)**	**Key Vocabulary**	**Resources (Activities/Lessons/Experiments)**	**Assessments**

8.P1U1.1 **Develop and use a model** to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved.	I can identify atoms, elements, and molecules. (as a review from 6th grade) I can identify compounds and mixtures. (as a review from 5th grade) I can compare and contrast compounds and mixtures. I can create a model of ionic and covalent bonding. I can demonstrate how atoms rearrange during a chemical reaction. I can balance simple chemical equations, demonstrating a conservation of matter.	Atoms elements Compounds molecules chemical reaction ionic bond covalent bond Mixtures Reactants Products conservation of matter Bohr Model Electron Cloud Model Valence Substances	Resources for Identifying Matter and its Interactions	
8.P1U1.2 **Obtain and evaluate information** regarding how scientists identify substances based on unique physical and chemical properties.	I can identify and distinguish between physical and chemical properties. (Review from 5th and 6th grade) I can identify physical and chemical changes. (Review from 5th and 6ht grade) I can explain what causes a chemical change.(Review from 5th and 6th Grade) I can design an investigation to collect and evaluate data based on substances unique physical and chemical properties. I can identify the reactivity of different groups and periods on the periodic table. I can explain how the periodic table is organized. I can use the periodic table to categorize unknown elements into the appropriate group.	Chemical Properties Physical Change Chemical Change Physical Properties thermal energy conservation of energy Metal Non-Metal Metalloids Groups Periods Periodic Table Reactivity Solvents Solutes mass pH Solubility boiling point melting point states of matter Density States of matter		
8.P4U1.3 **Construct an explanation** on how energy can be transferred from one energy store to another.	I can explain how energy can be stored in an atom. I can explain how energy is released from an atom. I can demonstrate that energy can be transferred through endothermic and exothermic reactions. I can describe how energy is conserved in a chemical reaction.	Physical Change Chemical Change Reactivity Endothermic Exothermic Fission Fusion conservation of matter		
Grade Level: 8		**Time: Q 2 Weeks/ Days?**		

Unit 3: Geological Processes and Events	**Cross Cutting Concepts:** Patterns**, Cause and Effect**; Scale, Proportion and Quantity; Systems and System Models**; Energy and Matter**; **Stability and Change**; Structure and function
Core Ideas for Knowing Science: P4: The total amount of energy in a closed system is always the same but can be transferred from one energy store to another during an event. E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate.	**Core Ideas for Using Science:** U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised. U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.
Essential Questions: What processes shape the Earth's surface? How can the ages of rock layers be used to date fossils? What things are used to predict natural hazards and other geological events?	
Learning Prrogression: Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geological history. Plate movements are responsible for most continental and ocean floor features and for the distribution of most rocks and minerals within Earth's crust. Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. 4 (p. 183) Some natural hazards are preceded by geological activities that allow for reliable predictions; others occur suddenly, with no notice, and are not yet predictable. By tracking the upward movement of magma, for example, volcanic eruptions can often be predicted with enough advance warning to allow neighboring regions to be evacuated. Earthquakes, in contrast, occur suddenly; the specific time, day, or year cannot be predicted. However, the history of earthquakes in a region and the mapping of fault lines can help forecast the likelihood of future events. Finally, satellite monitoring of weather patterns, along with measurements from land, sea, and air, usually can identify developing severe weather and lead to its reliable forecast. Evolution is shaped by Earth's varying geological conditions. Sudden changes in conditions (e.g., meteor impacts, major volcanic eruptions) have caused mass extinctions, but these changes, as well as more gradual ones, have ultimately allowed other life forms to flourish. The evolution and proliferation of living things over geological time have in turn changed the rates of weathering and erosion of land surfaces, altered the composition of Earth's soils and atmosphere, and affected the distribution of water in the hydrosphere	

Standards	Objectives (I Can)	Key Vocabulary	Resources (Activities/Lessons/Experiments)	Assessments
8.E1.U1.6 **Analyze and interpret data** about the Earth's geological column to **communicate** relative ages of rock layers and fossils.	I can understand the organization of a geological column. (The Rule of Superposition) I can identify different types of fossils and how they are formed. I can utilize data to predict the relative ages of rock layers and fossils.	Rock cycle Geological column geologic time relative age Fossils Rocks Minerals Plate tectonics Continental features Ocean floor features Crust	Resources for Geological Processes and Events	

8.E1.U3.7 **Obtain, evaluate and communicate** information about data and historical patterns to [predict] natural hazards and other geological events.	I can interpret data about natural hazards. I can evaluate historical patterns of natural hazards and geological events. I can identify natural hazards. I can utilize the history of earthquakes and fault lines in a region to identify the likelihood of future geological events. I can utilize satellite technology and geographic measurements to develop reliable forecasts. I can identify causes of mass extinctions.	Volcanic dike Fault Sedimentary layers Natural hazards Earthquakes fault lines satellite technology Landslides Floods fault lines mass extinctions meteors volcanic eruptions Geologic events Forecasts Weather patterns earthquakes Seismic waves Tornados Wildfires Cyclonic storms Avalanches Droughts Weathering Erosion Atmosphere Hydrosphere		

Grade Level: 8	**Time: Q3 Weeks/ Days?**
Unit 4: Genetics	**Cross Cutting Concepts:** Patterns**, Cause and Effect**; Scale, Proportion and Quantity; Systems and System Models**; Energy and Matter**; **Stability and Change**; Structure and function
Core Ideas for Knowing Science: L3: Genetic information is passed down from one generation of organisms to another**.**	**Core Ideas for Using Science:** U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised. U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.
Essential Questions: How do genes affect your physical appearance? What is the impact (positive or negative) of genetic research on human lives?	
Learning Prrogression: Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of a specific protein, which in turn affects the traits of the individual (e.g., human skin color results from the actions of proteins that control the production of the pigment melanin). Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. Sexual reproduction provides for transmission of genetic information to offspring through egg and sperm cells. These cells, which contain only one chromosome of each parent's chromosome pair, unite to form a new individual (offspring). Thus offspring possess one instance of each parent's chromosome pair (forming a new chromosome pair). Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited or (more rarely) from mutations. (Boundary: The stress here is on the impact of gene transmission in reproduction, not the mechanism.) In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism	

Standards	Objectives (I Can)	Key Vocabulary	Resources (Activities/Lessons/Experiments)	Assessments
8.L3U1.9 **Construct an explanation** of how genetic variations occur in offspring through the inheritance of traits or through mutations.	I can identify the function of a nucleus and nucleolus of a cell. I can identify the structure of RNA and DNA (AGCT). I can understand the difference between asexual and sexual reproduction. (Mitosis and Meiosis) I can identify the differences between DNA, chromosomes and genes. I can identify that genes are located on chromosomes in cells and exist in allele pairs, receiving one from each parent. I can explain the function of genes (alleles) in the production of a specific protein. I can use a punnett square to determine the probability of genes. I can explain the processes of cell division and how that leads to genetic variation. I can compare and contrast environmental and genetic causes of mutations.	Genes Chromosomes Cells Traits Mutation Homozygous Heterozygous Mitosis Meiosis Probability Protein Genotype Phenotype Egg cells Sperm cells Inherited Alleles Sexual reproduction Punnett Squares Acquired Dominant Recessive Variations	Resources for Genetics	
8.L3U3.10 **Communicate** how advancements in technology have furthered the field of genetic research and use **evidence to support an argument** about the positive and negative effects of genetic research on human lives.	I can create a timeline of major technological advancements in genetic research. I can design and critique an argument based on the positive and negative effects of genetic research. I can argue the ethical and moral responsibilities of scientists.	Biotechnolgy Genetic Disorder		

Grade Level: 8	**Time: Q3-4 Weeks/ Days?**
Unit 5: Natural Selection	**Cross Cutting Concepts:** Patterns**, Cause and Effect**; Scale, Proportion and Quantity; Systems and System Models**; Energy and Matter**; **Stability and Change**; Structure and function
Core Ideas for Knowing Science: L4: The unity and diversity of organisms, living and extinct, is the result of evolution.	**Core Ideas for Using Science:** U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is

Essential Questions: What are factors leading to natural selection? How does natural selection lead to variation in a population? What are factors that lead to advantageous characteristics? How does natural selection lead to the evolution of new species?	discovered, models and theories can be revised.

Learning Prrogression: Genetic variations among individuals in a population give some individuals an advantage in surviving and reproducing in their environment. This is known as natural selection. It leads to the predominance of certain traits in a population and the suppression of others. In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus,the distribution of traits in a population changes. In separated populations with different conditions, the changes can be large enough that the populations, provided they remain separated (a process called reproductive isolation), evolve to become separate species. Biodiversity is the wide range of existing life forms that have adapted to the variety of conditions on Earth, from terrestrial to marine ecosystems. Biodiversity includes genetic variation within a species, in addition to species variation in different habitats and ecosystem types (e.g., forests, grasslands, wetlands). Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.

Standards	Objectives (I Can)	Key Vocabulary	Resources (Activities/Lessons/Experiments)	Assessments
8.L4U1.11 **Develop and use a model** to explain how natural selection may lead to increases and decreases of specific traits in populations over time.	I can explain factors that affect a species over time. I can compare and contrast selective breeding, artificial selection, and natural selection. I can explain how environmental factors affect the process of natural selection.	Survival of the Fittest Evolution Extinction Natural Selection Population Diversity Species Variation Mutation Adaptation' Commensalism Parasitism Mutualism Reproductive isolation Biodiversity Selective breeding Artificial selection Organism Gene Pool Prey Predator Species Microevolution Macroevolution Consumer Primary Secondary Tertiary Producer		
8.L4U1.12 **Gather and communicate evidence** on how the process of natural selection provides an explanation of how new species can evolve.	I can explain how natural selection will allow species to adapt and evolve. I can explain how and why new species evolve using evidence.	Same as vocabulary above		

Grade Level: 8		**Time: Q4 Weeks/ Days?**		
Unit 6: Ecology, Sustainability and Marine Biology		**Cross Cutting Concepts:** Patterns**, Cause and Effect**; Scale, Proportion and Quantity; Systems and System Models**; Energy and Matter**; **Stability and Change**; Structure and function		
Core Ideas for Knowing Science: E1: The composition of the Earth and its atmosphere and the natural and human processes occurring within them shape the Earth's surface and its climate**.**		**Core Ideas for Using Science:** U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.		
Essential Questions: What can humans do to help sustain a growing population for future generations?				
Learning Prrogression: Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing extinction of many other species. But changes to Earth's environment can have different impacts (negative and positive) for different living things. Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.				
Standards	**Objectives (I Can)**	**Key Vocabulary**	**Resources (Activities/Lessons/Experiments)**	**Assessments**

8.E1U3.8 **Construct and support an argument** about how human consumption of limited resources impacts the biosphere.	I can define ecology. I can explain how humans impact biosphere over time. I can identify practical solutions for reducing mass consumption of resources. I can evaluate what might happen to the earth if humans consumed fewer resources.	Sustainability Ecology Reduce Reuse Recycle Global warming Environment Ecosystem Community Population Habitat Niche Carrying Capacity Limiting Factors Food Web Food chain Biodiversity Decomposer Energy Pyramid Omnivore Carnivore Herbivore' Competition Community Biosphere Ecosystem Prey Predator Symbiosis Mutualism Commensalism Parasitism Biotic Abiotic Primary consumer Secondary Consumer Tertiary Consumer Producer		