East Penn School District

Curriculum and Instruction

Curriculum for: Science, Grade 7

Course(s): 7th Grade Science

Grades: 7th Grade

Department: Middle Level Science

Length of Period (average minutes): 41 min.

Periods per cycle: 6 periods

Length of Course (yrs): 1 year

Type of offering: required

Credit(s) awarded:

Developed by: M. Laub and T. O'Connor

ADOPTED: 2018

Enduring Understandings & Essential Questions	Knowledge	Skills	Standards
Enduring Understandings: ● All matter is made of substances that can be identified through their properties and how they interact. ● Particles of substances behave in a predictable manner across all states of matter, energy transfers, phase changes, and chemical reactions. Essential Questions: ● What is matter and how is it conserved in all interactions? ● What are substances and how can they be identified and represented? ● How do temperature, kinetic energy transfer, and other outside forces affect particle behavior in a substance?	● Understand the relationship between the following concepts: ○ Substance ○ Matter ○ Particle ○ Atom ○ Molecule ○ Element ○ Compound ○ Mixture ● Understand the relationship between particles in each state of matter. ● Understand how particles respond to outside forces, including, temperature change and kinetic energy transfer. ● Understand the role of kinetic energy transfer in phase change and dissolving and	● Conduct investigations and use models to represent and show relationships between: ○ Substance ○ Matter ○ Particle ○ Atom ○ Molecule ○ Element ○ Compound ○ Mixture ● Use the periodic table of elements to support the modeling and representations. ● Conduct investigations and use models to represent how particles in different states of matter respond to outside forces, including, temperature change and kinetic energy transfer.	NGSS Standards: ● MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. ● MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. ● MS-ETS1-3. Analyze data from tests to determine similarities and difference among several design solutions to identify the best characteristics of each that can be combined into a new solutions to better meet the criteria for success. ● MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. ● MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures. [Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete description of all individual atoms in a complex molecule or extended structure is not required.]

● How do particles behave in all states of matter, during phase changes, and dissolving? ● How do particles interact during chemical reactions to create new substances?	how the particles behave. ● Understand that a chemical reaction is a process in which the atoms of substances (reactants) rearrange to form new substances (products). ● Understand that during all chemical and physical changes, matter and energy are conserved. ● Understand how limiting factors affect a chemical reaction. ● Understand synthetic materials are derived from natural resources.	● Conduct investigations and use mathematical formulas to demonstrate how kinetic energy is conserved during energy transfer between particles and temperature changes. ● Use engineering practices to design, construct, test, and modify devices that demonstrate the use of energy transfer to solve a problem. ● Conduct investigations and use models to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.	● MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [Assessment boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.] ● MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.] [Assessment Boundary: Assessment is limited to qualitative information.] ● MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawing and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.] ● MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms, that represent atoms.] [Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.]

			● MS-PS1-6. Undertake a design project to construct, test, and modify a device that either release or absorbs thermal energy by chemical processes. [Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride.] [Assessment Boundary: Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device.] ● MS-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. [Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.] ● MS-PS3-4: Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. [Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.] ● MS-PS3-5. Construct, use and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object. [Clarification Statement: Examples of empirical evidence used in

			arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] [Assessment Boundary: Assessment does not include calculations of energy.]
Enduring Understandings: ● All organisms share similar characteristics, but those characteristics can be met in different ways with varying levels of complexity. ● The cell is the basic unit of life. ● A combination of genetics, environmental factors, and other organisms combine to determine an organism's success. Essential Questions: ● How do you know if something is living or nonliving? ● What characteristics do all organisms have in common and what characteristics differ between groups of organisms?	● Understand that all living things are made up of one (unicellular) or more (multicellular) cells. ● Understand that cells have different structures (organelles) inside them that have various functions that contribute to the workings of the cell as a whole. ● Understand that in unicellular organisms, the single cell performs all the functions that support life, while in a multicellular organism, these functions are divided among different tissues,	● Use a microscope to investigate and analyze various forms of life to confirm that all organisms are made of one or more cells. ● Use models to represent the parts of cells and their functions. ● Conduct investigations and analyze models of various multicellular organisms to determine that the whole organism is composed of subsystems (tissues, organs, and organ systems) that perform functions to support life. ● Conduct investigations and	NGSS Standards: ● MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. ● MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. ● MS-ETS1-3. Analyze data from tests to determine similarities and difference among several design solutions to identify the best characteristics of each that can be combined into a new solutions to better meet the criteria for success. ● MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. ● MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.] ● MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment

● How do the structures in the bodies of organisms help them meet their needs and keep them alive? ● How do animals and plants rely on each other and their environments for resources and help in reproducing?	organs, and organ systems. ● Understand that genes passed from parent(s) to offspring carry the information for creating traits and that changes in those genes can cause changes in the traits. ● Understand that sexual reproduction results in genetic variation of offspring, while asexual reproduction does not. ● Understand that animals and plants rely on each other and their environments for various resources (oxygen, carbon dioxide, sugar, reproductive success, etc.) ● Understand that a combination of genetic and environmental factors affect the	analyze and create models of cellular respiration and photosynthesis. ● Use models to represent the passing of traits from parent(s) to offspring to demonstrate how the traits of organisms can change from one generation to the next. ● Conduct investigations and analyze models of various animal and plant structures that affect their successful growth and reproduction. ● Conduct investigations of environmental factors on plant germination and growth.	Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.] ● MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.] ● MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.] ● MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms.

	growth and success of organisms.		Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.] ● MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.] ● MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.] ● MS-LS3-2. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]
Enduring Understandings: ● Similarities in the traits of organisms (both modern and extinct) are attributed to a shared evolutionary history.	● Understand that anatomical similarities and differences between organisms living today and in the fossil record,	● Analyze and interpret anatomical and developmental characteristics of modern and extinct organisms to infer their	NGSS Standards: ● MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

● Differences in the traits of organisms (both modern and extinct) are attributed to differences in environment and genetics after the evolutionary lines diverged. ● Evolution is driven by natural selection. ● Humans can use artificial selection techniques to manipulate the traits of organisms. Essential Questions: ● How do we document the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth? ● What can the similarities and differences in the traits of organisms tell us about their evolutionary relationships? ● How are traits passed from parents to offspring?	enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. ● Understand that comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. ● Understand that genes passed from parent(s) to offspring carry the information for creating traits and that changes in those genes can cause changes in the traits. ● Understand that sexual reproduction results in genetic variation of offspring, while asexual reproduction doe	evolutionary relationships. ● Use models to represent the passing of traits from parent(s) to offspring to demonstrate how the traits of organisms can change from one generation to the next. ● Analyze and interpret data and models of natural selection and artificial selection to explain how and why the distribution of traits in a species changes over time. ● Analyze, develop, and use models to represent the fossil record and the evolutionary histories of related organisms.	● MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. ● MS-ETS1-3. Analyze data from tests to determine similarities and difference among several design solutions to identify the best characteristics of each that can be combined into a new solutions to better meet the criteria for success. ● MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. ● MS-LS3-1. Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.] ● MS-LS3-2. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.] ● MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. [Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.]

● How can humans influence certain traits of organisms? ● How does the distribution of traits within a species (and the species as a whole) change over time in response to changes in environmental conditions?	● Understand that in artificial selection, humans can influence certain characteristics of organisms by selective breeding. ● Understand that traits that support successful survival and reproduction in an organism's environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. ● Understand that collection of fossils and their placement in chronological order is the fossil record and documents the existence, diversity, extinction, and change of many life forms throughout the		● MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. [Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.] ● MS-LS4-3. Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.] ● MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.] ● MS-LS4-5. Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms. [Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.] ● MS-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment

	history of life on Earth.		Boundary: Assessment does not include Hardy Weinberg calculations.] ● MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geological timescale is used to organize Earth's 4.6-billion-year-old history. [Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]

Materials and Resources: