TIME FRAME	*TOPIC*	*STANDARD*	*DISCIPLINARY CORE IDEAS*	*ACTIVITIES & ASSESSMENTS*	*RESOURCES*	*VOCABULARY*
	Weathering and Erosion	**History of Earth** **MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying temporal and spatial scales.	**ESS2.C: The Roles of Water in Earth's Surface Processes** Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. (MS-ESS2-2)			
	Volcanoes, Earthquakes& Plate Tectonics	**History of Earth** **MS-ESS1-4** Construct a scientific explanation based on evidence from rock strata for how the geological time scale is used to organize Earth's 4.6-billion-year-old history. **MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying temporal and spatial scales. **MS-ESS2-3** Analyze and interpret data on the distribution	**ESS1.C: The History of Planet Earth** -The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1-4) -Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (MS-ESS2-3) **ESS2.A: Earth's Materials & Systems** -The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and			

		of fossils and rocks, continental shapes and seafloor structures to provide evidence of the past plate motions.	will determine its future. (MS-ESS2-2) **ESS2.B: Plate Tectonics & Large-Scale System Interactions** -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. (MS-ESS2-2)			
	Earth Processes and Cycles	**Earth's Systems** **MS-ESS2-1** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.	**ESS2.A: Earth's Materials & Systems** -All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1)			
	Energy Resources & Characteristics	**Earth's Systems** **MS-ESS3-1** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy and groundwater resources are the result of past and current geologic	**ESS3.A: Natural Resources** -Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around			

		processes.	the planet as a result of past geologic processes. (MS-ESS3-1)			
	Ecology	**Matter & Energy in Organisms & Ecosystems** **MS-LS2-1** Analyze & interpret data to provide evidence for the effects of resource availability on organisms & populations of organisms in an ecosystem. **MS-LS2-3** Develop a model to describe the cycling of matter & flow of energy among living & nonliving parts of an ecosystem. **MS-LS2-4** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.	**LS2.A: Interdependent Relationships in Ecosystems** - Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1) - In any ecosystem, organisms and populations with similar requirements for food, water, oxygen or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1) - Growth of organisms and population increases are limited by access to resources. (MS-LS2-1) **LS2.B: Cycle of Matter & Energy Transfer in Ecosystems** -Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle			

			nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3) **LS2.C: Ecosystem Dynamics, Functioning, & Resilience** -Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)			
		Interdependent Relationships in Ecosystems **MS-LS2-2** Construct an explanation that predicts patterns of interactions among organisms in a variety of ecosystems. **MS-LS2-5** Evaluate competing design solutions for maintaining biodiversity and protecting ecosystem stability.	**LS2.A: Interdependent Relationships in Ecosystems** -Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations or organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of			

			interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2) **LS2.C: Ecosystem Dynamics, Functioning, & Resilience** - Biodiversity describes the variety of species found in Earth's ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5) **LS4.D: Biodiversity & Humans** -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. (secondary to MS-LS2-5) - Humans impact biodiversity both positively and negatively. (secondary to MS-LS2-5)			
		Human Impacts **MS-ESS3-3** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.	**ESS3.C: Human Impacts on Earth Systems** - Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to the Earth's environments can have different impacts			

		MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.	(negative or positive) for different living things. (MS-ESS3-3) -Typically as human populations and per-capital consumptions of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MS-ESS3-3, MS-ESS3-4)			
	Genetics Heredity Natural Selection	**Growth, Development & Reproduction of Organisms** **MS-LS3-2** Develop and use a model to describe how asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. **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	**LS1.B: Growth & Development of Organisms** - Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MS-LS3-2) -Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4) **LS3.A: Inheritance of Traits** -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 specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to			

		animals and plants, respectively. **MS-LS3-1** Develop and use a model to explain 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. **MS-LS4-5** Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.	proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1) -Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2) **LS3.B: Variation of Traits** - 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. (MS-LS3-2) -In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1) - Mutations may result in changes to the structure and function of proteins. (MS-LS3-1) **LS4.B: Natural Selection** - 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. (MS-LS4-5)			
		Natural Selection & Adaptation **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. **MS-LS4-2** Apply scientific ideas to construct an explanation of the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. **MS-LS4-3** Analyze displays of pictorial data to compare patterns of similarities in the embryological development across	**LS4.A: Evidence of Common Ancestry & Diversity** -The collection of fossils and their placement in chronological order (e.g. through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS-LS4-1) -Anatomical similarities and differences between various organisms living today between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS-LS4-2) - Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully formed anatomy. (MS-LS4-3) **LS4.B: Natural Selection**			

		multiple species to identify relationships not evident in the fully formed anatomy. **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. **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.	-Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4) **LS4.C: Adaptation** -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. (MS-LS4-6)			

	Cellular Respiration Photosynthesis	**Matter & Energy in Organisms and Ecosystems** **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. **MS-LS1-7** Develop a model to describe how food molecules are rearranged through chemical reactions to release energy during cellular respiration and/or form new molecules that support growth as this matter moves through an organism.	**LS1.C: Organization for Matter & Energy Flow in Organisms** -Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6) -Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS1-7) **PS3.D: Energy in Chemical Processes & Everyday Life** -The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e. from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (MS-LS1-6) -Cellular respiration in plants and animals involves chemical reactions with			

			oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (MS-LS1-7)			