MIDDLE SCHOOL

Domain	Disciplinary Core Idea / Component Idea (NGSS)		5th	6th	7th	8th
PHYSICAL SCIENCES	MS – PS1 Matter and Its Interactions	PS1.A - Structure and Properties of Matter	5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen. 5-PS1-2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. 5-PS1-3. Make observations and measurements to identify materials based on their properties.	MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures. MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. 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.		
		PS1.B: Chemical Reactions	5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.		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.	

					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. MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.		
	MS-PS2 Motion and Stability: Forces and Interaction	PS2.A: Forces and Motion		MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. MS-PS2-2. Plan an investigation to provide evidence that the			

				change in an object's motion depends on the sum of the forces on the object and the mass of the object.		
		PS2.B: Types of Interactions	5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.		MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. MS-PS2-4. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. MS-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.	
	MS-PS3 Energy	PS3.A: Definitions of Energy				MS-PS3-1. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
		PS3.B: Conservation of			MS-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.	

		Energy and Energy Transfer			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. MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.	
		PS3.C: Relationship Between Energy and Forces			MS-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.	
		PS3.D: Energy in Chemical Processes and Everyday Life	5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun			
	MS-PS4 Waves and their Applications in Technologies for Information Transfer	PS4.A: Wave Properties			MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.	
		PS4.B: Electromagnetic Radiation			MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.	
		PS4.C: Information Technologies and Instrumentation			MS-PS4-3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.	
LIFE SCIENCES	MS-LS1 From Molecules to Organisms: Structures	LS1.A: Structure and Function			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.	

	and Processes.				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. MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.	
		LS1.B: Growth and Development of Organisms			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. MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.	
		LS1.C: Organization for Matter and Energy Flow in Organisms	5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water. [		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 is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.	
		LS1.D: Information Processing				MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or

						storage as memories.
	MS-LS2 Ecosystems: Interactions, Energy, and Dynamics	LS2.A: Interdependent Relationships in Ecosystems	5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.	MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.		
		LS2.B: Cycle of Matter and Energy Transfer in Ecosystems	5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.	MS-LS2-3. Develop a model to describe the cycling of		

				matter and flow of energy among living and nonliving parts of an ecosystem.		
		LS2.C: Ecosystem Dynamics, Functioning, and Resilience				MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
		LS4.D: Biodiversity and Humans				MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
		LS3.A: Inheritance of Traits And LS3.B: Variation of Traits				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. 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.
EARTH AND SPACE SCIENCES	MS-ESS1 Earth's Place in the Universe	ESS1.A: The Universe and Its Stars	5-ESS1-1. Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their	MS-ESS1-1. Develop and use a model of the Earth-sun-moon system to		

			relative distances from Earth.	describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.		
		ESS1.B: Earth and the Solar System	5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.	MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.		
		ESS1.C: The History of Planet Earth				MS-ESS1-4. Construct a scientific explanation based on evidence from rock

							strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.
	MS-ESS2 Earth's Systems	ESS2.A: Earth's Materials and Systems	5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.	MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and			

				spatial scales.			
		ESS2.B: Plate Tectonics and Large-Scale System Interactions		MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.			
		ESS2.C: The Roles of Water in Earth's	5-ESS2-2. Describe and graph the amounts of salt water and fresh water in various reservoirs to	MS-ESS2-5. Collect data to provide evidence for			

		Surface Processes And ESS2.D: Weather and Climate	provide evidence about the distribution of water on Earth.	how the motions and complex interactions of air masses result in changes in weather conditions. MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates		
	MS-ESS3 Earth and Human Activity	ESS3.A: Natural Resources				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 geoscience processes.
		ESS3.B: Natural Hazards				MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
		ESS3.C: Human Impacts on Earth Systems	5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.			MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

						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.
		ESS3.D: Global Climate Change				MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.
ENGINEERING DESIGN		ETS1.A: Defining and Delimiting Engineering Problems	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 Engineering Design.	ETS1.B: Developing 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 differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
		ETS1.C: Optimizing the Design Solution	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.