Middle School Grades 6-8
Science Essential Standards

Standard #1: INQUIRY

Design and conduct appropriate investigations in order to find valid solutions

Standard #2: CONNECTIONS

Analyze relationships within and between systems and disciplines using critical thinking skills

Standard #3: INFLUENCE

Investigate and evaluate the impact of science on personal and social decisions

Directions for Use of Content Standards

The grade level Content Standards are designed to accompany the Essential Standards. Faculty discussion will need to take place to ensure consistency in teaching. The administrator should reproduce the Content Standards and distribute them to all the teachers.

The format for the Content Standards is as follows:

1. Blank box to record date of instruction of content standards or to use as a check-off to indicate that instruction of standards occurred
2. Numeric system that identifies the specific standard statement
3. Standard Strand
4. Next Generation Science Standard Reference Number **(NGSS)**
5. Program Standard Reference: Inquiry (Q), Connection (C), Influence (I)

Teachers will use this guide as the basis for planning their lessons for the year. Use of the guide will assist students in attaining the Standards for which all are accountable. Teachers are required to spend 80% of their time teaching strictly from the curriculum guide with the remaining 20% of their time teaching concepts that enhance the curriculum.

Middle School Grades 6-8 Science Content Standards

Program Standards

A Guide for Integrating Inquiry and Engineering into the Content Standards

"**Q**" stands for **Inquiry**; "**C**" stands for **Connections** (NGSS Cross-cutting concepts);
"**I**" stands for **Influence**

Within each content standard strand, the Next Generation Science Standards (NGSS) equivalence is given in parentheses (e.g., NGSS MS-PS1-1)
Visit www.nextgenscience.org for more information about these standards.

Clarification statements supply examples or additional clarification to the performance expectations.
Assessment boundary statements *specify the limits to large scale assessment.*

Science Process Skills for Integrating Inquiry into the Content Areas

The following Middle School (MS) scientific process skills will be ***integrated throughout the content*** *areas for grades 6-8. These skills should be mastered at the appropriate level by the end of 8th grade.*

Q. MS.a	Abilities to do Scientific Inquiry
	Design and conduct investigations that will lead to descriptions of relationships between evidence and explanations. ● Clarification Statement: Students should be able to do the following: ○ Formulate testable questions that lead to predictions and scientific investigations ○ Design and conduct logical and sequential investigations including repeated trials ○ Determine controls and use dependent (responding) and independent (manipulated) variables ○ Select and use equipment appropriate to the investigation; demonstrate correct techniques ○ Make qualitative and quantitative observations ○ Record and represent data appropriately and review for quality, accuracy, and relevancy ○ Evaluate predictions, draw logical inferences based on observed patterns/relationships, and account for non-relevant information ○ Share information, procedures, results, and conclusions with appropriate audiences ○ Analyze and provide appropriate critique of scientific investigations ○ Use appropriate mathematics in all aspects of scientific inquiry

Q. MS.b	Abilities to do Engineering Design
	Use the following steps to come up with a solution to a problem or solve a certain task. ● Clarification Statement: Students should be able to do the following: ○ 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. **(NGSS MS-ETS1-1)** ○ Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. **(NGSS MS-ETS1-2)** ○ 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. **(NGSS MS-ETS1-3)** ○ Develop a model to generate data for repeated testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. **(NGSS MS-ETS1-4)**

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✓	Grade Level	Content Standard Strand	Progam Standard		
	MS.PS	**Physical Science**	**Q**	**C**	**I**
	MS.PS.1	**Structure and Properties of Matter**			
	PS.1.a	**Develop models to describe the subatomic structure and atomic composition of simple molecules. (NGSS MS-PS1-1)** ● Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of molecular-level models could include drawings, 3D ball and stick structures or computer representations showing different molecules with different types of atoms. Interpret the data provided on the periodic table in creating the model. ● *Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete depiction of all individual atoms in a complex molecule or extended structure.*		C	
	PS.1.b	**Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. (NGSS MS-PS1-3)** ● 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.*	Q	C	I
	PS.1.c	**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. (NGSS MS-PS1-4)** ● 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 drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.	Q	C	

	MS.PS 2	**Chemical Reactions**			
	PS.2.a	**Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. (NGSS MS-PS1-2)** ● Clarification Statement: Includes discrimination between physical and chemical changes. Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with HCl. ● *Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.*	Q	C	
	PS.2.b	**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. (NGSS MS-PS1-5)** ● 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.*	Q	C	
	MS.PS.3	**Forces and Interactions**			
	PS.3.a	**Apply Newton's Laws to design a solution to a problem involving motion. (NGSS MS-PS2-1 and MS-PS2-2)** ● Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.	Q	C	
	PS.3.b	**Use evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. (NGSS MS-PS2-4)** ● Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system. ● *Assessment Boundary: Assessment does not include Newton's Law of Gravitation or Kepler's Laws.*	Q	C	
	PS.3.c	**Demonstrate how simple machines make work easier.** ● Clarification Statement: Emphasis is on how simple machines transfer energy. Examples include experiments demonstrating mechanical advantage using levers, pulleys, or other simple machines.	Q	C	I

	PS.3.d	**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. (NGSS MS-PS2-5)** ● Clarification Statement: Examples of this phenomenon could include the interactions of magnets, showing static electricity using strips of tape or balloons, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations. ● Assessment Boundary: Assessment is limited to electric and magnetic fields, and limited to qualitative evidence for the existence of fields.	Q	C	
	MS.PS.4	**Energy**			
	PS.4.a	**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. (NGSS MS-PS3-1)** ● Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.	Q	C	
	PS.4.b	**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. (NGSS MS-PS3-2)** ● Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.	Q	C	
	PS.4.c	**Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. (NGSS MS-PS3-3)** ● 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.*	Q	C	I

	PS.4.d	**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. (NGSS MS-PS3-4)** ● 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.*	Q	C	
	PS.4.e	**Construct, use, and present evidence to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. (NGSS MS-PS3-5)** ● Clarification Statement: Examples of empirical evidence could include a 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.*	Q	C	
	MS.PS.5	**Waves and Electromagnetic Spectrum**			
	PS.5.a	**Use mathematical representations to describe a simple model for waves that includes how the amplitude and frequency of a wave is related to the energy in a wave. (NGSS MS-PS4-1)** ● Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking. ● *Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.*	Q	C	
	PS.5.b	**Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. (NGSS MS-PS4-2)** ● Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions. ● *Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.*	Q	C	

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✓	MS.LS	Life Science	Q	C	I
	MS.LS.1	**Structure, Function and Information Processing**			
	LS.1.a	**Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. (NGSS MS-LS1-1)** ● Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and nonliving things, and understanding that living things may be made of one cell or many and varied cells.	Q	C	
	LS.1.b	**Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. (NGSS MS-LS1-2)** ● 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 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.*	Q	C	
	LS.1.c	**Use an argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. (NGSS MS-LS1-3)** ● 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 skeletal, circulatory, excretory, digestive, respiratory, muscular, and nervous systems.*		C	I
	LS.1.d	**Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. (NGSS MS-LS1-8)** ● *Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.*	Q	C	

	MS.LS.2	Matter, Energy and Relationships within Organisms and Ecosystems			
	LS.2.a	**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. (NGSS MS-LS1-6)** ● Clarification Statement: Emphasis is on tracing movement of matter and flow of energy. ● *Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.*		C	I
	LS.2.b	**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. (NGSS MS-LS1-7)** ● 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.*	Q	C	I
	LS.2.c	**Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. (NGSS MS-LS2-1)** ● Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.		C	I
	LS.2.d	**Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (NGSS MS-LS2-3)** ● Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system. ● *Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.*	Q	C	
	LS.2.e	**Construct an argument supported by empirical evidence that when physical or biological components of an ecosystem are changed, populations are affected. (NGSS MS-LS2-4)** ● Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.		C	I

	LS.2.f	**Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. (NGSS MS-LS2-2)** ● Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.		C	I
	LS.2.g	**Evaluate competing design solutions for maintaining biodiversity and ecosystem services.* (NGSS MS-LS2-5)** ● Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.	Q	C	I
	MS.LS.3	**Study of Genes, Genetic Variation, and Heredity**			
	LS.3.a	**Use arguments 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. (NGSS MS-LS1-4)** ● 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.		C	I
	LS.3.b	**Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. (NGSS MS-LS1-5)** ● 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. 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.*	Q	C	

	LS.3.c	**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. (NGSS MS-LS3-1)** ● 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.*	Q	C	I
	LS.3.d	**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. (NGSS MS-LS3-2)** ● 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.	Q	C	
	LS.3.e	**Gather, synthesize, and discuss the ethics of the technologies that have changed the way humans influence the inheritance of desired traits in organisms. (NGSS MS-LS4-5)** ● Clarification Statement: Emphasis is on synthesizing information from reliable sources, including Catholic Church teachings (Example: CCC# 2275), about the influence of humans on genetic outcomes in artificial selection (such as genetically modified organisms (GMOs), animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.		C	I
	MS.LS.4	**Natural Selection and Adaptations**			
	LS.4.a	**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. (NGSS MS-LS4-1)** ● 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.*	Q	C	

	LS.4.b	**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. (NGSS MS-LS4-2)** ● 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.	Q	C	
	LS.4.c	**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.** **(NGSS MS-LS4-3)** ● 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.*	Q	C	
	LS.4.d	**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. (NGSS MS-LS4-4)** ● Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.	Q	C	I
	LS.4.e	**Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. (NGSS MS-LS4-6)** ● 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 Boundary: Assessment does not include Hardy Weinberg calculations.*	Q	C	
✓	**MS.ESS**	**Earth and Space Science**	**Q**	**C**	**I**
	MS.ESS.1	**Space Systems**			
	ESS.1.a	**Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, day, year, and seasons. (MS-ESS1-1)** ● Clarification Statement: Examples of models can be physical, graphical, or conceptual.	Q	C	

	ESS.1.b	**Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. (MS-ESS1-2)** ● Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state). ● *Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.*	Q	C	
	ESS.1.c	**Analyze and interpret data to determine scale properties of objects in the solar system. (NGSS MS-ESS1-3)** ● Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects (includes knowledge of the planets, meteors, comets, and asteroids). Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), composition, and orbital radius. Examples of data include statistical information, drawings and photographs, and models. ● *Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.*		C	
	MS.ESS.2	**History of Earth**			
	ESS.2.a	**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. (NGSS MS-ESS1-4)** ● 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.*	Q	C	

	ESS.2.b	**Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. (NGSS MS-ESS2-2)** ● Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.		C	I
	ESS.2.c	**Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. (NGSS MS-ESS2-3)** ● Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches). ● *Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.*	Q	C	
	MS.ESS.3	**Earth's Systems**			
	ESS.3.a	**Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. (NGSS MS-ESS2-1)** ● Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.	Q	C	
	ESS.3.b	**Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. (NGSS MS-ESS2-4)** ● Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical. ● *Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.*	Q	C	

	ESS.3.c	**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. (NGSS MS-ESS3-1)** ● Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).		C	I
	MS.ESS.4	**Weather and Climate**			
	ESS.4.a	**Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. (NGSS MS-ESS2-5)** ● Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation). ● *Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.*	Q	C	I
	ESS.4.b	**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. (NGSS MS-ESS2-6)** ● Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations. ● *Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.*	Q	C	

	ESS.4.c	**Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. (NGSS MS-ESS3-5)** ● Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.	Q	C	I
	MS.ESS.5	**Human Impact (Science in Personal and Social Perspective)**			
	ESS.5.a	**Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. (NGSS MS-ESS3-2)** ● Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and without notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).	Q	C	I

	ESS.5.b	**Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. (NGSS MS-ESS3-3)** ● Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).	Q	C	I
	ESS.5.c	**Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. (NGSS MS-ESS3-4)** ● Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.		C	I

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