**MS.PS1.A: Structure and Properties of Matter**

Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)

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**MS.PS1.A: Structure and Properties of Matter**

Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2), (MS-PS1-3)

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**MS.PS1.A: Structure and Properties of Matter**

Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4)
**MS.PS1.A: Structure and Properties of Matter**

In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4)

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**MS.PS1.A: Structure and Properties of Matter**

Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)

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**MS.PS1.A: Structure and Properties of Matter**

The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)
**MS.PS1.B: Chemical Reactions**

Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2), (MS-PS1-3), (MS-PS1-5)

**MS.PS1.B: Chemical Reactions**

The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5)

**MS.PS1.B: Chemical Reactions**

Some chemical reactions release energy, others store energy. (MS-PS1-6)
**MS.PS3.A: Definitions of Energy**

The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (MS-PS1-4)

**MS.PS3.A: Definitions of Energy**

The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system’s material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (MS-PS1-4)

**MS.ETS1.B: Developing Possible Solutions**

A solution needs to be tested, and then modified on the basis of the test results in order to improve it. (MS-PS1-6)
**DCI: Engineering Design**

**MS.ETS1.C: Optimizing the Design Solution**

Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process - that is, some of the characteristics may be incorporated into the new design. (MS-PS1-6)

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**DCI: Engineering Design**

**MS.ETS1.C: Optimizing the Design Solution**

The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-PS1-6)

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**DCI: Energy**

**MS.PS3.D: Energy in Chemical Processes and 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)
**MS.LS1.C: Organization for Matter and 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)

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**MS.PS3.D: Energy in Chemical Processes and Everyday Life**

Cellular respiration in plants and animals involve 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)

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**MS.LS1.C: Organization for Matter and Energy Flow in Organisms**

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)
MS.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)
**DCI: Ecosystems: Interactions, Energy, and Dynamics**

**MS.LS2.A: Interdependent Relationships in Ecosystems**

Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of 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)

**DCI: Earth and Human Activity**

**MS.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 Earth’s environments can have different impacts (negative and positive) for different living things.  
(MS-ESS3-3)

**DCI: Earth and Human Activity**

**MS.ESS3.C: Human Impacts on Earth Systems**

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. (MS-ESS3-3)
DCI: Earth and Human Activity

**MS.ESS3.C: Human Impacts on Earth Systems**

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. (MS-ESS3-4)

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DCI: Earth's Systems

**MS.ESS2.A: Earth Materials and 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)

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DCI: Earth's Systems

**MS.ESS2.A: Earth Materials and 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 will determine its future. (MS-ESS2-2)
MS.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)

MS.ESS2.C: The Roles of Water in Earth’s Surface Processes

Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4)

MS.ESS2.C: The Roles of Water in Earth’s Surface Processes

Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)
DCI: Earth's Systems

**MS.ESS2.C: The Roles of Water in Earth’s Surface Processes**

The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5)

DCI: Earth's Systems

**MS.ESS2.D: Weather and Climate**

Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)

DCI: Earth's Systems

**MS.ESS2.C: The Roles of Water in Earth’s Surface Processes**

Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6)
**MS.ESS2.D: Weather and Climate**

Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6)

**MS.ESS2.D: Weather and Climate**

The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)

**Performance Expectation**

**MS-PS1-1: Develop models to describe the atomic composition of simple molecules and extended structures.**

**Clarification 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.
Performance Expectation

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.

Performance Expectation

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.

Performance Expectation

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.
Assessment Boundary: none
Performance Expectation

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.

Performance Expectation

MS-PS1-6: Undertake a design project to construct, test, and modify a device that either releases 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.
* This performance expectation integrates traditional science content with engineering through a practice or disciplinary code idea.

Performance Expectation

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.
Performance Expectation

**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.

Performance Expectation

**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.

**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.

**Assessment Boundary:** none

Performance Expectation

**MS-LS2-2:** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

**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.

**Assessment Boundary:** none
Performance Expectation

**MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.**

*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).

*Assessment Boundary:* none

*This performance expectation integrates traditional science content with engineering through a practice or disciplinary code idea.*

Performance Expectation

**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.**

*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.

*Assessment Boundary:* none

Performance Expectation

**MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.**

*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.

*Assessment Boundary:* Assessment does not include the identification and naming of minerals.
Performance Expectation

**MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.**

**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.

**Assessment Boundary:** none

Performance Expectation

**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.**

**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.

Performance Expectation

**MS-ESS2-5: Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.**

**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.
Performance Expectation

**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.

**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.

Science and Engineering Practices

**Developing and Using Models**

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

Develop a model to predict and/or describe phenomena. (MS-PS1-1), (MS-PS1-4)

Science and Engineering Practices

**Developing and Using Models**

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

Develop a model to describe unobservable mechanisms. (MS-PS1-5)
Science and Engineering Practices

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2)

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MS-PS1-6)

Science and Engineering Practices

Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in 6–8 builds on K–5 experiences and progresses to evaluating the merit and validity of ideas and methods.

Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-PS1-3)
Science and Engineering Practices

**Constructing Explanations and Designing Solutions**

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

*Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.* (MS-LS1-6)

Science and Engineering Practices

**Developing and Using Models**

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

*Develop a model to describe unobservable mechanisms.* (MS-LS1-7)

Science and Engineering Practices

**Analyzing and Interpreting Data**

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

*Analyze and interpret data to provide evidence for phenomena.* (MS-LS2-1)
Science and Engineering Practices

**Constructing Explanations and Designing Solutions**

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2)

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**Constructing Explanations and Designing Solutions**

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

Apply scientific ideas or principles to design an object, tool, process or system. (MS-ESS3-3)

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**Engaging in Argument from Evidence**

Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-ESS3-4)
Science and Engineering Practices

**Developing and Using Models**

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

*Develop a model to describe unobservable mechanisms.* (MS-ESS2-4)

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Science and Engineering Practices

**Constructing Explanations and Designing Solutions**

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

*Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.* (MS-ESS2-2)

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Science and Engineering Practices

**Developing and Using Models**

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

*Develop and use a model to describe phenomena.* (MS-ESS2-1)
Science and Engineering Practices

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.

Collect data about the performance of a proposed object, tool, process, or system under a range of conditions. (MS-ESS2-5)

Science and Engineering Practices

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

Develop and use a model to describe phenomena. (MS-ESS2-6)

Crosscutting Concepts

Patterns

Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)
Crosscutting Concepts

**Cause and Effect**

Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

Crosscutting Concepts

**Scale, Proportion, and Quantity**

Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1)

Crosscutting Concepts

**Energy and Matter**

Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)
Crosscutting Concepts

**Energy and Matter**

The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS1-6)

Crosscutting Concepts

**Structure and Function**

Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)

Crosscutting Concepts

**Energy and Matter**

Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6)
Crosscutting Concepts

**Energy and Matter**
Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7)

Crosscutting Concepts

**Cause and Effect**
Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)

Crosscutting Concepts

**Patterns**
Patterns can be used to identify cause-and-effect relationships. (MS-LS2-2)
### Crosscutting Concepts

**Cause and Effect**

Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (MS-ESS3-3)

<table>
<thead>
<tr>
<th>Crosscutting Concepts</th>
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<tbody>
<tr>
<td><strong>Cause and Effect</strong></td>
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<tr>
<td>Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-4)</td>
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<tr>
<td><strong>Stability and Change</strong></td>
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<tr>
<td>Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (MS-ESS2-1)</td>
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Crosscutting Concepts

**Scale, Proportion, and Quantity**
Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS2-2)

Crosscutting Concepts

**Energy and Matter**
Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)

Crosscutting Concepts

**Cause and Effect**
Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5)
Crosscutting Concepts

**Systems and System Models**

Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS-ESS2-6)

Connections to Nature of Science

**Science Knowledge Is Based on Empirical Evidence**

Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)

Connections to Nature of Science

**Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena**

Laws are regularities or mathematical descriptions of natural phenomena. (MS-PS1-5)
Connections to Engineering, Technology, and Applications of Science

**Influence of Science, Engineering, and Technology on Society and the Natural World**

The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-PS1-3)

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Connections to Engineering, Technology, and Applications of Science

**Interdependence of Science, Engineering, and Technology**

Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. (MS-PS1-3)

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Connections to Engineering, Technology, and Applications of Science

**Science Knowledge Is Based on Empirical Evidence**

Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6)
Science Addresses Questions About the Natural and Material World

Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-ESS3-4)

Influence of Science, Engineering, and Technology on Society and the Natural World

The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-ESS3-3)

Influence of Science, Engineering, and Technology on Society and the Natural World

All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ESS3-4)
Reading in Science  
RST.6-8.1 - Key Ideas and Details  
Cite specific textual evidence to support analysis of science and technical texts. (MS-PS1-2), (MS-PS1-3)

Reading in Science  
RST.6-8.3 - Key Ideas and Details  
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS1-6)

Reading in Science  
RST.6-8.7 - Integration of Knowledge and Ideas  
Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS1-1), (MS-PS1-2), (MS-PS1-4), (MS-PS1-5)
Common Core State Standards for ELA/Literacy

Writing in Science

WHST.6-8.7 - Research to Build and Present Knowledge

Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS1-6)

Common Core State Standards for ELA/Literacy

Writing in Science

WHST.6-8.8 - Research to Build and Present Knowledge

Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-PS1-3)

Common Core State Standards for Mathematics

The Number System

6.NS.C.5 - Apply and extend previous understandings of numbers to the system of rational numbers.

Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-PS1-4)
Common Core State Standards for Mathematics

Ratios & Proportional Relationships
6.RP.A.3 - Understand ratio concepts and use ratio reasoning to solve problems.
Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. (MS-PS1-1), (MS-PS1-2), (MS-PS1-5)

Common Core State Standards for Mathematics

Statistics & Probability
6.SP.B.4 - Summarize and describe distributions.
Display numerical data in plots on a number line, including dot plots, histograms, and box plots. (MS-PS1-2)

Common Core State Standards for Mathematics

Statistics & Probability
6.SP.B.5 - Summarize and describe distributions.
Summarize numerical data sets in relation to their context. (MS-PS1-2)
Common Core State Standards for Mathematics

Expressions & Equations
8.EE.A.3 - Expressions and Equations Work with radicals and integer exponents.
Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. (MS-PS1-1)

Common Core State Standards for Mathematics

Mathematical Practices
MP.2 - Reason abstractly and quantitatively
Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects. (MS-PS1-1), (MS-PS1-2), (MS-PS1-5)

Common Core State Standards for Mathematics

Mathematical Practices
MP.4 - Model with mathematics
Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. A student might apply proportional reasoning to plan a school event or analyze a problem in the community. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose. (MS-PS1-1), (MS-PS1-5)