Washington Science

6th-8th Grades

Physical Science	Physical Science
Matter and its Interactions MS-PS1	**How do atomic and molecular interactions explain the properties of matter that we see and feel?** 1 Use evidence, data, and modeling to show how atomic and molecular interactions explain the properties of matter. Apply this understanding to engineer a device that releases or absorbs thermal energy. WA.MS.PS1 1 Develop models to describe the atomic composition of simple molecules and extended structures. [Climate] MS-PS1-1 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-PS1-2 3 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. [Climate] [ESE] MS-PS1-3 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. [Climate] [ESE] MS-PS1-4 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-PS1-5 6 Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. [Engineering] MS-PS1-6

Motion and Stability: Forces and Interactions MS-PS2

How can one describe physical interactions between objects and within systems of objects?

2 Use data from investigations to construct an argument about how different forces interact to create motion. Apply this understanding to engineer a solution to a problem involving colliding objects. WA.MS.PS2

1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. [Engineering] MS-PS2-1

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. MS-PS2-2

3 Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. MS-PS2-3

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-PS2-4

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-PS2-5

Energy MS-PS3

How can energy be transferred from one object to another?

3 Use evidence, data, and modeling to support claims about the transfer of energy between objects and systems. Apply this understanding to engineer a device that minimizes or maximizes the transfer of thermal energy. WA.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. (supporting MS-PS3-5) MS-PS3-1

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. MS-PS3-2

3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. [Engineering] [ESE] MS-PS3-3

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. [Climate] MS-PS3-4

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. MS-PS3-5

Waves and Their Applications in Technologies for Information Transfer MS-PS4

What are the characteristic properties of waves and how can they be used?

4 Use modeling and mathematical representation to describe wave properties and their applications. WA.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. MS-PS4-1

2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [Climate] MS-PS4-2

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. MS-PS4-3

Life Science

Life Science

From Molecule to Organisms: Structures and Processes MS-LS1

How can one explain the ways cells contribute to the function of living organisms?

1 Use evidence and modeling to support explanations of how cells contribute to the structure and function of living organisms. WA.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. MS-LS1-1

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-LS1-2

3 Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. MS-LS1-3

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-LS1-4

5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [Climate] [Engineering] MS-LS1-5

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. [Climate] [ESE] MS-LS1-6

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. MS-LS1-7

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-LS1-8

Ecosystems: Interactions, Energy, and Dynamics MS-LS2

How does a system of living and non-living things operate to meet the needs of the organisms in an ecosystem?

2 Use evidence and modeling to support explanations of how living and non-living components of an ecosystem interact and are utilized by organisms. Apply this understanding to engineer solutions to problems related to maintaining biodiversity or ecosystem services. WA.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. [Climate] [ESE] MS-LS2-1
- 2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Climate] [ESE] MS-LS2-2
- 3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [ESE] MS-LS2-3
- 4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [Climate] [ESE] MS-LS2-4
- 5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services. [Climate] [Engineering] [ESE] MS-LS2-5

Heredity: Inheritance and Variation of Traits MS-LS3

How do living organisms pass traits from one generation to the next?

3 Develop and use models of how organisms pass traits from one generation to the next and how the environment affects the traits an organism develops, and how the genetic information of offspring may be the same or different from a parent. WA.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-LS3-1
- 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. MS-LS3-2

Biological Evolution: Unity and Diversity MS-LS4

How do organisms change over time in response to changes in the environment?

4 Use evidence and data to create explanations of how organisms change over time in response to environmental shifts. WA.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-LS4-1

2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. MS-LS4-2

3 Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. MS-LS4-3

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-LS4-4

5 Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms. MS-LS4-5

6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. MS-LS4-6

Earth and Space Sciences

Earth and Space Sciences

Earth's Place in the Universe MS-ESS1

What is Earth's place in the Universe? What makes up our solar system and how can the motion of Earth explain seasons and eclipses? How do people figure out that the Earth and life on Earth have changed through time?

1 Use data and modeling to explain Earth's history and place in the universe, including patterns of celestial motion and solar system dynamics. WA.MS.ESS1

1 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, and seasons. [ESE] MS-ESS1-1

2 Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. MS-ESS1-2

3 Analyze and interpret data to determine scale properties of objects in the solar system. MS-ESS1-3

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-ESS1-4

Earth's Systems MS-ESS2

How do the materials in and on Earth's crust change over time? How does the movement of tectonic plates impact the surface of Earth? How does water influence weather, circulate in the oceans, and shape Earth's surface? What factors interact and influence weather? How have living organisms changed the Earth and how have Earth's changing conditions impacted living organisms?

2 Use evidence, data, and modeling to create explanations of how Earth's major systems (geosphere, hydrosphere, atmosphere, and biosphere) interact to shape Earth's surface materials and processes. WA.MS.ESS2

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

2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. [ESE] MS-ESS2-2

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-ESS2-3

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. [ESE] MS-ESS2-4

5 Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. [Climate] [ESE] MS-ESS2-5

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. [Climate] [ESE] MS-ESS2-6

Earth and Human Activity MS-ESS3

How is the availability of needed natural resources related to naturally occurring processes? How can natural hazards be predicted? How do human activities affect Earth systems? How do we know our global climate is changing?

3 Use data and evidence to construct explanations about the impact of human activities on Earth systems. Apply this understanding to engineer methods for monitoring and minimizing a human impact on the environment. WA.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. [ESE] MS-ESS3-1

2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. [Climate] [ESE] MS-ESS3-2

3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. [Climate] [Engineering] [ESE] MS-ESS3-3

4 Construct an argument supported by evidence for how increases in human population and percapita consumption of natural resources impact Earth's systems. [Climate] [ESE] MS-ESS3-4

5 Ask questions to clarify evidence of the factors that have caused climate change over the past century. [Climate] [ESE] MS-ESS3-5

6–8 Engineering, Technology, and Applications of Science	6–8 Engineering, Technology, and Applications of Science
Use modeling, investigation, and data to design, evaluate, and refine solutions to a problem that can be solved through engineering; include impacts on people and the natural environment and use systemic strategies to ensure solutions meet criteria and constraints. WA.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. [Climate] [ESE] MS-ETS1-1 2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. [ESE] MS-ETS1-2 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. [ESE] MS-ETS1-3 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. [ESE] MS-ETS1-4
Environmental and Sustainability Education	**Environmental and Sustainability Education**
Demonstrate understanding of the connections between ecological, social, and economic systems by designing and implementing civic engagement projects that address environmental justice and sustainability issues across different scales. WA.MS.ESE.1	1 Apply understanding of ecological, social, and economic systems to develop and communicate solutions for environmental issues at local, regional, national, and tribal scales. MS.ESE.1-1 2 Design an investigation to gather, analyze, and present data about how the built environment of the local community improves or reduces environmental quality (e.g. impacts on/benefits to water quality, air quality, biodiversity, waste). MS.ESE.1-2 3 Conduct a project that specifies a local environmental problem, identifies solution paths, solves the problem, and reports results in a way that demonstrates individual knowledge, attitudes, and an understanding of personal and civic responsibility for environmental justice and sustainable communities. MS.ESE.1-3