Vocabulary

Definitions of Energy	Conservation of Energy	Investigating Energy and Making Claims
energy kinetic energy potential energy gravitational potential energy mass speed energy transformation friction	conserve transfer thermal energy heat temperature Law of Conservation of Energy conduct insulate solar energy absorb	molecules energy transformation thermal energy kinetic energy pure substances heat thermal impact temperature conduction

Crosscutting Concepts

MS.PS3.1, 3.4	MS.PS3.2	MS.PS3.3	MS.PS3.5
Scale, Proportion, and Quantity Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.	**Systems and System Models** Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems.	**Energy and Matter** The transfer of energy can be tracked as energy flows through a designed or natural system.	**Energy and Matter** Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion).

Resources *

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Lansing School District

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Lansing School District

Sixth Grade • First Quarter Pacing Guide

Science

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Definitions of Energy MS.PS3.1	Definitions of Energy MS.PS3.2	Conservation of Energy MS.PS3.3	Conservation of Energy MS.PS3.4	Investigating Energy and Making Claims MS.PS3.4	Investigating Energy and Making Claims MS.PS3.5
I CAN STATEMENT					
☐ **I CAN** explain how riding a bicycle at different speeds affects the kinetic and mass separately from kinetic energy and speed. ☐ **I CAN** construct a graph that displays data describing the relationships of kinetic energy to the mass of an object and to the speed of an object. ☐ **I CAN** interpret a graph that displays data describing the relationship of kinetic energy to the mass of an object and to its speed.	☐ **I CAN** infer the amount of potential energy of a roller coaster car depending on the position or height of the car.	☐ **I CAN** design, construct, and test a device that either minimizes or maximizes thermal energy transfer.	☐ **I CAN** define thermal energy transfer.	☐ **I CAN** design an experiment that compares the initial and final temperatures of different materials/masses when a specific amount of energy is added.	☐ **I CAN** support the claim with evidence that when the motion energy of an object changes, energy is transferred to or from the object.
Standard					
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. *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.*	**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.** *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.*	**Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.** *Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.*	**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.** *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.*	**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.** *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.*	**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.** *Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.*
Science and Engineering Practices					
Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. ▸ Construct and interpret graphical displays of data to identify linear and nonlinear relationships.	**Developing and Using Models** Modeling in 6–8 builds on K–5 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.	**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, construct, and test a design of an object, tool, process or system.	**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. ▸ Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.	**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. ▸ Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.	**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 worlds. ▸ Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for **a** phenomenon.

Vocabulary

HIstory of the Earth
- paleontologists
- geologic time
- sedimentary
- igneous
- metamorphic
- crystal
- luster
- streak
- rock cycle
- intrusive
- extrusive
- gem

Earth's Materials and Systems
- landform
- magma
- lava
- volcano
- sheild volcano
- cinder cone volcano
- composite volcanoe
- stratovolcano
- earthquake
- crust
- mantle
- core
- lithosphere

Plate Tectonics
- continental drift

Crosscutting Concepts

MS.ESS1.4, 2.2

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.ESS2.1

Stability and Change
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.ESS2.4

Energy and Matter
Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

MS.ESS3.1, 3.3

Cause and Effect
Cause and effect relationships may be used to predict phenomena in natural or designed systems. (3.1)
Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (3.3)

Resources *

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Sixth Grade • Second Quarter Pacing Guide

Science

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Grade 6 Science Second Quarter

	History of the Earth MS.ESS1.4	Earth's Materials and Systems MS.ESS2.1	Earth's Materials and Systems MS.ESS2.2	Earth's Materials and Systems MS.ESS2.4	Earth's Materials and Systems MS.ESS3.1	Plate Tectonics MS.ESS2.3
I CAN STATEMENT	☐ **I CAN** give examples of major events that ocurred in the Earth's history based on evidence from rock strata.	☐ **I CAN** develop a model describing the use of the Earth's energy to form rocks and minerals.	☐ **I CAN** use evidence to explain how the Earth's surface has changed over long and short periods of time. ☐ **I CAN** identify how earthquakes, volcanoes, mountain building and meteor impacts affect changes in the Earth's surface.	☐ **I CAN** create a model that explains how the energy from the sun and Earth's gravity drives the water cycle.	☐ **I CAN** use evidence to explain how geoscience processes have unevely distributed Earth's resources.	☐ **I CAN** explain how the continents were formed based on examination of rock and fossil types. ☐ **I CAN** identify the locations of ocean ridges, fracture zones, and trenches based on examination of rock and fossil types on different continents.
Standard	**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.** *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.*	**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.*	**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.*	**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.*	**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.** *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).*	**Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.** *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).*
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.	**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.	**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 nature operate today as they did in the past and will continue to do so in the future.	**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.	**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 nature operate today as they did in the past and will continue to do so in the future.	**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 principles to design an object, tool, process or system

Vocabulary

Roles of Water
sediments
landslides
erosion
deposition
topographic map
topography
weathering

Human Impact
surface runoff
groundwater
watershed
surface mining
deforestation
overpopulation
construction and urban development
farming
dams

Crosscutting Concepts

MS.ESS2.2

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.ESS3.2

Patterns
Graphs, charts, and images can be used to identify patterns in data.

MS.ESS3.3

Cause and Effect
Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.

MS.ESS3.5

Stability and Change
Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

Resources *

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Sixth Grade • Third Quarter Pacing Guide

Science

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Grade 6 Science Third Quarter

Roles of Water on the Earth's Surface MS.ESS2.2	Human Impacts MS.ESS3.2	Human Impacts MS.ESS3.3	Human Impacts MS.ESS3.4
I CAN STATEMENT			
☐ **I CAN** infer how surface weathering and deposition shape the Earth's surface on a globally. ☐ **I CAN** explain how the weathering and erosion have shaped the Earth's surface in Michigan.	☐ **I CAN** analyze and interpret data on natural hazards to forcast catastrophic events and inform the development of technologies to mitigate their effects.	☐ **I CAN** apply scientific principles to design a method formonitoring and minimizing a human impact on the environment.	☐ **I CAN** construct an argument supported by evidence for how increases in the human population and per-capita consumption ofnatural resources impact Earth's systems.
Standard			
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.*	**Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.** *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 with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (earthquakes and volcanic eruptions), surface processes (mass wasting and tsunamis), or severe weather events (hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (satellite systems to monitor hurricanes or forest fires) or local (building basements in tornado- prone regions or reservoirs to mitigate droughts).*	**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).*	**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.*
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 nature operate today as they did in the past and will continue to do so in the future.	**Analyzing and Interpreting Data** Analyzing data in 6–8 builds on K–5 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.	**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 principles to design an object, tool, process or system.	**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.

Vocabulary

Matter and Energy in Ecosystems
solar energy
producers
food web
consumers
decomposers
organic
inorganic
photosynthesis
ecosystem

Interdependent Relationships in Ecosystems
Abiotic
biotic
predator
prey
mutualism
symbiosis
competition
species extinction
habitat
population

Crosscutting Concepts

MS.LS2.1	MS.LS2.2	MS.LS2.3	MS.LS2.4, 2.5
Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems.	**Patterns** Patterns can be used to identify cause and effect relationships	**Energy and Matter** The transfer of energy can be tracked as energy flows through a natural system.	**Stability and Change** Small changes in one part of a system might cause large changes in another part.

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Sixth Grade • Fourth Quarter Pacing Guide

Science

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Grade 6 Science Fourth Quarter

Matter and Energy in Ecosystems MS.LS2.1	Matter and Energy in Ecosystems MS.LS2.3	Matter and Energy in Ecosystems MS.LS2.4	Interdependent Relationships in Ecosystems MS.LSS2.2	Interdependent Relationships in Ecosystems MS.LSS2.5
I CAN STATEMENT				
☐ **I CAN** use data to interpret populations and to analyze effects of factors such as competition, predators, and various environmental conditions on population size.	☐ **I CAN** give examples of how decomposers recycle nutrients back into the soil or water. ☐ **I CAN** give examples of how decomposers recycle nutrients back into the soil or water. ☐ **I CAN** explain how a food web transfers matter and energy from producers, consumers, and decomposers.	☐ **I CAN** make a claim with supporting evidence that when changing the physical environment or when a new species is introduced it affects populations.	☐ **I CAN** use data and make inferences about change in populations and in multiple ecosystems.	☐ **I CAN** evaluate possible solutions to a threatened existing ecosystem.
Standard				
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.*	**Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.** *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.*	**Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.** *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.*	**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.*	**Evaluate competing design solutions for maintaining biodiversity and ecosystem services.** *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.*
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.*	**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 phenomena.*	**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.*	**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.*	**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).* ► *Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.*

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