8th Grade Science

Year-at-a-Glance

Gravity and Kinetic Energy	Waves	Planetary Science	Human Systems Interactions	Heredity and Adaptation
September-October Approximately 35 teaching days	October-November Approximately 33 teaching days	December-January Approximately 47 teaching days	February-March Approximately 28 teaching days	April-May Approximately 31 teaching days
Physical Sciences MS-PS2-1 MS-PS2-2 MS-PS2-4 MS-PS2-5 (foundational) MS-PS3-1 MS-PS3-2 MS-PS3-5 Earth and Space Sciences MS-ESS1-2 (foundational) Engineering, Technology, and the Applications of Science MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4	Physical Sciences MS-PS4-1 MS-PS4-2 MS-PS4-3 Engineering Design MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4	Earth Science MS-ESS1-1 MS-ESS1-2 MS-ESS1-3 MS-ESS1-4 MS-ESS2-4 MS-ESS3-2 Physical Science MS-PS2-4 MS-PS4-2 Engineering,Technology and the Applications of Science MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4	Life Sciences MS-LS1-1 MS-LS1-3 MS-LS1-7 MS-LS1-8	Life Sciences MS-LS3-1 MS-LS3-2 MS-LS4-1 MS-LS4-2 MS-LS4-3 MS-LS4-4 MS-LS4-5 MS-LS4-6 Earth Sciences MS-ESS1-4

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Standards are listed in a numerical order only and may be taught in any order within the unit.
NOTE: The Science and Engineering Practices are interwoven and should be addressed throughout the year in as many different units and tasks as possible in order to stress the natural connections that exist among mathematical concepts.
NGSS Instructional Sequence

Science Curriculum - Adopted & Approved August 2017 8th grade		
Unit 1 **Gravity and Kinetic Energy**		
Performance Expectations:		
Physical Sciences MS-PS2-1 MS-PS2-2 MS-PS2-4 MS-PS2-5 (foundational) MS-PS3-1 MS-PS3-2 MS-PS3-5	Earth and Space Sciences MS-ESS1-2 (foundational)	Engineering, Technology, and the Applications of Science MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4

Essential Question(s)

How can one predict an object's continued motion, changes in motion, or stability?
What underlying forces explain the variety of interactions observed?
How is energy transferred and conserved?
What are the predictable patterns caused by Earth's movement in the solar system?
How can the various proposed design solutions be compared and improved?
How do engineers solve problems?

Vocabulary:

acceleration	position	weight	constant speed	variable	constraint	impulse
air resistance	slope	energy	collision	criterion	potential energy	kinetic energy
average speed	speed	friction	Newton	gravity	mass	force
distance	gram	joule				

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Science and Engineering Practices: 1. Asking questions and defining problems • Ask questions to clarify and/or refine a model, an explanation, or an engineering problem. •Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. •Define a design problem that can be solved through the development of an object, tool, process, or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. 2. Developing and using models • Develop and/or use a model to predict and/or describe phenomena. • Develop a model to describe unobservable mechanisms. • Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. 3. Planning and carrying out investigations	**Disciplinary Core Ideas Addressed** •The average speed of an object is the distance it travels in a unit of time ($v = \Delta x / \Delta t$). • The slope of the line on a graph of distance versus time represents the speed; steeper slopes represent faster speeds. • An object that does not move at a constant speed has acceleration, change of •speed per unit time ($a = \Delta v / \Delta t$). • A falling object increases speed with a constant acceleration, regardless of the object's mass. •Gravity is an attractive force between two objects with a rate of acceleration of 9.8 m/s^2 on Earth. • Gravity is an attractive force between two objects. • Mass is the amount of matter in an object. • Weight is the force of gravity on an object. • The acceleration of an object increases if the force acting upon it increases ($F = ma$). • If identical force is applied to two objects with different masses, the more massive object will accelerate less than the less massive object ($F = ma$) • Kinetic energy is energy of moving things; potential energy is energy dependent on the position of an object. • A collision transfers kinetic energy. • Increasing the mass of an object by some factor increases its kinetic energy by the same factor; increasing the speed of an	**Crosscutting Concept** Patterns: Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them. • Patterns in rates of change and other numerical relationships can provide information about natural and human-designed systems. • Patterns can be used to identify cause-and-effect relationships. • Graphs, charts, and images can be used to identify patterns in data. Cause and effect: Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering . • Cause-and-effect relationships may be used to predict phenomena in natural or designed systems. Scale, proportion, and quantity: In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change. • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. • Proportional relationships among different types of quantities provide information

• 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. • Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation. • Collect data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. 4. Analyzing and interpreting data • Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships. • Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships. • Analyze and interpret data to provide evidence for phenomena. • Analyze and interpret data to determine similarities and differences in findings. • Analyze data to define an optimal operational range for a proposed object, tool, process or system that best meets criteria for success.	object by some factor increases its kinetic energy by the same factor squared. • An object in motion will stay in motion with the same speed (or a still object will stay still) unless acted on by an external force. • For every action, there is an equal and opposite reaction. • Impulse is force applied over a period of time. • Extending the time of a collision, by slowing an object's deceleration, results in less force on the object. • Safety features to protect humans in collisions use properties of physics to slow deceleration. • Engineers use an iterative process to solve problems.	about the magnitude of properties and processes. • Scientific relationships can be represented through the use of algebraic expressions and equations. Systems and system models: A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. • Models can be used to represent systems and their interactions— such as inputs, processes, and outputs—and energy, matter, and information flows within systems. Energy and matter: Tracking energy and matter flows into, out of, and within systems helps to understand the system's behavior. • Within a natural (or designed) system, the transfer of energy drives the motion and/or cycling of matter. • The transfer of energy can be tracked as energy flows through a designed or natural system. Structure and function: The way an object is shaped or structured determines many of its properties and its functions. • Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. Stability and change: For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

5. Using mathematics and computational thinking • Use mathematical representations to describe and/or support scientific conclusions and design solutions. • Create algorithms (a series of ordered steps) to solve a problem. • Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems. 6. Constructing explanations and designing solutions • Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena. • 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. • Apply scientific ideas, principles, and/or evidence to construct, revise and/or use an explanation for real-world phenomena, examples, or events. • Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system. • Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. 7. Engaging in argument from evidence		• Stability might be disturbed either by sudden events or gradual changes that accumulate over time

• Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. 8. Obtaining, evaluating, and communicating information • Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s). • Integrate qualitative and/or quantitative scientific and/or technical information in written text with that contained in media and visual displays to clarify claims and findings.		

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Connections to CCSS:

Reading—Literacy in Science and Technical Subjects

1. Cite specific textual evidence to support analysis of science and technical texts.
2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases.
5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
7. 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).
8. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
9. Compare and contrast the information gained from experiments, video, or multimedia sources with that gained from reading a text on the same topic.
10. Read and comprehend science/technical texts in grades 6–8 text independently and proficiently.

Speaking and Listening

Engage effectively in a range of collaborative discussions with diverse partners, building on others' ideas and expressing their own clearly.

Interpret and analyze information presented in diverse media and formats and evaluate the motives behind its presentation.

3. Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.
4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.
5. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
9. Draw evidence from informational texts to support analysis, reflection, and research.
3. Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced. 4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

Writing—Literacy in Science and Technical Subjects

5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
7. Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
8. Gather relevant information from multiple print and digital sources, using search terms effectively.
9. Draw evidence from informational texts to support analysis, reflection, and research.

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Language 5. Demonstrate understanding of word relationships and nuances in word meaning 6. Acquire and use academic and domain-specific words and phrases.
Learning Objectives: Students will be able to: Apply Newton's third law to design a solution to a problem involving the motion of two colliding objects. 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. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. 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 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. 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 Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
Assessments: Entry-Level Survey Investigation 1 I-Check Investigation 2 I-Check Investigation 3 I-Check Benchmark Assessment

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Science Curriculum - Adopted & Approved August 2017 8th grade	
Unit 2 Waves	
Performance Expectations:	
Physical Sciences MS–PS4-1 MS–PS4-2 MS–PS4-3	**Engineering, Technology, and the Applications of Science** MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4
Essential Question(s) What are the characteristic properties and behaviors of waves? What is light? How can one explain the varied effects that involve light? What other forms of electromagnetic radiation are there? How are instruments that transmit and detect waves used to extend human senses? What is a design for? What are the criteria and constraints of a successful solution? What is the process for developing potential design solutions? How can the various proposed design solutions be compared and improved?	
Vocabulary:	

trough	compression wave	amplitude	node	Reflection
wavelength	kinetic energy	crest	trough	frequency
longitudinal wave	longitudinal wave	node	velocity	pulse
transverse wave	reflection	pulse	wave	

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Science and Engineering Practices Addressed	Disciplinary Core Ideas Addressed	Crosscutting Concepts Addressed
Asking questions and defining problems • Ask questions that arise from careful observation of phenomena, models, or unexpected results; to clarify and/or seek additional information. • Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. • Define a design problem that can be solved through the development of an object, tool, process, or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. Developing and using models • Evaluate limitations of a model for a proposed object or tool. • Develop and/or use a model to predict and/or describe phenomena. • Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. Planning and carrying out investigations • 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	PS4.A: Wave properties • A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. A sound wave needs a medium through which it is transmitted. • Geologists use seismic waves and their reflection at interfaces between layers to probe structures deep in the planet. PS4.B: Electromagnetic radiation • When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. • The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. • A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. • However, because light can travel through space, it cannot be a matter wave, like sound or water waves. PS4.C: Information technologies and instrumentation • Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. ETS1.A: Defining and delimiting an engineering problem • The more precisely a design task's criteria and constraints can be defined, the	Patterns: Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them. • Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. • Patterns can be used to identify cause-and-effect relationships. • Graphs, charts, and images can be used to identify patterns in data. Cause and effect: Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering. • Cause-and-effect relationships may be used to predict phenomena in natural or designed systems. • Phenomena may have more than one cause, and some causeand-effect relationships in systems can only be described using probability. Scale, proportion, and quantity: In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change. • The observed function of natural and designed systems may change with scale. • Proportional relationships among different types of quantities provide information

recorded, and how many data are needed to support a claim. • Collect data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. • Collect data about the performance of a proposed object, tool, process, or system under a range of conditions. Analyzing and interpreting data • Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships. • Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships. • Analyze and interpret data to provide evidence for phenomena.	more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. 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. There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. • Models of all kinds are important for testing solutions.	about the magnitude of properties and processes. • Phenomena that can be observed at one scale may not be observable at another scale. Systems and system models: A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. • Models can be used to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems. Energy and matter: Tracking energy and matter flows into, out of, and within systems helps to understand the system's behavior. • Energy may take different forms (e.g., energy in fields, thermal energy, energy of motion). Structure and function: The way an object is shaped or structured determines many of its properties and its functions. • Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.

Connections to CCSS:

Writing—Literacy in Science and Technical Subjects

2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

4. Produce clear and coherent writing.
5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
7. Conduct short research projects to answer a question, drawing on several sources.
8. Gather relevant information from multiple print and digital sources, using search terms effectively.
9. Draw evidence from informational texts to support analysis, reflection, and research.

Language

4. Determine or clarify the meaning of unknown words.
5. Demonstrate understanding of word relationships.
6. Acquire and use academic and domain-specific words and phrases.

Reading—Literacy in Science and Technical Subjects

1. Cite specific textual evidence to support analysis of science and technical texts.
2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct.
4. Determine the meaning of symbols, key terms, and domain-specific words and phrases as used in text.
5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
6. Analyze the author's purpose in providing an explanation or discussing an experiment in a text.
7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually.
9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text.
10. Read and comprehend science texts in the grades 6–8 text complexity independently and proficiently.

Speaking and Listening

1. Engage effectively in a range of collaborative discussions.
3. Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning.
4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, valid reasoning, and well-chosen details.
5. Integrate multimedia and visual displays into presentations to clarify information.
6. Adapt speech to a variety of contexts and tasks, demonstrating command of formal English.

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Assessments: Entry-Level Survey Investigation 1-2 I-Check Investigation 3 I-Check Investigation 4 I-Check Benchmark Assessment

Science Curriculum - Adopted & Approved August 2017
8th grade

Unit 3
Planetary Science

Performance Expectations:

Earth Science MS-ESS1-1 MS-ESS1-2 MS-ESS1-3 MS-ESS1-4 MS-ESS2-4 MS-ESS3-2 Physical Science MS-PS2-4 MS-PS4-2	**Engineering, Technology, and the Applications of Science** MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4

Essential Question(s)
Where Are You When You Are in Science Class?
How Does the Moon Change Day by Day?
Why Is Earth Described as a System?
What Causes Day and Night?
Why Is It Hotter in the Summer?
Why Are There More Hours of Daylight in the Summer?

Vocabulary:

altitude location	atmosphere	biosphere	bird's-eye view	elevation frame
subsystem	reference	geosphere	hydrosphere	point of view
equator orbit	system	axis	North Star	rotation
revolution	equinox	longitude	latitude	season
model ray	solstice	solar angle	Moon	crater
first quarter full	highland	mare (maria)	scaling factor	rille
Moon gibbous	crescent	accretion galaxy	asteroid	
lunar eclipse		gravity	comet	

meteoroid regolith simple absorption line emission line light signature	new Moon phase solar eclipse third quarter waning waxing craters	light-year (ly) nebula orbital radius solar system universe anthropocene atmosphere exoplanet	complex crater ejecta flooded impact	Phases of the Moon astronomical unit (AU) spectroscope spectrum visible light orbital period orbital radius orrery transit

Science and Engineering Practices Addressed	Disciplinary Core Ideas Addressed	Crosscutting Concept
1. Asking questions Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information. Ask questions to identify and/or clarify evidence and/or the premise(s) of an argument. Ask questions to clarify and/or refine a model, an explanation, or an engineering problem. Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. 2.Developing and using models Evaluate limitations of a model for a proposed object or tool.	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. [Clarification Statement: Examples of models can be physical, graphical, or conceptual.] MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. [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 their school or state).] [Assessment Boundary: Assessment does not include Kepler's laws of orbital	**Patterns:** Observed patterns in nature guide organization and classification, and they prompt questions about relationships and causes underlying them. Patterns in rates of change and other numerical relationships can provide information about natural and human-designed systems. Patterns can be used to identify cause-and-effect relationships. Graphs, charts, and images can be used to identify patterns in data. Cause and effect: Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering. Cause-and-effect relationships may be used to predict phenomena in natural or designed systems. Phenomena may have more than one cause, and some cause-and-effect relationships in

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Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena. Develop and/or use a model to predict and/or describe phenomena. Develop a model to describe unobservable mechanisms. Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. 3.Planning and carrying out investigations 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. Collect data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. 4.Analyzing and interpreting data Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships. Use graphical displays (e.g., maps, charts, graphs, and/or tables) of	motion or the apparent retrograde motion of the planets as viewed from Earth.] MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system. [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. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), 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.] MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. [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	systems can only be described using probability. Scale, proportion, and quantity: In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change. Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. 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. Scientific relationships can be represented through the use of algebraic expressions and equations. Phenomena that can be observed at one scale may not be observable at another scale. Systems and system models: A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. Systems may interact with other systems; they may have subsystems and be a part of larger complex systems. Models can be used to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems.

large data sets to identify temporal and spatial relationships. Analyze and interpret data to provide evidence for phenomena. 5.Using mathematics and computational thinking Use digital tools (e.g., computers) to analyze very large data sets for patterns and trends. Use mathematical representations to describe and/or support scientific conclusions and design solutions. Create algorithms (a series of ordered steps) to solve a problem. Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems. 6.Constructing explanations Construct an explanation that includes qualitative or quantitative relationships between variables that predict and/or describe phenomena. Construct an explanation using models or representations. 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.	volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.] 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.] 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.]	Energy and matter: Tracking energy and matter flows into, out of, and within systems helps one understand their system's behavior. Energy may take different forms (e.g., energy in fields, thermal energy, energy of motion). The transfer of energy can be tracked as energy flows through a designed or natural system. Structure and function: The way an object is shaped or structured determines many of its properties and functions. Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function. Stability and change: For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand. Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. Stability might be disturbed either by sudden events or gradual changes that accumulate over time.

Apply scientific ideas, principles, and/or evidence to construct, revise, and/or use an explanation for real-world phenomena, examples, or events. 7.Engaging in argument from evidence Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail. Construct, use, and/or present 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. 8.Obtaining, evaluating, and communicating information Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s). Integrate qualitative and/or quantitative scientific and/or technical information in written text with that contained in media and visual displays to clarify claims and findings.	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. [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).] MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. [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 (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).] 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).] 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.] MS-PS2-4. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. [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.] NOTE: This standard is also a main focus of the FOSS Gravity and Kinetic Energy Course. MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [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.]	

	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.	

Connections to CCSS:

READING STANDARDS FOR LITERACY IN SCIENCE

1. Cite specific textual evidence to support analysis of science and technical texts.
   Inv 2, Part 3, Step 28 Inv 4, Part 3, Step 9 Inv 5, Part 1, Step 30 Inv 5, Part 2, Step 25 Inv 6, Part 2, Step 15 Inv 7, Part 3, Step 14 Inv 7, Part 4, Step 18 Inv 9, Part 2, Step 23

2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
   Inv 1, Part 2, Step 7 Inv 2, Part 3, Step 33 Inv 5, Part 1, Step 30 Inv 5, Part 2, Steps 10, 25 Inv 6, Part 1, Step 14 Inv 6, Part 2, Step 15 Inv 7, Part 4, Step 18 Inv 8, Part 1, Step 15
3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
   Inv 5, Part 1, Step 5
4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.
   Inv 1, Part 2, Step 7 Inv 2, Part 3, Step 28 Inv 5, Part 1, Step 30 Inv 6, Part 1, Step 14 Inv 7, Part 4, Step 18
5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
   Inv 5, Part 1, Step 30 Inv 6, Part 1, Step 14 Inv 7, Part 4, Step 18
6. Determine an author's point of view or purpose in a text and explain how it is conveyed in the text.
   Inv 1, Part 2, Step 7 Inv 4, Part 2, Step 12 Inv 5, Part 1, Step 30 Inv 6, Part 2, Step 15 Inv 7, Part 4, Step 18 Inv 8, Part 1, Step 15
7. 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).
   Inv 1, Part 2, Step 7 Inv 2, Part 3, Steps, 28, 33 Inv 4, Part 3, Step 9 Inv 6, Part 1, Step 14 Inv 6, Part 2, Step 15 Inv 7, Part 4, Step 18 Inv 8, Part 1, Step 15
8. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
   Inv 6, Part 2, Step 15 Inv 8, Part 1, Step 15
9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
   Inv 2, Part 1, Step 28 Inv 2, Part 3, Step 28 Inv 5, Part 1, Step 30 Inv 6, Part 1, Step 14

Year-at-a-Glance

10. By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.

Inv 2, Part 3, Step 33 Inv 4, Part 3, Step 9 Inv 5, Part 1, Step 30 Inv 5, Part 2, Steps 10, 25 Inv 6, Part 1, Step 14 Inv 6, Part 2, Step 15 Inv 7, Part 3, Step 14 Inv 8, Part 1, Step 15 Inv 9, Part 2, Step 23

WRITING STANDARDS FOR LITERACY IN SCIENCE

1. Write arguments focused on discipline-specific content.
   a. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
   b. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
   c. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
   d. Establish and maintain a formal style.
   e. Provide a concluding statement or section that follows from and supports the argument presented.

   Inv 1, Part 2, Step 12 Inv 2, Part 3, Step 23 Inv 5, Part 1, Step 28

2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
   a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
   b. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
   c. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
   d. Use precise language and domain specific vocabulary to inform about or explain the topic.
   e. Establish and maintain a formal style and objective tone.
   f. Provide a concluding statement or section that follows from and supports

   Inv 2, Part 3, Step 25 Inv 4, Part 3, Step 6 Inv 5, Part 2, Step 21 Inv 6, Part 2, Step 21 Inv 7, Part 4, Step 23

3. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

   Inv 2, Part 1, Step 27 Inv 3, Part 1, Step 21 Inv 4, Part 2, Step 14 Inv 6, Part 2, Steps 9, 21 Inv 7, Part 1, Step 9 Inv 7, Part 2, Step 17 Inv 7, Part 3, Step 12 Inv 7, Part 4, Step 21 Inv 8, Part 1, Step 17 Inv 9, Part 1, Step 17

4. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
5. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently

   Inv 2, Part 1, Step 27 Inv 5, Part 1, Steps 30, 31 Inv 6, Part 1, Step 19 Inv 6, Part 2, Steps 15, 16

6. 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.

Year-at-a-Glance

Inv 7, Part 4, Steps 7, 8, 11 Inv 7, Extending the Investigation

7. 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.
   Inv 3, Part 1, Step 17 Inv 5, Part 2, Step 10 Inv 7, Part 2, Step 8 Inv 7, Part 3, Step 8
8. Draw evidence from informational texts to support analysis reflection, and research.
   Inv 1, Part 1, Step 12 Inv 1, Part 2, Step 7 Inv 1, Extending the Investigation Inv 2, Part 1, Step 28 Inv 2, Part 3, Step 26 Inv 5, Part 1, Step 30 Inv 5, Part 2, Step 10 Inv 7, Part 4, Step 18 Inv 8, Part 1, Step 9
9. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
   Inv 1, Part 2, Step 7 Inv 5, Part 1, Step 30 Inv 6, Part 1, Step 14 Inv 6, Part 2, Steps 15, 16 Inv 7, Part 3, Step 15 Inv 7, Part 4, Step 18 Inv 9, Part 2, Step 23

SPEAKING AND LISTENING STANDARDS

1. Engage effectively in a range of collaborative discussions (one-onone, in groups, and teacher led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly
   Inv 1, Part 1, Steps 5, 20, 28 Inv 1, Part 2, Step 7 Inv 1, Part 3, Step 5 Inv 2, Part 2, Step 15 Inv 4, Part 1, Step 10 Inv 5, Part 1, Step 31 Inv 6, Part 2, Step 15 Inv 8, Part 1, Step 15 Inv 9, Part 1, Step 13 Inv 9, Part 2, Step 15
2. Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.
   Inv 1, Part 2, Steps 5, 7 Inv 2, Part 3, Step 28 Inv 5, Part 1, Steps 30, 31 Inv 6, Part 1, Step 14 Inv 6, Part 2, Step 15 Inv 7, Part 4, Step 18 Inv 8, Part 1, Step 15
3. Delineate a speaker's argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not.
   Inv 1, Part 2, Step 12
4. Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.
   Inv 1, Part 1, Step 13 Inv 5, Part 1, Step 24
5. Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.
   Inv 5, Extending the Investigation Inv 8, Extending the Investigation
6. Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grade 6 Language standards 1 and 3 for specific expectations.)
   Inv 2, Part 1, Steps 21, 26 Inv 2, Part 3, Steps 23, 29 Inv 4, Part 1, Step 26 Inv 5, Part 1, Step 24 Inv 5, Part 2, Step 23 Inv 8, Part 2, Step 15 Inv 9, Part 3, Step 4

LANGUAGE STANDARDS

1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
   Inv 1, Part 1, Steps 4, 23, 26 Inv 1, Part 3, Steps 2, 26 Inv 2, Part 1, Step 13 Inv 2, Part 2, Steps 8, 10 Inv 3, Part 1, Steps 16, 26 Inv 3, Part 2, Steps 15, 17 Inv 4, Part 2, Step 2

2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
Inv 1, Part 1, Step 23 Inv 2, Part 2, Step 3
3. Use knowledge of language and its conventions when writing, speaking, reading, or listening.
Inv 1, Part 1, Steps 4, 23, 25, 26 Inv 1, Part 2, Step 18 Inv 1, Part 3, Steps 2, 24, 26 Inv 2, Part 1, Step 13 Inv 2, Part 2, Steps 8, 10, 25 Inv 3, Part 1, Steps 16, 24, 26 Inv 3, Part 2, Steps 15, 17 Inv 3, Part 3, Step 11 Inv 4, Part 2, Step 2
4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grades 6-8 reading and content, choosing flexibly from a range of strategies
Inv 2, Part 1, Step 21 Inv 2, Part 3, Steps 23, 25, 29 Inv 3, Part 1, Step 21 Inv 4, Part 1, Step 26 Inv 4, Part 3, Step 6 Inv 5, Part 1, Step 24 Inv 5, Part 2, Steps 21, 23 Inv 6, Part 2, Steps 9, 21 Inv 7, Part 2, Step 17 Inv 7, Part 4, Steps 21, 23 Inv 8, Part 2, Step 15 Inv 9, Part 3, Step 4
5. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings. a. Interpret figures of speech (e.g., personification) in context.
Inv 2, Part 3, Step 25 Inv 4, Part 2, Step 14 Inv 5, Part 2, Step 21 Inv 6, Part 2, Steps 9, 21 Inv 7, Part 2, Step 17 Inv 7, Part 3, Step 12 Inv 8, Part 1, Step 17
6. Acquire and use accurately grade appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.
Inv 2, Part 1, Step 21 Inv 2, Part 3, Steps 25, 29, 33 Inv 3, Part 1, Step 21 Inv 4, Part 1, Step 26 Inv 4, Part 3, Steps 6, 9 Inv 5, Part 1, Steps 24, 30 Inv 5, Part 2, Steps 21, 23, 25 Inv 6, Part 2, Steps 9, 15, 21 Inv 7, Part 2, Step 17 Inv 7, Part 4, Steps 21, 23 Inv 8, Part 1, Step 15 Inv 8, Part 2, Step 15 Inv 9, Part 2, Step 23 Inv 9, Part 3, Step 4

Assessments:
Entry-Level Survey
Investigation 1 I-Check
Investigation 2 I-Check
Investigation 3 I-Check
Benchmark Assessment

Science Curriculum - Adopted & Approved August 2017

8th grade

Unit 4

Human Systems Interactions

Performance Expectations:

Life Sciences	**Engineering, Technology, and the Applications of Science**
MS-LS1-1 MS-LS1-3 MS-LS1-7 MS-LS1-8	MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4

Essential Question(s)

How do organisms live, grow, respond to their environment, and reproduce?
How do the structures of organisms enable life's functions?
How do organisms obtain and use the matter and energy they need to live and grow?
How do organisms detect, process, and use information about the environment?

Vocabulary:

atom	cell	cell structure	hormone	molecule	muscular system
circulatory system	diabetes	diagnosis	nervous system	organ skeletal system	organ system symptom
digestive system	endocrine system aerobic cellular respiration	excretory system Alveolus	respiratory system	synapse	touch
vision calorie	capillary	glucose	tissue abnormal	bone marrow	capillary
cerebral cortex	chemoreceptor	learning	cell	alveoli	cartilage
mechanoreceptor	memory autonomic nervous system	Metacognition	stimulus artery	central nervous system	circulatory system neuron
nerve	cardiac muscle	Neurotransmitter			

Year-at-a-Glance

photoreceptor	reaction time	receptive field	response	sensory	smell
plasma	digestive system	endocrine system	red blood cell	epiglottis	temporal lobe
axon	cell body	cerebral cortex	sensory neuron	gland	heart
chemoreceptor	cone	dendrite	skeletal system	hormone	interneuron
electromagnetic	hippocampus	interneuron	stimulus	metabolism	motor neuron
mechanoreceptor	motor neuron	excretory system	vein	nervous system	neuron
neurotransmitter	peripheral nervous system	pressure	glucose	photoreceptor	pain
reaction time	rod	sense of sight	muscular system	synapse	sensory receptor
sense of hearing	sense of smell	sense of taste	osteoblast	peristalsis	receptor
sense of touch	sensory neuron	stimulus	neuron		

Science and Engineering Practices Addressed

1. **Asking questions**
   - Identify and/or clarify evidence and/or the premise(s) of an argument.
2. **Developing and using models**
   - Develop and/or use a model to predict and/or describe phenomena.
   - Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales.
3. **Planning and carrying out investigations**
   - Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.
4. **Analyzing and interpreting data**

Disciplinary Core Ideas Addressed

Life Sciences

LS1: From Molecules to Organisms: Structures and Processes—How do organisms live, grow, respond to their environment, and reproduce?

- **LS1.A**: Structure and function
  How do the structures of organisms enable life's functions? [All living things are made up of cells, which is the smallest unit that can
  be said to be alive. An organism may consist of one single
  cell (unicellular) or many different numbers and types of cells (multicellular). Unicellular organisms (microorganisms), like multicellular organisms, need food, water, a way to dispose of waste, and an environment in

Crosscutting Concepts

Patterns: Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

- Patterns in rates of change and other numerical relationships can provide information about natural and human-designed systems.
- Patterns can be used to identify cause-and-effect relationships. Cause and effect: Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

Cause-and-effect relationships may be used to predict phenomena in natural or designed systems.

Scale, proportion, and quantity: In considering phenomena, it is critical to recognize what is

• Analyze and interpret data to provide evidence for phenomena. 5. **Constructing explanations** • Apply scientific ideas, principles, and/or evidence to construct, revise, and/or use an explanation for real-world phenomena, examples, or events. 6. **Engaging in argument from evidence** • Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail. • Construct, use, and/or present 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). 7. **Obtaining, evaluating, and communicating information** • Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s). • Integrate qualitative and/or quantitative scientific and/or technical information in written text with that contained in media and visual displays to clarify claims and findings.	which they can live. Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues or organs that are specialized for particular body functions.] • **LS1.C:** Organization for matter and energy flow in organisms How do organisms obtain and use the matter and energy they need to live and grow? [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. Animals obtain food from eating plants or eating other animals. 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. In most animals and plants, oxygen reacts with carbon-containing molecules (sugars) to provide energy and produce carbon dioxide; anaerobic bacteria achieve their energy needs in other chemical processes that do not require oxygen.] **LS1.D:** Information processing How do organisms detect, process, and use	relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change. • The observed function of natural and designed systems may change with scale. • Phenomena that can be observed at one scale may not be observable at another scale. **Systems and system models:** A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. • Systems may interact with other systems; they may have subsystems and be a part of larger complex systems. • Models are limited in that they only represent certain aspects of the system under study **Energy and matter:** Tracking energy and matter flows into, out of, and within systems helps one understand their system's behavior. • Within a natural (or designed system), the transfer of energy drives the motion and/or cycling of matter. **Structure and function:** The way an object is shaped or structured determines many of its properties and functions. • Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function.

• Communicate scientific and/or technical information (e.g., about a proposed object, tool, process, system) in writing and/or through oral presentations.	information about the environment? [Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. Changes in the structure and functioning of many millions of interconnected nerve cells allow combined inputs to be stored as memories for long periods of time.] **PS3: Energy—How is energy transferred and conserved?** • PS3.D: Energy in chemical processes and everyday life How do food and fuel provide energy? If energy is conserved, why do people say it is produced or used? [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. Both the burning of fuel and cellular digestion 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.]	

Connections to CCSS:

Reading—Literacy in Science and Technical Subjects

1. Cite specific textual evidence to support analysis of science and technical texts.
4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.
5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
7. 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).
10. Read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.

Writing—Literacy in Science and Technical Subjects

8. Gather relevant information from multiple print and digital sources, using search terms effectively.

Speaking and Listening

1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on middle school topics, texts, and issues, building on others' ideas and expressing their own clearly.
3. Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.
4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

Language

4. Determine or clarify the meaning of unknown words or phrases.

4b. Use Greek or Latin affixes and roots as clues to the meaning of a word.

Year-at-a-Glance

Assessments:

Entry-Level Survey
Investigation 2 I-Check
Investigation 3 I-Check
Benchmark Assessment

Science Curriculum - Adopted & Approved August 2017

8th grade

Unit 5

Heredity and Adaptations

Performance Expectations:

Life Sciences	Earth Sciences
MS-LS3-1 MS-LS3-2 MS-LS4-1 MS-LS4-2 MS-LS4-3 MS-LS4-4 MS-LS4-5 MS-LS4-6	MS-ESS1-4

Essential Question(s)

- How are the characteristics of one generation related to the previous generation?
- Why do individuals of the same species vary in how they look, function, and behave?
- What evidence shows that different species are related?
- How does genetic variation among organisms affect survival and reproduction?
- How does the environment influence populations of organisms over multiple generations?
- How do people reconstruct and date events in Earth's planetary history?

Year-at-a-Glance

Vocabulary:

biodiversity extinct	fossil record organism	sediment sedimentary rock	chromosome cladogram	phenotype genotype	limitation most recent common ancestor
extinction fossil	paleontologist principle of superposition	tetrapod transition	heredity Evolution	heterozygous Punnett square	homozygous natural selection
Heredity allele	common ancestor descendant	dominant feature filial	generation gene	gene therapy genetically modified organism	adaptation artificial selection
characteristic	DNA	inherited characteristic	genome	mutation	speciation
population protein	recessive transgenic organism	variation trait	inheritance related species	theory	theory of evolution

Science and Engineering Practices Addressed

1. Developing and using models

- Develop and/or use a model to predict and/or describe phenomena.

2. Planning and carrying out investigations

- Collect data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions.

3. Analyzing and interpreting data

- Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.
- Use graphical displays (e.g., maps, charts, graphs, and/or tables) of

Disciplinary Core Ideas Addressed

LS3.A: Inheritance of traits

- Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits.

LS3.B: Variation of traits

- In addition to variations that arise from sexual reproduction, genetic information can be altered because of

Crosscutting Concept

Patterns: Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.

- Patterns in rates of change and other numerical relationships can provide information about natural and human-designed systems.
- Patterns can be used to identify cause-and-effect relationships.
- Graphs, charts, and images can be used to identify patterns in data.

Cause and effect: Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by

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large data sets to identify temporal and spatial relationships. • Analyze and interpret data to provide evidence for phenomena. **4. Using mathematics and computational thinking** • Use mathematical representations to describe and/or support scientific conclusions and design solutions. • Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems. **5. Constructing explanations** • Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena. • Apply scientific ideas, principles, and/or evidence to construct, revise, and/or use an explanation for real-world phenomena, examples, or events. **6. Obtaining, evaluating, and communicating information** • Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s). • Integrate qualitative and/or quantitative scientific and/or	mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. **LS4.B: Natural selection** • Natural selection leads to the predominance of certain traits in a population, and the suppression of others. • In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring. **LS4.C: Adaptation** • Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.	which they are mediated, is a major activity of science and engineering. • Cause-and-effect relationships may be used to predict phenomena in natural or designed systems. • Phenomena may have more than one cause, and some cause and-effect relationships in systems can only be described using probability. **Scale, proportion, and quantity:** In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change. • The observed function of natural and designed systems may change with scale. • Phenomena that can be observed at one scale may not be observable at another scale. **Systems and system models:** A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. • Models are limited in that they only represent certain aspects of the system under study

technical information in written text with that contained in media and visual displays to clarify claims and findings.		

Connections to CCSS:

Reading—Literacy in Science and Technical Subjects

1. Cite specific textual evidence to support analysis of science and technical texts.
2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.
5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text. 7. 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).
8. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
10. Read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.

Writing—Literacy in Science and Technical Subjects

5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
7. Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
8. Gather relevant information from multiple print and digital sources, using search terms effectively.
9. Raw evidence from informational texts to support analysis reflection, and research.

Speaking and Listening

1. Engage effectively in a range of collaborative discussions with diverse partners on middle school topics, texts, and issues, building on others' ideas and expressing their own clearly.
4. Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence.
6. Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.

Language

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4. Determine or clarify the meaning of unknown words or phrases.
5. Demonstrate understanding of word relationships and nuances in word meaning.
6. Acquire and use academic and domain-specific words and phrases.

Assessments:
Entry-Level Survey
Investigation 1 I-Check
Investigation 2 I-Check
Investigation 3 I-Check
Benchmark Assessment