Science Standards

Grade	Strand	Substrand	Standard	Content Area	Benchmark
K	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.1 Analyzing and interpreting data	2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.	Earth and Space Science	0E.2.1.1.2 Make daily and seasonal observations of local weather conditions to describe patterns over time.** (P: 4, CC: 1, CI: ESS2) *Examples of qualitative observations may include descriptions of the weather (such as sunny, cloudy, rainy, and warm). Examples of quantitative observations may include numbers of sunny, windy, and rainy days in a month. Examples of patterns may include that it is usually cooler in the morning than in the afternoon and that different months have different numbers of sunny days versus cloudy days in different months.*
K	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.1 Analyzing and interpreting data	2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.	Life Science	0L.2.1.1.3 Record and use observations to describe patterns of what plants and animals (including humans) need to survive.** (P: 4, CC: 1, CI: LS1) *Examples of patterns may include that animals need to take in food, but plants do not; different animals need different kinds of food; plants require light; and that all living things need water.*
K	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.2 Using mathematics and computational thinking	2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	Physical Science	0P.2.2.1.1 Identify and describe patterns that emerge from the effects of different strengths or different directions of pushes and pulls on the motion of an object.** (P: 5, CC: 2, CI: PS2) *Emphasis is on different relative strengths or different directions, but not both at the same time. Examples of pushes or pulls may include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.*

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1	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.1 Analyzing and interpreting data	2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.	Physical Science	1P.2.1.1.1 Identify and describe patterns obtained from testing different materials and determine which materials have the properties that are best suited for producing and/or transmitting sound.* (P: 4, CC: 1, CI: PS1, ETS1) *Examples of materials may be wood, paper, string, plastics, cloth, etc.*
2	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.2 Using mathematics and computational thinking	2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	Physical Science	2P.2.2.1.1 Identify and predict quantitative patterns of the effects of balanced and unbalanced forces on the motion of an object.** (P: 5, CC: F412, CI: PS2) *Examples may include an unbalanced force on one side of a ball can make it start moving; and balanced forces pushing on a box from both sides will not produce any motion at all. Data displays may include pictographs and bar graphs.*
2	3 Developing possible explanations of phenomena or designing solutions to engineering problems	3.1 Developing and using models	3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions and/or explanations, and communicate ideas to others.	Physical Science	2P.3.1.1.1 Develop a simple diagram or physical model to illustrate how some changes caused by heating or cooling can be reversed and some cannot.** (P: 2, CC: 2, CI: PS3) *Examples of reversible changes may include materials such as water and butter at different temperatures. Examples of irreversible changes may include cooking an egg, freezing a plant leaf, and heating paper. Examples of diagrams may include a flow chart.*

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2	4 Communicating reasons, arguments and ideas to others	4.2 Obtaining, evaluating and communicating information	4.2.1 Students will be able to read and interpret multiple sources to obtain information, evaluate the merit and validity of claims and design solutions, and communicate information, ideas, and evidence in a variety of formats.	Earth and Space Science	2E.4.2.1.2 Obtain and use information from multiple sources, including electronic sources, to describe climates in different regions of the world.** (P: 8, CC: 1, CI: ESS2) *Emphasis of the practice is on learning how to use electronic sources to integrate and evaluate content. Examples of information may include data on an area's typical weather conditions and how these patterns are considered climate.*
3	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.1 Analyzing and interpreting data	2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.	Earth and Space Science	3E.2.1.1.1 Record observations of the sun, moon, and stars and use them to describe patterns that can be predicted.** (P: 4, CC: 1, CI: ESS1) *Examples of patterns may include that the sun and moon appear to rise in one part of the sky, move across the sky, and set; and stars other than our sun are visible at night but not during the day.*
3	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.2 Using mathematics and computational thinking	2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	Earth and Space Science	3E.2.2.1.1 Organize and electronically present collected data to identify and describe patterns in the amount of daylight in the different times of the year.** (P: 5, CC: 1, CI: ESS1) *Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.*

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3	3 Developing possible explanations of phenomena or designing solutions to engineering problems	3.1 Developing and using models	3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions and/or explanations, and communicate ideas to others.	Physical Science	3P.3.1.1.1 Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. (P: 2, CC: 2, CI: PS4) *Examples of models may include diagrams, drawings, physical models, or computer programs.*
3	4 Communicating reasons, arguments and ideas to others	4.2 Obtaining, evaluating and communicating information	4.2.1 Students will be able to read and interpret multiple sources to obtain information, evaluate the merit and validity of claims and design solutions, and communicate information, ideas, and evidence in a variety of formats.	Life Science	3L.4.2.1.1 Obtain information from various types of media to support an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.** (P: 8, CC: 4, CI: LS1) *Examples of structures may include thorns, stems, roots, colored petals, heart, stomach, lungs, brain, and skin. Examples of media may include electronic sources.*
4	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.2 Using mathematics and computational thinking	2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	Earth and Space Science	4E.2.2.1.1 Interpret charts, maps and/or graphs of the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.** (P: 5, CC: 4, CI: ESS2) *Emphasis is on oceans, lakes, rivers, glaciers, ground water, and polar ice caps.*

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4	4 Communicating reasons, arguments and ideas to others	4.2 Obtaining, evaluating and communicating information	4.2.1 Students will be able to read and interpret multiple sources to obtain information, evaluate the merit and validity of claims and design solutions, and communicate information, ideas, and evidence in a variety of formats.	Life Science	4L.4.2.1.2 Obtain information from various media sources to determine that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.** (P: 8, CC: 1, CI: LS3) *Emphasis of the practice is to compare and/or combine information across texts and other reliable media. Emphasis is on organisms other than humans and the patterns in traits between offspring and their parents or among siblings.*
5	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.2 Using mathematics and computational thinking	2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	Earth and Space Science	5E.2.2.1.2 Use data to describe patterns in the daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.** (P: 5, CC: 1, CI: ESS1) *Examples of patterns may include the number of daylight hours over the course of a year, selected stars that are visible only in particular months, and the length and direction of shadows over a year.*
5	3 Developing possible explanations of phenomena or designing solutions to engineering problems	3.1 Developing and using models	3.1.1 Students will be able to develop, revise, and use models to represent their understanding of phenomena or systems as they develop questions, predictions and/or explanations and communicate ideas to others.	Life Science	5L.3.1.1.3 Create an electronic visualization of the movement of matter among plants, animals, decomposers, and the environment.** (P: 2, CC: 4, CI: LS2) *Emphasis is on the idea that matter that is not food is changed by plants into matter that is food. Examples of systems through which matter cycles may include organisms, ecosystems, and the Earth. Examples of an electronic visualization may include a computer program, simulation, or animation.*

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6	1 Exploring phenomena or engineering problems	1.2 Planning and carrying out investigations	1.2.1 Students will be able to design and conduct investigations in the classroom, laboratory, and/or field to test students' ideas and questions, and will organize and collect data to provide evidence to support claims the students make about phenomena.	ESS: Weather and Climate	6E.1.2.1.1 Collect data and use digital data analysis tools to identify patterns to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.** (P: 3, CC: 2, CI: ESS2) *Emphasis is on how weather at a fixed location changes in response to moving air masses and to interactions at frontal boundaries between air masses. Examples of weather data may include temperature, air pressure, precipitation, and wind. Examples of data analysis may include weather maps, diagrams, and visualizations or may be obtained through laboratory experiments (such as with condensation).*
7	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.1 Analyzing and interpreting data	2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.	LS: Ecosystems: Interactions, Energy, and Dynamics	7L.2.1.1.1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.** (P: 4, CC: 2, CI: LS2) *Emphasis is on cause and effect relationships between resources and growth of individual organisms and the number or organisms in ecosystems during periods of abundant and scarce resources. Examples may include populations of MN deer, moose, wolf, scavengers or aquatic populations in Lake Superior or algal blooms in lakes and ponds. Examples of evidence may include the use of flow charts to organize and sequence the algorithm, and to show relationships.*

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7	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.1 Analyzing and interpreting data	2.1.1 Students will be able to represent observations and data in order to recognize patterns in the data, the meaning of those patterns, and possible relationships between variables.	LS: Evolution: Unity and Diversity	7L.2.1.1.3 Analyze visual data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.** (P: 4, CC: 1, CI: LS4) *Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing their macroscopic appearances on diagrams or pictures.*
7	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.2 Using mathematics and computational thinking	2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	LS: Evolution: Unity and Diversity	7L.2.2.1.1 Use an algorithm to explain how natural selection may lead to increases and decreases of specific traits in populations.** (P: 5, CC: 2, CI: LS4) *Emphasis is on using proportional reasoning to develop mathematical models, probability statements, or simulations to support explanations of trends in changes to populations over time.*
8	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.2 Using mathematics and computational thinking	2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	PS: Energy	8P.2.2.1.2 Create a computer program to illustrate the transfer of energy within a system where energy changes form.** (P: 5, CC: 7, CI: PS3) *Emphasis of the programming skills is the use of sequences, events and conditionals. Examples of a system may include a roller coaster, a pendulum, an electric water heater, and a solar electric collector.*

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8	4 Communicating reasons, arguments and ideas to others	4.2 Obtaining, evaluating and communicating information	4.2.1 Students will be able to read and interpret multiple sources to obtain information, evaluate the merit and validity of claims and design solutions, and communicate information, ideas, and evidence in a variety of formats.	PS: Waves and their Applications	8P.4.2.1.2 Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.** (P: 8, CC: 6, CI: PS4) *Emphasis of the practice is on using information to support and clarify claims. Emphasis of the core idea is on understanding that waves (encoded both analog and digitally) can be used for communication purposes. Examples of encoding and transmitting information may include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen.*
9-12 Earth and Space Science	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.2 Using mathematics and computational thinking	2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	ESS: Earth's Place in the Universe	9E.2.2.1.1 Use mathematical and computational representations to predict the motion of natural and human-made objects that are in orbit in the solar system.** (P: 5, CC: 3, CI: ESS1, ETS2) *Emphasis is on Kepler's laws of planetary motion and Newtonian gravitational laws governing orbital motions, which apply to human-made satellites as well as planets and moons.*

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9-12 Earth and Space Science	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.2 Using mathematics and computational thinking	2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	ESS: Earth's Systems and Processes	9E.2.2.1.2 Develop a computational model, based on observational data, experimental evidence, and chemical theory, to describe the cycling of carbon among Earth's systems.** (P: 2, CC: 5, CI: ESS2) *Emphasis is on quantitative modeling of carbon as it cycles through the ocean, air, rock (particularly limestone), soil, and organisms. Emphasis is also on using empirical evidence and scientific reasoning to inform the algorithmic thinking about the conservation and cycling of matter.*
9-12 Life Science	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.2 Using mathematics and computational thinking	2.2.1 Students will be able to use mathematics to represent physical variables and their relationships, compare mathematical expressions to the real world, and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	LS: Ecosystems: Interactions, Energy, and Dynamics	9L.2.2.1.1 Use a computational model to support or revise an evidence-based explanation for factors that have ecological and economic impacts on different sized ecosystems, including factors caused by the practices of various human groups.** (P: 5, CC: 3, CI: LS2) *Examples of ecological impacts might include changes in the carrying capacity, species numbers and/or types of organisms present in an environment. Examples of human practices that can have positive or negative impacts, such as stream restoration versus deforestation as an ecological example. Examples of computational models may include online simulations of population dynamics, population ecology, or population growth.*

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9-12 Life Science	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.2 Using mathematics and computational thinking	2.2.1 Students will be able to use mathematics to represent physical variables and their relationships, compare mathematical expressions to the real world, and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	LS: Ecosystems: Interactions, Energy, and Dynamics	9L.2.2.1.2 Use a computational model to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.** (P: 5, CC: 5, CI: LS2) *Examples of claims about matter cycles may include how carbon, nitrogen, or water cycles through the environment, and/or how disruptions to those systems affect matter cycling. Examples of energy flow may include the transfer of the sun's energy into and among organisms, and/or connections between fossil fuel burning and the carbon cycle. Examples of computational models may include online simulations and animated representations.*
9-12 Chemistry	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.2 Using mathematics and computational thinking	2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	Chem: Structure and Properties of Matter	9C.2.2.1.1 Develop a data simulation, based on observations and experimental data of how the pressure, volume, temperature, and mass of a gas are related to each other, to predict the effect on a system of changing one of those variables.** (P: 5, CC: 2, CI: PS1) *Emphasis is on applying the kinetic molecular theory of gases to develop gas laws. Example systems may include balloons, tires, or syringes.*

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9-12 Physics	1 Exploring phenomena or engineering problems	1.1 Asking questions and defining problems	1.1.1 Students will be able to ask questions about aspects of the phenomena they observe, the conclusions they draw from their models or scientific investigations, each other's ideas, and the information they read.	Phys: Waves and their Applications	9P.1.1.1.1 Evaluate questions about the advantages and disadvantages of using digital transmission and storage of information.* ** (P: 1, CC: 7, CI: PS4, ETS1) *Emphasis is on the tradeoffs involved in the transmission and storage of data elements. Examples of advantages may include that digital information is stable because it can be stored reliably in computer memory, transferred easily, and copied and shared rapidly. Examples of disadvantages may include issues of easy deletion, security, and theft.*
9-12 Physics	2 Looking at data and empirical evidence to understand phenomena or solve problems	2.2 Mathematics and Computational Thinking	2.2.1 Students will be able to use mathematics to represent physical variables and their relationships; compare mathematical expressions to the real world; and engage in computational thinking as they use or develop algorithms to describe the natural or designed worlds.	Phys: Energy	9P.2.2.1.3 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in or out of the system are known.** (P: 5, CC: 4, CI: PS3) *Emphasis is on explaining the meaning of mathematical expressions used in the model for systems of two or three components. Forms of energy may include thermal energy, kinetic energy, and elastic potential energy. Computational models may include the creation or use of a simulation or the analysis of a data set.*

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9-12 Physics	3 Developing possible explanations of phenomena or designing solutions to engineering problems	3.1 Developing and using models	3.1.1 Students will be able to develop, revise, and use models to represent the students' understanding of phenomena or systems as they develop questions, predictions and/or explanations, and communicate ideas to others.	Phys: Energy	9P.3.1.1.1 Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). (P: 2, CC: 5, CI: PS3) *Examples of phenomena at the macroscopic scale may include the conversion of kinetic energy to thermal energy, the energy stored due to position of an object above Earth, and the energy stored between two electrically-charged plates. Examples of models may include diagrams, drawings, descriptions, and computersimulations.*
9-12 Physics	3 Developing possible explanations of phenomena or designing solutions to engineering problems	3.2 Constructing explanations and designing solutions	3.2.2 Students will be able to use their understanding of scientific principles and the engineering design process to design solutions that meet established criteria and constraints.*	Phys: Motion and Stability: Forces and Interactions	9P.3.2.2.1 Develop a computer simulation to demonstrate the impact of a proposed solution that minimizes the force on a macroscopic object during a collision.** (P: 6, CC: 2, CI: PS2, ETS1) *Emphasis is on applying science and engineering principles and analyzing the energy conversions. Examples of a device may include a helmet, a parachute, an airbag, and packaging for safe shipping.*