SCIENCE 8 Curricular Document

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MS Science 8 Course Information

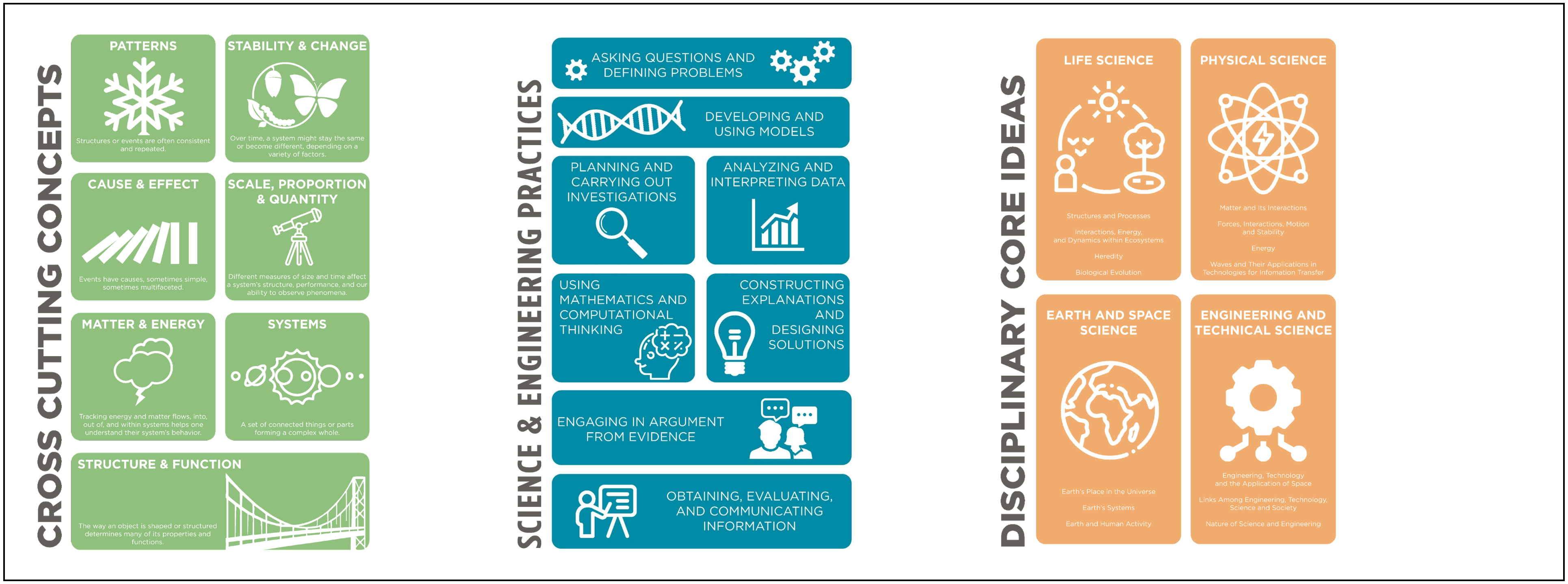
CURRICULUM/CONTENT AREA	COURSE LENGTH
Science	1 year
GRADE LEVEL	**DATE LAST REVIEWED**
8	2016 Program Evaluation 2023
PREREQUISITE(s) ***if applicable***	**BOARD APPROVAL DATE**
NA	2024
PRIMARY RESOURCE ***if applicable***	
Carolina OpenSciEd	

Desired Results

COURSE DESCRIPTION

Elmbrook's Middle School Science Programming is designed to build scientific thinking and inquiry by exploring various scientific disciplines such as physical, life, earth & space sciences as well as engineering. Overall, our middle school science programming aims to instill a love for science, nurture critical thinking skills, and lay the groundwork for further scientific study as students progress through their education. Students strengthen their ability to solve problems, become more curious about the world around them, foster a scientific mindset, and discover the wonders of science in their classrooms and their lives.

ENDURING UNDERSTANDINGS *These are big ideas of science, a.k.a.crosscutting concepts, that provide lenses for viewing phenomena and understanding problems in the world around us, and which transfer across all areas of science and engineering.*	ESSENTIAL QUESTIONS *In this course, students will ponder, investigate, reflect, argue, and discuss these open-ended, inquiry questions.*
Patterns: Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them. **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. **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. **Systems and Models:** A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. **Energy and Matter:** Tracking energy and matter flows, into, and out of, and within systems helps one understand their system's behavior. **Structure and Function:** The way an object is shaped or structured determines many of its properties and functions. **Stability and Change:** For both designed and natural systems, conditions that affect stability and factors that control the rates of change are critical elements to consider and understand.	Unit 1: Contact Forces ● Why do things sometimes get damaged when they hit each other? Unit 2: Sound Waves ● How can a sound make something move? Unit 3: Forces at a Distance ● How can a magnet move another object without touching it? Unit 4: Earth in Space ● How are we connected to the patterns we seem in the sky and space? Unit 5: Genetics ● Why are living things different from one another?
3 Dimensional Standards	



Crosscutting Concepts Science Standards by Grade Level Band and Unit	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Cross Cutting Concepts- Grade Level Band						
Standard SCI.CC1 - Patterns Students recognize macroscopic patterns are related to the nature of microscopic and atomic level structure. They identify patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. They use patterns to identify cause and effect relationships and use graphs and charts to identify patterns in data.	x	x	x	x	x	x
Standard SCI.CC2 - Cause and Effect Students classify relationships as either causal or correlational, and recognize correlation does not necessarily imply causation. They use cause and effect relationships to predict phenomena in natural or designed systems. They also understand that phenomena may have more than one cause, and some cause-and-effect relationships in systems can only be explained using probability.	x	x	x	x	x	x
Standard SCI.CC3 - Scale, Proportion, and Quantity Students observe time, space, and energy phenomena at various scales using models to study systems that are too large or too small. They understand phenomena observed at one scale may not be observable at another scale, and the function of natural and designed systems may change with scale. They use proportional relationships (e.g., speed as the ratio of distance traveled to time taken) to gather information about the magnitude of properties and processes. They represent scientific relationships through the use of algebraic expressions and equations.		x	x	x	x	
Standard SCI.CC4 - Systems and System Models Students understand systems may interact with other systems: They may have sub-systems and be a part of larger complex systems. They use models to represent systems and their interactions- such as inputs, processes, and outputs,-- and energy, matter, and information flows within systems. They also learn that models are limited in that they only represent certain aspects of the system understudy.	x		x	x		
Standard SCI.CC5 - Energy and Matter	x	x	x			

Students understand matter is conserved because atoms are conserved in physical and chemical processes. They also understand that within a natural or designed system the transfer of energy drives the motion and cycling of matter. Energy may take different forms (e.g. energy in fields, thermal energy, and energy of motion". The transfer of energy can be tracked as energy flows through a designed or natural system.						
Standard SCI.CC6 - Structure and Function Students model complex and microscopic structures and systems and visualize how their function depends on the shapes, composition, and relationships among their parts. They analyze many complex natural and designed structures and systems to determine how they function. They design structures to serve particular functions by taking into account properties of different materials and how materials can be shaped and used.	x				x	x
Standard SCI.CC7 - Stability and Change Students explain stability and change in natural or designed systems by examining changes over time and considering forces at different scales, including the atomic scale. They understand changes in one part of a system might cause large changes in another part, systems in dynamic equilibrium are stable due to a balance of feedback mechanisms, and stability might be distributed by either sudden events or gradual changes that accumulate over time.	x					x

Science & Engineering Practices Science Standards by Grade Level Band and Unit	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Science and Engineering Practices						
Standard SCI.SEP1 - Asking Questions and Defining Problems Students ask questions to specify relationships between variables and clarify arguments and models. This includes the following: ● Ask questions that arise from careful observation of phenomena, models, or unexpected results to clarify or seek additional information. ● Ask questions to identify and clarify evidence and the premise(s) of an argument. ● Ask questions to determine relationships between independent and dependent variables and relationships in models. ● Ask questions to clarify or refine a model, an explanation, or an engineering problem. ● Ask questions that require sufficient and appropriate empirical evidence to answer. ● 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. ● Ask questions that challenge the premise(s) of an argument of a data set. ● Students can 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.	x		x		x	x
Standard SCI.SEP2 - Developing and Using Models Students develop, use, and revise models to describe, test, and predict more abstract phenomena and design systems. This includes the following: ● Evaluate limitations of a model for a proposed object or tool. ● Develop or modify a model - based on evidence - to match what happens if a variable or component of a system is changed. ● Use and develop a model of simple systems with uncertain and less predictable factors. ● Develop and/or revise a model to show the relationships among variables, including those that are not observable but predict observable phenomena. ● Develop and use a model to predict and describe phenomena. ● Develop a model to describe unobservable mechanisms. ● Develop and 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.	x	x	x	x	x	x
Standard SCI.SEP3 - Planning and Conducting Investigations Students plan and carry out investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models: This includes the following: ● Individually and collaboratively plan an investigation, identifying: independent and dependent variables and controls, tools needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. ● Conduct an investigation. Evaluate and revise the experimental design to produce data that serve as the basis for evidence to meet the goals of the investigation.	x		x	x	x	x

• Evaluate the accuracy of various methods for collecting data. • Collect data under a range of conditions that serve as the basis for evidence to answer scientific questions or test design solutions. • Collect data about the performance of a proposed object, tool, process, or system under a range of conditions.						
Standard SCI.SEP4 - Analyze and Interpret Data Students extend quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. This includes the following: • Construct, analyze, or interpret graphical displays of data and large data sets to identify linear and nonlinear relationships. • Use graphical displays (e.g., maps, charts, graphs, and tables) of large data sets to identify temporal and spatial relationships. • Distinguish between causal and correlational relationships in data. • Analyze and interpret data to provide evidence for explanations of phenomena. • Apply concepts of statistics and probability (including mean, median, mode, and variability) to analyze and characterize data, using digital tools when feasible. • Consider limitations of data analysis (e.g., measurement, error), and seek to improve precision and accuracy of data with better technological tools and methods (e.g., multiple trials). • 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.	x	x	x	x		x
Standard SCI.SEP5 - Mathematics and Computational Thinking Students identify patterns in large data sets and use mathematical concepts to support explanations and arguments. This includes the following: • Decide when to use qualitative and quantitative data. • Use digital tools (e.g., computers) to analyze very large data sets for patterns and trends. • Use mathematical representations to describe and support scientific conclusions and design solutions. • Create algorithms (a series of ordered steps) to solve a problem. • Apply mathematical concepts and processes (such as ratio, rate, percent, basic operations, and simple algebra) to scientific and engineering questions and problems. • Use digital tools and mathematical concepts and arguments to test and compare proposed solutions to an engineering design problem.		x	x		x	
Standard SCI.SEP6 - Construct Explanations and Design Solutions Students construct explanations supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. This includes the following: • Construct an explanation that includes qualitative or quantitative relationships between variables that predict and 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. Solutions should build on the following assumption: 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 evidence to construct, revise, or use an explanation for real-world phenomena, examples, or events. Students design solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. This includes the following: • Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process, or system. • Undertake a design project, engaging in the design cycle, to construct and implement a solution that meets specific design criteria and constraints. • Optimize performance of a design by prioritizing criteria, making trade-offs, testing, revising, and retesting.	x		x		x	x
Standard SCI.SEP7 - Engage in Arguments Students construct a convincing argument that supports or refutes claims for either explanations or solutions about the natural world. This includes the following: • Compare and critique two arguments on the same topic. Analyze whether they emphasize similar or different evidence and interpretations of facts. • 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 present oral and written arguments 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.	x	x				x

• Make an oral or written argument that supports or refutes the advertised performance of a device, process, or system. Based the argument on empirical evidence concerning whether or not the technology meets relevant criteria and constraints. • Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.						
Standard SCI.SEP8 - Obtain, evaluate, and Communication Information Students evaluate the validity and reliability of claims, methods, and designs. This includes the following: • Critically read scientific texts adapted for classroom use to determine the central ideas, to obtain scientific and technical information, and to describe patterns in and evidence about the natural and designed world(s). • Clarify claims and findings by integrating text-based qualitative and quantitative scientific information with information contained in media and visual displays. • Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication. Describe how they are supported or not supported by evidence and evaluate methods used. • Evaluate data, hypotheses, and conclusions in scientific and technical texts in light of competing information or accounts. • Communicate scientific and technical information (e.g., about a proposed object, tool process, or system) in writing and through oral presentations.				x	x	x

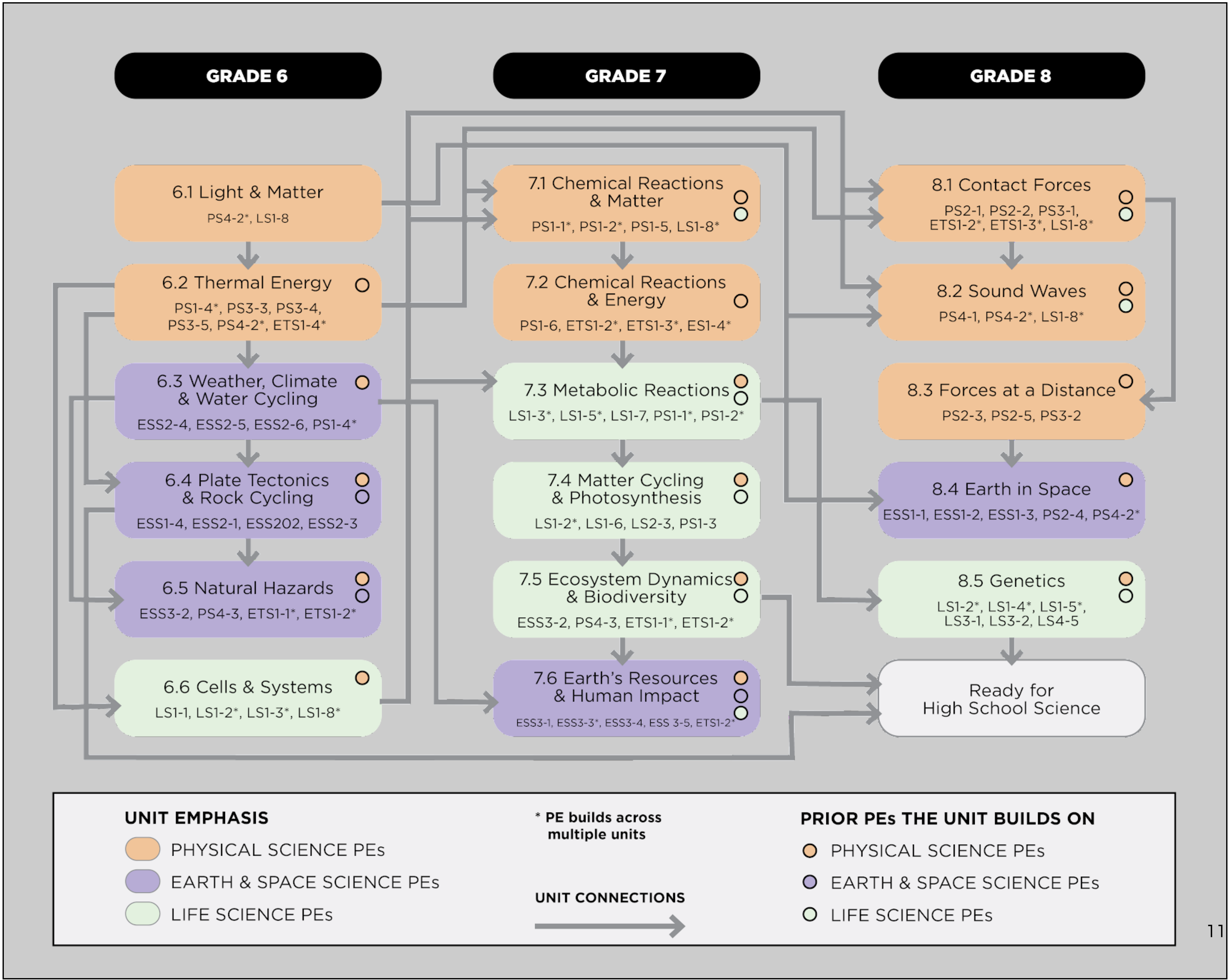
Disciplinary Core Ideas Science Standards by Grade Level Band and Unit		Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Disciplinary Core Ideas							
Life Science- Grade Band Level	***Essential Elements*** *These are alternate standards aligned with college, career, and community ready expectations for students with the most significant cognitive disabilities.*						
Standard SCI.LS1- STRUCTURES AND PROCESSES A. STRUCTURE & FUNCTION: All living things are made up of cells. In organisms, cells work together to form tissues and organs that are specialized for particular body functions. B. GROWTH AND DEVELOPMENT OF ORGANISMS: Reproduction is essential to every kind of organism. Organisms have unique and diverse life cycles. C. ORGANIZATION FOR MATTER AND FLOW IN ORGANISMS: Plants use the energy from light to make sugars through photosynthesis. Within individual organisms, food is broken down through a series of chemical reactions that rearrange molecules and release energy. D. INFORMATION PROCESSING: Each sense receptor responds to different inputs, transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain resulting in immediate behavior or memories.	EE.MS-LS1-3:Make a claim about how a structure (e.g., organs and organ systems) and its related function supports the survival of animals (circulatory, digestive, and respiratory systems). EE.MS-LS1-5: Interpret data to show that environmental resources (e.g., food, light, space, water) influence growth of organisms (e.g., drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, fish growing larger in large ponds than small ponds).	x	x			x	
Standard SCI.LS2- INTERACTIONS, ENERGY, AND DYNAMICS WITHIN ECOSYSTEMS A. INTERDEPENDENT RELATIONSHIPS IN ECOSYSTEMS: Organisms and populations are dependent on their environmental interactions both with other living things and with nonliving, any of which can limit their growth. Competitive, predatory, and mutually beneficial interactions vary across ecosystems but the patterns are shared. B. CYCLES OF MATTER AND ENERGY TRANSFER IN ECOSYSTEMS: The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. Food webs model how matter and energy are transferred among producers, consumers, and decomposers as the three groups interact within an ecosystem. C. ECOSYSTEM DYNAMICS, FUNCTIONING, AND RESILIENCE: Ecosystems characteristics vary over time. Disruptions to any part of an ecosystem can lead to shifts in all of its populations. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.	EE.MS-LS2-2: Use models of food chains/webs to identify producers and consumers in aquatic and terrestrial ecosystems.						

D. SOCIAL INTERACTIONS AND GROUP BEHAVIOR: Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on - for example, water purification and recycling.							
Standard SCI.LS3- HEREDITY A. INHERITANCE OF TRAITS: Genes chiefly regulate a specific protein, which affect an individual's traits. B. VARIATION OF TRAITS: In sexual reproduction, each parent contributes half of the genes acquired by the offspring resulting in variation between parent and offspring resulting in variation between parent and offspring. Genetic information can be altered because of mutations, which may result in beneficial, negative, or no change to proteins in or traits of an organism.	EE.MS-LS3-2: Make a claim supported by evidence that offspring inherit traits from their parents					x	
Standard SCI.LS4- BIOLOGICAL EVOLUTION A. EVIDENCE OF COMMON ANCESTRY AND DIVERSITY: The fossil record documents the existence, diversity, extinction, and change of many life forms and their environments through Earth's history. The fossil record and comparisons of anatomical similarities between organisms enables the inference of lines of evolutionary descent. B. NATURAL SELECTION: Both natural and artificial selection result from certain traits giving some individuals an advantage in surviving and reproducing, leading to predominance of certain traits in a population. C. ADAPTATION: Species can change over time in response to changes in environmental conditions through adaptation by natural selection action over generations. Traits that support successful survival and reproduction in the new environment become more common. D. BIODIVERSITY AND HUMANS: Changes in biodiversity can influence humans' resources and ecosystem services they rely on.						x	
Physical Science	***Essential Elements***						
Standard SCI.PS1- MATTER AND ITS INTERACTIONS A. STRUCTURE AND FUNCTION: The fact that matter is composed of atoms and molecules can be used to explain the properties of substances, diversity of materials, states of matter, phase changes, and conservation of matter. B. CHEMICAL REACTIONS: Reacting substances rearrange to form different molecules, but the number of atoms is conserved. Some reactions release energy and others absorb energy.	EE.MS-PS1-2: Interpret and analyze data on the properties (e.g., color, texture, odor, and state of matter) of substances before and after chemical changes have occurred (e.g., burning sugar or burning steel wool, rust, effervescent tablets).						
Standard SCI.PS2- FORCES, INTERACTIONS, MOTION, AND STABILITY A. FORCES AND MOTION: Motion and changes in motion can be qualitatively described using concepts of speed, velocity, and acceleration (including speeding up, slowing down, and/or changing direction). The role of the mass of an object must be qualitatively accounted for in any change of motion due to the application of a force (Newton's first and second law". For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). B. TYPES OF INTERACTIONS: Forces that act at a distance involve fields that can be mapped by their relative strength and effect on an object.	EE.MS-PS2-2: Investigate and predict the change in motion of objects based on the forces acting on those objects.	x		x	x		
Standard SCI.PS3- ENERGY A. DEFINITIONS OF ENERGY: Kinetic energy can be distinguished from the various forms of potential energy. B. CONSERVATION OF ENERGY AND ENERGY TRANSFER: Energy changes to and from each type can be tracked through physical or chemical interactions. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter.	EE.MS-PS3-3: Test and refine a device (e.g., foam cup, insulated box, or thermos) to either minimize or maximize thermal energy transfer (e.g., keeping liquids hot or cold, preventing liquids from freezing, keeping hands warm in cold temperatures).	x		x			

C. RELATIONSHIPS BETWEEN ENERGY AND FORCES: When two objects interact, each one exerts a force on the other, and these forces can transfer energy D. ENERGY IN CHEMICAL PROCESSES AND EVERYDAY LIFE: Sunlight captured by plants and used in a chemical reaction to produce sugar molecules for storing this energy. This stored energy can be released by respiration or combustion, which can be reversed by burning those molecules to release energy.							
Standard SCI.PS4- WAVES AND THEIR APPLICATIONS IN TECHNOLOGIES FOR INFORMATION TRANSFER **A.** WAVE PROPERTIES: A simple wave model has a repeating pattern with a specific wavelength, frequency, and amplitude, and mechanical waves need a medium through which they are transmitted. This model can explain many phenomena including sound and light. Waves can transmit energy. B. ELECTROMAGNETIC RADIATION: The construct of a wave is used to model how light interacts with objects. C. INFORMATION TECHNOLOGIES AND INSTRUMENTATION: Waves can be used to transmit digital information. Digitized information is comprised of a pattern of 1s and 0s.	EE.MS-PS4-2: Use a model to show how light waves (e.g., light through a water glass, light on colored objects) or sound waves are reflected, absorbed, or transmitted through various materials (e.g., water, air, table).		x		x		
Earth and Space Science	***Essential Elements***						
Standard SCI.ESS1- EARTH'S PLACE IN THE UNIVERSE A. THE UNIVERSE AND ITS STARS: The solar system is part of the Milky Way, which is one of many billions of galaxies. B. EARTH AND THE SOLAR SYSTEM: The solar system contains many varied objects held together by gravity. Solar system models explain and predict eclipses, lunar phases, and seasons. C. THE HISTORY OF PLANET EARTH: Rock strata and the fossil record can be used as evidence to organize the relative occurrence of major historical events in Earth's history..	EE.5-ESS1-2: Represent and interpret data on a picture, line, or bar graph to show seasonal patterns in the length of daylight hours. EE.MS-ESS1-1: Use an Earth-Sun-Moon model to show that Earth's orbit around the Sun corresponds to a calendar year and the orbit of the Moon around Earth corresponds to a month.				x		
Standard SCI.ESS2- EARTH'S SYSTEMS A. EARTH MATERIALS AND SYSTEMS: Energy flows and matter cycles within and among Earth's systems, including the sun and Earth's interior as primary energy sources. Plate tectonics is one result of these processes. B. PLATE TECTONICS AND LARGE-SCALE SYSTEM INTERACTIONS: Plate tectonics is the unifying theory that explains movements of rocks at Earth's surface and geological history. Maps are used to display evidence of plate movement. C. THE ROLES OF WATER IN EARTH'S SURFACE PROCESSES: Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features. D. WEATHER AND CLIMATE: Complex interactions determine local weather patterns and influence climate, including the role of the ocean. E. BIOGEOLOGY: The fossil record documents the existence, diversity, extinction, and change of many life forms throughout history.	EE.5-ESS2-1: Develop a model showing how water (hydrosphere) affects the living things (biosphere) found in a region. EE.MS-ESS2-1: Use a model to describe the change within the rock cycle between the igneous, metamorphic, and sedimentary rock. EE.MS-ESS2-2: Explain how geoscience processes that occur daily (e.g., wind, rain, runoff) slowly change the surface of Earth, while catastrophic events (e.g., earthquakes, tornadoes, floods) can quickly change the surface of Earth. EE.MS-ESS2-6: Interpret basic weather information (e.g., radar, map) to make predictions about future conditions (e.g., precipitation, temperature, wind).						
Standard SCI.ESS3- EARTH AND HUMAN ACTIVITY A. NATURAL RESOURCES: Humans depend on Earth's land, oceans, fresh water, atmosphere, and biosphere for different resources, many of which are limited or not renewable. Resources are distributed unevenly around the planet as a result of past geologic process B. NATURAL HAZARDS: Patterns can be seen through mapping the history of natural hazards in a region and understanding related geological forces.	EE.5-ESS3-1: Use information to describe how people can help protect the Earth's resources and how that affects the environment. EE.MS-ESS3-1: Interpret, based on evidence, how the geoscience processes (e.g., weathering, erosion) create resources.						

C. HUMAN IMPACTS ON EARTH SYSTEMS: Human activities have altered the hydrosphere, atmosphere, and lithosphere which in turn has altered the biosphere. Changes to the biosphere can have different impacts for different living things. Activities and technologies can be engineered to reduce people's impacts on Earth. D. GLOBAL CLIMATE CHANGE: Evidence suggests human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics..	EE.MS-ESS3-3: Develop a plan to monitor and minimize a human impact on the local environment (e.g., water, land, pollution).						
Engineering and Technical Science	***Essential Elements***						
Standard SCI.ETS1- ENGINEERING, TECHNOLOGY, AND THE APPLICATION OF SCIENCE **A.** DEFINING AND DELIMITING ENGINEERING PROBLEMS: The more precisely a design task's criteria and constraints can be defined, the 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. B. DEVELOPING POSSIBLE SOLUTIONS: A solution needs to be tested and then modified on the basis of 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. Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. Models of all kinds are important for testing solutions. C. Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process- That is, some of those characteristics may be incorporated into the new design. The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.		x					
Standard SCI.ETS2- ILINKS AMONG ENGINEERING, TECHNOLOGY, SCIENCE, AND SOCIETY **A.** INTERDEPENDENCE OF SCIENCE, ENGINEERING, AND TECHNOLOGY: 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 evaluation solutions with respect to how well they meet the criteria and constraints of a problem. B. INFLUENCE OF ENGINEERING, TECHNOLOGY, AND SCIENCE ON SOCIETY AND THE NATURAL WORLD: All human activity draws on natural resources and has both short- and long-term consequences, positive as well as negative, for the health of people and the natural environment. The uses of technologies are driven by people's needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources,and economic conditions.							
Standard: SCI.ETS3: NATURE OF SCIENCE AND ENGINEERING A. SCIENCE AND ENGINEERING ARE HUMAN ENDEAVORS: Individuals and teams from many nations, cultures, and backgrounds have contributed to advances in science and engineering. Scientists and engineers are persistent, use creativity, reasoning, and skepticism, and remain open to new ideas. B. SCIENCE AND ENGINEERING ARE UNIQUE WAYS OF THINKING WITH DIFFERENT PURPOSES: Science asks questions to understand the natural world and assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. Science carefully considers and evaluates anomalies in data and evidence. Engineering seeks solutions to human problems, including issues that arise due to human interaction with the environment. It uses some of the same practices as science and often applies scientific principles to solutions. Science and engineering have direct impacts on the quality of life for all people. Therefore, scientists and engineers need to pursue their work in an ethical manner that requires honesty, fairness, and dedication to public health, safety, and welfare.							

C. SCIENCE AND ENGINEERING USE MULTIPLE APPROACHES TO CREATE NEW KNOWLEDGE AND SOLVE PROBLEMS: A theory is an explanation of some aspect of the natural world. Scientists develop theories by using multiple approaches. Validity of these theories and explanations is increased through a peer review process that tests and evaluates the evidence supporting scientific claims. Theories are explanations for observable phenomena based on a body of evidence developed over time. A hypothesis is a statement that can be tested to evaluate a theory. Scientific laws describe cause and effect relationships among observable phenomena. Engineers develop solutions using multiple approaches and evaluate their solutions against criteria such as cost, safety, time, and performance. This evaluation often involves tradeoffs between constraints to find the optimal solution.							


GRADE 6
GRADE 7
GRADE 8
6.1 Light & Matter
PS4-2*, LS1-8
6.2 Thermal Energy
PS1-4*, PS3-3, PS3-4, PS3-5, PS4-2*, ETS1-4*
6.3 Weather, Climate & Water Cycling
ESS2-4, ESS2-5, ESS2-6, PS1-4*
6.4 Plate Tectonics & Rock Cycling
ESS1-4, ESS2-1, ESS202, ESS2-3
6.5 Natural Hazards
ESS3-2, PS4-3, ETS1-1*, ETS1-2*
6.6 Cells & Systems
LS1-1, LS1-2*, LS1-3*, LS1-8*
7.1 Chemical Reactions & Matter
PS1-1*, PS1-2*, PS1-5, LS1-8*
7.2 Chemical Reactions & Energy
PS1-6, ETS1-2*, ETS1-3*, ES1-4*
7.3 Metabolic Reactions
LS1-3*, LS1-5*, LS1-7, PS1-1*, PS1-2*
7.4 Matter Cycling & Photosynthesis
LS1-2*, LS1-6, LS2-3, PS1-3
7.5 Ecosystem Dynamics & Biodiversity
ESS3-2, PS4-3, ETS1-1*, ETS1-2*
7.6 Earth's Resources & Human Impact
ESS3-1, ESS3-3*, ESS3-4, ESS 3-5, ETS1-2*
8.1 Contact Forces
PS2-1, PS2-2, PS3-1, ETS1-2*, ETS1-3*, LS1-8*
8.2 Sound Waves
PS4-1, PS4-2*, LS1-8*
8.3 Forces at a Distance
PS2-3, PS2-5, PS3-2
8.4 Earth in Space
ESS1-1, ESS1-2, ESS1-3, PS2-4, PS4-2*
8.5 Genetics
LS1-2*, LS1-4*, LS1-5*, LS3-1, LS3-2, LS4-5
Ready for High School Science
UNIT EMPHASIS
PHYSICAL SCIENCE PEs
EARTH & SPACE SCIENCE PEs
LIFE SCIENCE PEs
* PE builds across multiple units
UNIT CONNECTIONS
PRIOR PEs THE UNIT BUILDS ON
PHYSICAL SCIENCE PEs
EARTH & SPACE SCIENCE PEs
LIFE SCIENCE PEs

UNIT 1: Contact Forces
In this unit, students develop observations about what happens to the motion and shape of objects. They develop the idea that all solid objects deform when forces are applied to them, behaving elastically up to a point and then incurring permanent damage beyond that point. Students conduct investigations ito how the contact forces between objects in a collision compare. They develop and use free-body diagrams to represent the changes in the relative strength of forces in a collision. Students also develop mathematical models to represent changes in the mass and speed of an object affecting the amount of kinetic energy the object has. They unite two different perspectives (energy and forces) to develop and use system models to support explanations for how contact forces, including friction and air resistance, cause energy to be transferred from one part of the system to another before, during, and after a collision. Students then design solutions to protect an object of their choice in a collision. They gather design input from stakeholders to refine the criteria and constraints for their design solution and they carry out investigations to determine which cushioning materials reduce peak forces the most in a collision. They develop models of how these cushioning materials function using the microscopic structures of these materials. They use these models to generate data about how space to deform increases contact time and decreases overall peak forces in a collision. They use what they figure out from these investigations to identify trade-offs, analyze and critique design solutions, and optimize a design solution to solve different design problems for different stakeholders and different contexts. They apply their new understandings to different sports-related contexts, in different transfer tasks over the course of the unit.

UNIT 1 DESIRED RESULTS		
ESSENTIAL QUESTION: *Students will keep considering…* ➔ Why do things sometimes get damaged when they hit each other?		
UNIT PRIORITY STANDARDS: *Students will know and be able to…*		
Cross Cutting Concepts	*Science & Engineering Practices (SEP)*	*Disciplinary Core Idea (DCI)*
➔ Systems and system models	➔ Planning and Carrying Out Investigations (priority)	➔ PS2.A
➔ Energy and matter	➔ Analyzing and Interpreting Data (Supporting)	➔ PS3.A
➔ Structure and function	➔ Constructing Explanations and Designing Solutions (Supporting)	➔ ETS1.B

➔ Stability and change	➔ Engaging in Argument from Evidence (Supporting)	➔ ETS1.C
		➔ LS1.D

3 DIMENSIONAL LEARNING TARGETS

- ➔ MS-PS2-1 I can apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- ➔ MS-PS-2-2 I can plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
- ➔ MS-PS3-1 I can 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.
- ➔ MS-ETS1-2 I can evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- ➔ MS-ETS1-3 I can analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

UNIT 1 ASSESSMENT EVIDENCE

Performance is evaluated in terms of... Students will show their learning by...

Performance Task Description:
Given an authentic scenario...

- ➔ ... evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- ➔ ...apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
    - ◆ Example: Explore various types of padding and explain how padding helps ensure that objects in collisions change motion using small forces over long distances (rather than large forces over short distances). Then students apply their understanding from the entire unit to their own design idea. These material properties are used to refine designs, and trade-offs of different material choices are examined. Students have to apply the ideas of structure and function while considering stakeholder feedback and trade-offs to optimize their designs.
- ➔ ...apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- ➔ ... evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- ➔ ... analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
    - ◆ Example: Students apply this knowledge to evaluate cheerleading helmets for safety, support or refute claims about the protective qualities of the device, explain the structural properties of protective materials and how they can contribute to a reduction of peak forces on the object they are protecting, and design a new device while considering the needs of stakeholders.

Success Criteria Rubrics

- ➔ Standards-aligned rubrics are used for communicating the success criteria, goal setting, reflecting during & after the unit learning, and feedback.
    - ◆ Planning and Conducting Investigations
    - ◆ Analyze and Interpret Data
    - ◆ Construct Explanations and Design Solutions

- Engage in Argument from Evidence

Key Feedback & Assessment Strategies:

- *Conferring/Strategy Groups: Use current evidence of standards & learning targets, feedback is scaffolded based on student strengths, needs, and goals.*
- *Assessment of Unit Skills- Examples for Targeted Data Collection*
  - *Driving Question Board to gather background knowledge and activate prior knowledge*
  - *Student evidence notebooks: focus notes, CER argument writing, model & model revisions*
  - *Checks for understanding (exit slips, quickwrites, etc.) aligned to unit guiding questions*
  - *Progress Tracker*
  - *Assess unit vocabulary terms*
  - *Evaluate student investigation tasks*
  - *Assess key unit concepts (Unit summative assessment)*
- *Extensions & AP Readiness may include:*
  - Lesson 3: Consider letting students investigate the deformation of a table and other rigid materials in small groups using the laser setup. If this option is utilized, consider all proper safety precautions when using glass with students, such as safety goggles, gloves for potential sharp edges, and proper distribution and cleanup procedures that minimize encounters with any potential broken glass or other materials. See the materials preparation section of this lesson for more guidance.
  - Lesson 3: Add in additional slow-motion videos in areas of student interest, such as a football making contact with the ground for classrooms that have several students engaged in football.
  - Lesson 4: Expand the investigation to allow multiple groups to test multiple conditions. This would involve an increased number of materials and increased class time.
  - Lesson 5: Allow students to spend more time at each investigation station. Ask students to test out each station with increased mass, increased speed, and with a variety of moving and non-moving carts.
  - Lesson 6: Ask students to also revisit the related phenomena. Ask students to pick a related phenomena and explain the outcomes of the related phenomena (damage, no damage) using our science ideas. At this point, students should be able to construct a partial explanation for their related phenomena.
  - Lesson 10: Ask students to once again revisit their related phenomena and attempt to explain the outcomes of the collisions. At this point, students should be able to explain the forces on each object and the energy transfer that occurs in the collision.
  - Lesson 12: Consider allowing students to test a complete CD case in addition to a section of CD case plastic. Allow students to explain why a CD case that has space for air between the cover and backing reduces peak force more than a section of plastic.
  - Lesson 16: Conduct the optional 16 iterative design process.
  - Lesson 16, option 2: Expand the iterative design process by involving those from the community to share their own personal protective design issues and allow students to develop a real-world solution to a problem within the community. Consider holding a design fair where the community can explore student's designs and offer feedback.

UNIT 2: Sound Waves

students develop ideas related to how sounds are produced, how they travel through media, and how they affect objects at a distance. Their investigations are motivated by trying to account for a perplexing anchoring phenomenon — a truck is playing loud music in a parking lot and the windows of a building across the parking lot visibly shake in response to the music. They make observations of sound sources to revisit the idea that objects vibrate when they make sounds. They figure out that patterns of differences in those vibrations are tied to differences in characteristics of the sounds being made. They gather data on how objects vibrate when making different sounds to characterize how a vibrating object's motion is tied to the loudness and pitch of the sounds they make. Students also conduct experiments to support the idea that sound needs matter to travel through, and they will use models and simulations to explain how sound travels through matter at the particle level.

UNIT 2 DESIRED RESULTS

ESSENTIAL QUESTION: *Students will keep considering…*

- ➔ How can a sound make something move?

UNIT PRIORITY STANDARDS: *Students will know and be able to…*

Cross Cutting Concepts	*Science & Engineering Practices (SEP)*	*Disciplinary Core Idea (DCI)*
➔ Patterns	➔ Developing & Using Models	➔ PS4.A
➔ Scale, Proportion & Quantity	➔ Using Mathematics & Computational Thinking	
	➔ Engaging in Argument from Evidence	

3 DIMENSIONAL LEARNING TARGETS

- ➔ MS-PS4-1. I can use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
- ➔ MS-PS4-2* I can develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
  *This performance expectation is developed across multiple units.
- ➔ MS-LS1-8. I can gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. (addressed in 6.1, 7.1, and 8.2)

UNIT 2 ASSESSMENT EVIDENCE

Performance is evaluated in terms of... Students will show their learning by...

Performance Task Description:

- Given an authentic scenario, students will develop a model to demonstrate their understanding of how the amplitude of a wave is related to the energy in a wave.
  - Example: Musicians experience hearing loss more often than non-musicians. Hearing loss is the result of repeated damage to the ears. The New Orleans Musicians' Clinic recommends reducing the loudness of sounds as much as possible to slow hearing loss. Using words and pictures, develop a model by completing circles **A-C** below to show how hitting a cymbal loudly would damage a musician's ears. Make sure your model shows how energy is transferred from the cymbal to the eardrum. Include a key, if needed, to explain what you draw.
  - Example: Students observe a video of a large speaker creating loud sounds that make a distant window move. Using words and pictures, develop a model to explain how the sound source creates the sound, how the sound travels through the air, and how the sound makes the window move.
- Students will construct an explanation to describe that waves are reflected, absorbed, or transmitted through various materials.
  - Example: The New Orleans Musicians' Clinic recommends avoiding listening to loud sounds for long periods of time to protect your ears. Why do soft sounds do less damage to your ears than loud sounds? Use your model and what you have learned about sound waves and energy to **write an explanation**. Some helpful words to include in your response are "air particles", "energy", "force", and "eardrum."
  - Example: The New Orleans Musicians' Clinic **did not** make any recommendations about low or high pitch sounds. Why are high pitch sounds less damaging to ears than louder sounds? Use your model and what you have learned about sound waves and energy to **write an explanation**. Some helpful words to include in your response are "transfer of energy", "eardrum", and "air particles."

Success Criteria Rubrics

- Standards-aligned rubrics are used for communicating the success criteria, goal setting, reflecting during & after the unit learning, and feedback.
  - Making Models
  - Using Mathematics and Computational Thinking
  - Engage in Argument from Evidence

Key Feedback & Assessment Strategies:

- *Conferring/Strategy Groups: Use current evidence of standards & learning targets, feedback is scaffolded based on student strengths, needs, and goals.*
- *Assessment of Unit Skills- Examples for Targeted Data Collection*
  - *Driving Question Board to gather background knowledge and activate prior knowledge*
  - *Student evidence notebooks: focus notes, CER argument writing, model & model revisions*
  - *Checks for understanding (exit slips, quickwrites, etc.) aligned to unit guiding questions*
  - *Progress Tracker*
  - *Assess unit vocabulary terms*
  - *Evaluate student investigation tasks*
  - *Assess key unit concepts (Unit summative assessment)*
- *Extensions & AP Readiness may include:*

- Lesson 6-We added two supplemental investigations in Lesson 6. In supplemental investigation 6A students can use a camera phone and wooden coffee stirrers to explore the relationship between how changing one variable (e.g. length of stick, thickness of sticks) affects the frequency of vibrations in the video to try to address this. It is currently designed as a differentiation option for students and teachers. Supplemental investigation 6B provides students with an opportunity to explore how our voices can make different kinds of sounds.
- Additionally, several readings are included that could extend the learning. Some readings, such as the Big Ben reading (Lesson 3) is at a slightly higher lexile and could be used independently for those students who are at a higher reading levels or in pairs or small groups for those needing more support. Similarly, in lesson 12, there are 2 additional readings. The second reading allows students to connect what they learned about the human ear to variations in the structure and range of hearing (function) in different animals (explaining a new phenomena) (Lexile 1200-1300). Finally, a third optional reading is included to provide a differentiation option about how humpback whales hear and produce sound (Lexile 1000-1100).
- All lessons: Remove scaffolds provided with Science and Engineering Practices as a way to give students more independent work with the elements of these practices.

UNIT 3: Forces at a Distance

T In the previous unit, students developed a model of sound. This unit allows students to investigate the cause of a speaker's vibration in addition to the effect. Students dissect speakers to explore the inner workings, and engineer homemade cup speakers to manipulate the parts of the speaker. They identify that most speakers have the same parts–a magnet, a coil of wire, and a membrane. Students investigate each of these parts to figure out how they work together in the speaker system. Along the way, students manipulate the components (e.g. changing the strength of the magnet, number of coils, direction of current) to see how this technology can be modified and applied to a variety of contexts, like MagLev trains, junkyard magnets, and electric motors.

UNIT 3 DESIRED RESULTS

ESSENTIAL QUESTION: *Students will keep considering...*

➔ How can a magnet move another object without touching it?

UNIT PRIORITY STANDARDS: *Students will know and be able to...*

Cross Cutting Concepts	*Science & Engineering Practices (SEP)*	*Disciplinary Core Idea (DCI)*
➔ Cause and Effect	➔ Asking Questions and Defining Problems	➔ PS2.B
➔ Systems & System Models	➔ Developing and Using Models	➔ PS3.A
	➔ Planning and Carrying Out Investigations	

3 DIMENSIONAL LEARNING TARGETS

➔ MS-PS2-3: Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
➔ MS-PS2-5: Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact [Cause and Effect].
➔ MS-PS3-2: Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
➔ MS-PS2-2*: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object [Cause and Effect].
➔ MS-PS3-1*: Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object [Cause and Effect].
➔ MS-PS3-5*: Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object [Cause and Effect].

*These performance expectations are developed across multiple units.

UNIT 3 ASSESSMENT EVIDENCE

Performance is evaluated in terms of… Students will show their learning by…

Performance Task Description:

Given an authentic scenario, students will…

- …provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
  - Example: Students write a claim for the following scenarios: - If a system contains a permanent magnet and we bring a paperclip near the system, we will feel a pull. -If a system does not contain a permanent magnet and we bring a paperclip near the system, we will not feel a pull, indicating that there are no forces on the paperclip. -Connecting a copper coil to a magnet creates an electromagnet creating an attractive magnet field that creates force pairs with metal objects
- …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.
- …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
  - Students make sense of an application of an electromagnet of their choice. This assessment elicits student ideas about forces at a distance as they design an experiment, using the cause-effect language they have been practicing throughout this unit.

Success Criteria Rubrics

- Standards-aligned rubrics are used for communicating the success criteria, goal setting, reflecting during & after the unit learning, and feedback.

- Asking Questions/Defining Problems
- Making Models
- Planning and Conducting Investigations

Key Feedback & Assessment Strategies:

- *Conferring/Strategy Groups: Use current evidence of standards & learning targets, feedback is scaffolded based on student strengths, needs, and goals.*
- *Assessment of Unit Skills- Examples for Targeted Data Collection*
  - *Driving Question Board to gather background knowledge and activate prior knowledge*
  - *Student evidence notebooks: focus notes, CER argument writing, model & model revisions*
  - *Checks for understanding (exit slips, quickwrites, etc.) aligned to unit guiding questions*
  - *Progress Tracker*
  - *Assess unit vocabulary terms*
  - *Evaluate student investigation tasks*
  - *Assess key unit concepts (Unit summative assessment)*
- *Extensions & AP Readiness may include:*
  - Lesson 2: Draw on students' experiences with magnets to help them see why this content is relevant to them. Consider asking students to each bring in a magnet from their own refrigerator or locker to test in this investigation. Would one of those magnets also make the speaker work? If there is time, try it. If students bring in magnets, give some space for them to share the magnet with the class and where it came from. Is it from a family trip? Is it sent from a relative who lives elsewhere? Is it an advertisement from a local company? Is it a picture of a loved one? Use these examples to highlight how common magnets are in our lives across a variety of contexts, even when we don't notice them.
  - Lessons 8-12: These lessons include guidance on how to provide a coherent enrichment experience for students who are interested in learning more about electricity or who have met and exceeded the performance expectations. These might also be helpful if your state has standards in addition to those laid out in the NGSS related to electricity and circuits. Look for guidance with heading "Electricity extension opportunity" to find optional enrichment support over the next four lessons. There may also be optional handouts associated with this enrichment. For more details on these opportunities, see the reference document titled Electricity extension opportunity.
  - All lessons: Remove scaffolds provided with Science and Engineering Practices as a way to give students more independent work with the elements of these practices.

UNIT 4: Earth in Space

In this unit, students begin observing the repeating biannual pattern of the Sun setting perfectly aligned between buildings in New York City along particular streets and then try to explain additional patterns in the sky that they and others have observed. Students draw on their own experiences and the stories of family or community members to brainstorm a list of patterns in the sky. students develop models for the Earth-Sun and Earth-Sun-Moon systems that explain some of the patterns in the sky that they have identified, including seasons, eclipses, and lunar phases. Students investigate a series of related phenomena motivated by their questions and ideas for investigations. Students explore the planets and other objects farther out in space.

UNIT 4 DESIRED RESULTS

ESSENTIAL QUESTION: *Students will keep considering...*

➔ How are we connected to the patterns we seem in the sky and space?

UNIT PRIORITY STANDARDS: *Students will know and be able to...*

Cross Cutting Concepts	*Science & Engineering Practices (SEP)*	*Disciplinary Core Idea (DCI)*
➔ Patterns	➔ Developing and Using Models	➔ ESS1.A
➔ Scale, Proportion, and Quantity	➔ Analyzing and Interpreting Data	➔ ESS1.B
➔ System and System Models	➔ Obtaining, Evaluating, and Communicating Information	➔ PS2.B
		➔ PS4.B

3 DIMENSIONAL LEARNING TARGETS

➔ MS-ESS1-1: I can 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.

➔ MS-ESS1-2: I can develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

➔ MS-PS2-4: I can construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

➔ MS-ESS1-3: I can analyze and interpret data to determine scale properties of objects in the solar system.

➔ MS-PS4-2*: I can develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
*This performance expectation is developed across multiple units.

UNIT 4 ASSESSMENT EVIDENCE

Performance is evaluated in terms of... Students will show their learning by...

Performance Task Description:

Given an authentic scenario, students will...

- ...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.
  - Example: students to use seasonal temperature variation data and a model to explain what causes the varied temperatures (effect in different seasons in Australia like we heard about in the podcasts. Students also explain seasons and temperature variation by comparing the Northern and Southern Hemispheres.
- develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
  - Example: Students demonstrate their understanding of how light travels through different mediums to explain why a certain color of a fishing lure would be a better choice for fishing than other colors that are less visible underwater at the depths where fish live. Students apply science ideas to explain why some colors are more visible than others underwater and how an object can appear in a different location than they actually are underwater.
- ...develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
- ...analyze and interpret data to determine scale properties of objects in the solar system.
  - Example: Students apply ideas about factors that influence gravity forces to shape the universe and develop explanations for why so much of the universe is composed of empty space. They build a model of the universe showing nested subsystems of galaxies, solar systems within galaxies, and planet-moon systems within solar systems.

Success Criteria Rubrics

- Standards-aligned rubrics are used for communicating the success criteria, goal setting, reflecting during & after the unit learning, and feedback.
  - Making Models
  - Analyze and Interpret Data
  - Obtain, Evaluate, and Communicate Information

Key Feedback & Assessment Strategies:

- *Conferring/Strategy Groups: Use current evidence of standards & learning targets, feedback is scaffolded based on student strengths, needs, and goals.*
- *Assessment of Unit Skills- Examples for Targeted Data Collection*
  - *Driving Question Board to gather background knowledge and activate prior knowledge*
  - *Student evidence notebooks: focus notes, CER argument writing, model & model revisions*
  - *Checks for understanding (exit slips, quickwrites, etc.) aligned to unit guiding questions*
  - *Progress Tracker*
  - *Assess unit vocabulary terms*
  - *Evaluate student investigation tasks*
  - *Assess key unit concepts (Unit summative assessment)*
- *Extensions & AP Readiness may include:*
  - Many lessons: Within many lessons are extension readings, videos, simulations, or activities offered as alternates or home learning. If you find that students are highly engaged or looking for a challenge, offer these readings as either in-class or home learning

extensions.

- All lessons: Remove scaffolds provided with Science and Engineering Practices as a way to give students more independent work with the elements of these practices.

UNIT 5: Genetics

In this unit, students explore the anchoring phenomenon of why living things are different from one another. Students will explore various familiar species, including cattle with extra-big muscles! Students will predict what causes the differences among individuals, ask questions and share ideas for investigations around why there are differences among living things and specifically around the causes of extra-big muscles on certain cattle.

UNIT 5 DESIRED RESULTS

ESSENTIAL QUESTION: *Students will keep considering…*

- ➔ Why are living things different from one another?

UNIT PRIORITY STANDARDS: *Students will know and be able to…*

Cross Cutting Concepts	*Science & Engineering Practices (SEP)*	*Disciplinary Core Idea (DCI)*
➔ Cause and Effect	➔ Obtaining, Evaluating, and Communicating Information	➔ LS1.B
➔ Structure and Function	➔ Using Mathematics and Computational Thinking	➔ LS1.B
	➔ Developing and Using Models	➔ LS3.A
		➔ LS4.B
		➔ LS1.B
		➔ LS1.A

3 DIMENSIONAL LEARNING TARGETS

- ➔ MS-LS1-2: I can develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.
- ➔ MS-LS1-4: I can use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
- ➔ MS-LS1-5: I can construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
- ➔ MS-LS3-1: I can develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

- ➔ MS-LS3-2: I can develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- ➔ MS-LS4-5: I can gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

UNIT 5 ASSESSMENT EVIDENCE

Performance is evaluated in terms of... Students will show their learning by...

Performance Task Description:
Given an authentic scenario, students will...

- ➔ develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
- ➔ develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- ➔ gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.
  - ◆ Example: Students use a checklist to critically read and evaluate a research study adapted for classroom use to determine how the brown, speckled, and transparent trait variations of goldfish scales are inherited. They use this information to develop models explaining the inheritance patterns of this trait variation and to give a recommendation for selective breeding of the speckled phenotype. They also apply mathematical concepts of probability and use basic operations to calculate the chances of various goldfish phenotypes resulting from certain matings.
- ➔ ...construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
  - ◆ In the context of redwood tree heights, students construct an explanation about how environmental and genetic factors influence the growth of organisms and how organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.
- ➔ Standards-aligned rubrics are used for communicating the success criteria, goal setting, reflecting during & after the unit learning, and feedback.
  - ◆ Obtain, Evaluate, and Communicate Information
  - ◆ Using Mathematics and Computational Thinking
  - ◆ Making Models

Key Feedback & Assessment Strategies:

- ➔ *Conferring/Strategy Groups: Use current evidence of standards & learning targets, feedback is scaffolded based on student strengths, needs, and goals.*
- ➔ *Assessment of Unit Skills- Examples for Targeted Data Collection*
  - ◆ *Driving Question Board to gather background knowledge and activate prior knowledge*
  - ◆ *Student evidence notebooks: focus notes, CER argument writing, model & model revisions*
  - ◆ *Checks for understanding (exit slips, quickwrites, etc.) aligned to unit guiding questions*
  - ◆ *Progress Tracker*
  - ◆ *Assess unit vocabulary terms*
  - ◆ *Evaluate student investigation tasks*
  - ◆ *Assess key unit concepts (Unit summative assessment)*

- *Extensions & AP Readiness may include but are not limited:*

To extend or enhance the unit, consider the following:

- *Students spend more time researching details about organisms that reproduce asexually and/or students could communicate the information they've learned in a different format than the suggested slide or to a different audience than just their peers.*
- *Students explore the Arm Span Data Set and online data tool by themselves before discussing it as a class.*
- *Students return to the specific examples of trait variations and apply the model they've developed in this unit to explain those. As additional practice with "obtaining, evaluating, and communicating information", students could do additional research to find details about those trait variations, such as the function of specific protein(s), the number of genes, and/or the specific environmental factors that influence that trait variation.*

Capstone Unit: Science & Engineering Challenge

In this mini capstone unit, students have the opportunity to transfer their 3 dimensional learning from the year to a Science & Engineering Challenge. The challenge may be determined as a grade level, class, or individual, and includes an authentic audience component. Examples may include but are not limited to: Science Fair, Rube Goldberg, a hands-on career connected problem/project, etc.

Capstone DESIRED RESULTS

ESSENTIAL QUESTION: *Students will keep considering...*

- ➔ *How do Science cutting concepts and Science & Engineering Practices help explain everyday phenomena about Science Disciplinary Core Ideas ?*

UNIT PRIORITY STANDARDS: *Students will know and be able to...*

Cross Cutting Concepts	*Science & Engineering Practices (SEP)*	*Disciplinary Core Idea (DCI)*
➔ All	➔ All	➔ Dependent on challenge

Capstone ASSESSMENT EVIDENCE

Performance is evaluated in terms of... Students will show their learning by...

Performance Task Description:

- ➔ Students will demonstrate their 3 Dimensional learning in multiple ways to an authentic audience which may include creation of design or solution, an oral presentation or defense, portfolio, real world performance task, etc.

Success Criteria Rubrics

- ➔ Standards-aligned rubrics are used for communicating the success criteria, goal setting, reflecting during & after the unit learning, and feedback.

Key Feedback & Assessment Strategies:

- ➔ *Conferring/Strategy Groups: Use current evidence of standards & learning targets, feedback is scaffolded based on student strengths, needs, and goals.*
- ➔ *Reflection on Science & Engineering Practices, Crosscutting Concepts, Disciplinary Core Ideas, teamwork/collaboration skills, process, and product management skills.*