Science
Graduation Proficiencies
(Performance Indicators/Scoring Criteria)

Proficiency-Based Graduation Requirements (PBGRs) are the locally-delineated set of content knowledge and skills connected to state standards that, when supplemented with any additional locally-developed requirements, have been determined to qualify a student for earning a high school diploma. Vermont's Education Quality Standards (EQS) require that schools' graduation requirements be rooted in demonstrations of student proficiency, as opposed to time spent in classrooms. This requirement will take effect in Vermont beginning with the graduating class of 2020.

#1 - Earth & Space Sciences: Student understands and analyzes Earth's systems and the origins, interactions and relationships between and among the Earth, our solar system and the universe.				
Elementary K-2				
Performance Indicators: a. Students (I) can use evidence and scientific reasoning to raise questions and make explanations about the world. b. Students (I) can make explanations that are supported by student-generated sources of evidence consistent with scientific ideas principles, and theories. c. Students (I) can record data in an investigation				
Kindergarten Scoring Criteria- Proficiency 1				
Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*
a. Students (I) can use evidence and scientific reasoning to raise questions and make explanations about the world.	Students (I) can use provided materials like pictures to make simple explanations about the world.	Students (I) can use scientific reasoning to make simple explanations about the world.	Students (I) can use evidence and scientific reasoning to raise questions and make explanations about the world.	Students (I) can engage in argument using evidence and scientific reasoning to defend and critique claims and explanations about the world.
b. Students (I) can make explanations that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.	With support and modelling, students (I) can make explanations that are supported by some scientific evidence	Students (I) can make explanations that are supported by some scientific evidence	Students (I) can make explanations that are supported by student-generated sources of evidence consistent with scientific ideas principles, and theories.	Students (I) can make explanations that are supported by multiple student-generated sources of evidence consistent with scientific ideas principles, and theories.
c.Students (I) can record data in an investigation	Students (I) know what data is	With support, students (I) can explain how to gather data	Students (I) can record data in an investigation	Students (I) can record data in an investigation and make conclusions using that data

#1 - Earth & Space Sciences: Student understands and analyzes Earth's systems and the origins, interactions and relationships between and among the Earth, our solar system and the universe.

Elementary 3-5

Performance Indicators:
a. Students (I) can engage in argument using evidence and scientific reasoning to defend claims and explanations about the world.
b. Students (I) can construct explanations and designs that are supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.
c. Students (I) can conduct an investigation or test a design individually and collaboratively to produce data to serve as the basis for models, or testing solutions to problems.
d. Students (I) can understand that evidence is required to make claims pertaining to specific cause and effect relationships, to explain or predict behaviors in complex systems.

Grade 3-5 Scoring Criteria- Proficiency 1

Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*
a. Students (I) can engage in argument using evidence and scientific reasoning to defend claims and explanations about the world.	With support and modeling, students (I) can use evidence and scientific reasoning to provide explanations about the world.	Students (I) can use evidence and scientific reasoning to provide explanations about the world.	Students (I) can engage in argument using evidence and scientific reasoning to defend claims and explanations about the world.	Students (I) can engage in persuasive argument using evidence and scientific reasoning to defend claims and explanations about the world.
b. Students (I) can construct explanations and designs that are supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.	With support, students (I) can construct simple explanations that are supported by a source of evidence consistent with scientific ideas.	Students (I) can construct explanations or designs that are supported by one or more sources of evidence consistent with scientific ideas, principles, and theories.	Students (I) can construct explanations and designs that are supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.	Students (I) can construct complex explanations and designs that are supported by multiple sources of synthesized evidence consistent with scientific ideas, principles, and theories.
c. Students (I) can conduct an investigation	With scaffolding and support, students (I) can	With support, students (I) can conduct an	Students (I) can conduct an	Students (I) can plan and conduct an investigation or

or test a design individually and collaboratively to produce data to serve as the basis for models, or testing solutions to problems.	help conduct an investigation or test a design collaboratively to record data.	investigation or test a design collaboratively to produce data to serve as the basis for models, or testing solutions to problems.	investigation or test a design individually and collaboratively to produce data to serve as the basis for models, or testing solutions to problems.	test a design individually and collaboratively to produce data to serve as the basis for complex models, or testing new solutions to problems.
d. Students (I) can understand that evidence is required to make claims pertaining to specific cause and effect relationships, to explain or predict behaviors in complex systems.	Students (I) understand the term evidence.	Students (I) can understand that evidence is required when making claims.	Students (I) can understand that evidence is required to make claims pertaining to specific cause and effect relationships, to explain or predict behaviors in complex systems.	Students (I) can understand that evidence is required to make claims pertaining to specific cause and effect relationships, to explain or predict behaviors in complex systems AND apply my own evidence to scientific problems.

#1 - Earth & Space Sciences: Student understands and analyzes Earth's systems and the origins, interactions and relationships between and among the Earth, our solar system and the universe.

Middle School 6-8

Performance Indicators:

a. 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-ESS1-1)
b. Analyze and interpret to determine the scale properties of objects in the solar system. (MS-ESS1-3)
c. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. (MS-ESS2-1)
d. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. (MS-ESS2-2)
e. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. (MS-ESS2-3)
f. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

(MS-ESS2-5)

g. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes (MS-ESS3-1)
h. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. (MS-ESS3-2)
i. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. (MS-ESS3-3)
j. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. (MS-ESS3-5)

Grade 6-8 Scoring Criteria-Proficiency 1

Performance Indicator	*Beginning*	*Approaching*	*Proficiency*	*Exemplary*
a. 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-ESS1-1)	Students (I) can identify the many parts of the Sun, Earth and moon cycles.	Students (I) can demonstrate how the Earth, Moon and Sun interact with a simple model.	Students (I) can demonstrate how the sun, Earth and moon interact in predictable patterns creating: the phases of the moon, eclipses and seasons.	Students (I) can extend what I know about Earth's cycles and apply to areas outside the Sun, Moon and Earth, and/or other phenomenon other than seasons, moon phases, tides and eclipses.
b. Analyze and interpret data to determine scale properties of objects in the solar system. (MS-ESS1-3)	Students (I) can simply explain the relative distance between the planets in our solar system and their respective sizes.	Students (I) can begin to create a scale to understand the significant size and distances in our solar system	Students (I) can use a scale to more accurately understand the true size and distances between different solar system objects.	Students (I) can use what I learned about scale and size and apply it to areas outside of the classroom and/or our solar system.
c. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. (MS-ESS2-1)	Students (I) can identify the 3 types of rocks.	Students (I) can identify the 3 types of rocks and begin to demonstrate the rock cycle with a simple model.	Students (I) can create a model that clearly demonstrates the rock cycle and explain the forces that drive this cycle.	Students (I) can apply the forces that drive the rock cycle to other phenomenon.

d. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. (MS-ESS2-2)	Students (I) can recall the definition of geological time scale, and argue that Earth has and will change over time.	Students (I) can use evidence to support my explanation of how forces change the surface of the Earth.	Students (I) can differentiate between forces that act quickly and forces that act slowly resulting in a change of Earth's surface over time. I can explain how Vermont's Green Mountains were formed.	Students (I) can evaluate and communicate the impact of forces that act quickly and slowly resulting in a change of the Earth's surface over time.
e. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.(MS-ESS2-3)	Students (I) can recall who Alfred Wegener was, and restate the theory of continental drift.	Students (I) can begin the use evidence from fossils, rocks and continental shape to support Wegener's theory.	Students (I) can present an argument supporting Alfred Wegener's theory of Continental Drift using evidence from fossils, rocks, continental shape and seafloor structures.	Students (I) can apply the theory of continental drift to other phenomena on/in Earth.
f. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. (MS-ESS2-5)	Students (I) can collect data to serve as the basis for motions and air masses.	Students (I) can collect data to serve as the basis for motions and complex interactions of air masses.	Students (I) can collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.	Students (I) can plan an investigation or test a design individually and/or collaboratively to produce data to serve as the basis for evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
g. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to	Students (I) can identify natural hazards and the effect they have on our planet and humanity.	Students (I) can begin to formulate ideas to assist in the prediction and management of natural disasters.	Students (I) can use data on natural hazards to determine the likelihood of future catastrophic events and describe and model the efforts of engineers to reduce the impact of natural hazards	Students (I) can raise awareness outside the classroom, and/or further develop new ideas to assist in the prevention of mass destruction due to natural disasters.

mitigate their effects. (ESS3-2)				
h. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes (MS-ESS3-1)	Students (I) can communicate simple scientific ideas about the uneven distributions of Earth's mineral, energy, and groundwater.	Students (I) can communicate ideas about how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.	Students (I) can construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.	Students (I) can construct, and evaluate, a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
i. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. (ESS3-3)	Students (I) can understand and identify the positive and negative effects humans have on the environment.	Students (I) can begin to formulate ideas that may monitor and reduce human impact on the environment.	Students (I) can design a way to monitor and reduce human impact on the environment	Students (I) can apply what I learned in class to a real-world scenario outside the classroom.
j. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. (ESS3-4)	Students (I) can begin to formulate an argument that illustrates my understanding of climate change and its widespread effects on our planet.	Students (I) can use evidence and research to support my argument.	Students (I) can write a persuasive letter to a congressional representative that clearly explains the importance of sustainable practices	Students (I) can take action and work outside the classroom to educate and raise awareness around my community.

#1 - Earth & Space Sciences: Student understands and analyzes Earth's systems and the origins, interactions and relationships between and among the Earth, our solar system and the universe.

High School 9-12

Performance Indicators:

a. Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. (HS-ESS1-2)
b. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of the Solar System and Earth's formation and early history and be able to use mathematical models to represent the motion, both past and present, of planets within the solar system (ESS1-6; HS-ESS1-4)
c. Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks and the process of mantle convection. (HS-ESS1-5)
d. Communicate scientific ideas about the way that stars, both sunlike and non-sunlike, produce elements through the process of nuclear fusion and specifically explain the relationship between nuclear fusion and gravity in this process. (HS-ESS1-1; HS-ESS1-3)
e. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. (HS-ESS3-1)
f. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. (HS-ETS1-3)

9-12 Scoring Criteria- Proficiency 1

Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*
a. Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. (HS-ESS1-2)	Students (I) can construct a simple explanation of the Big Bang theory.	Students (I) can construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.	Students (I) can construct an explanation supported by multiple sources of evidence consistent with the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.	Students (I) can construct complex explanations of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe supported by multiple sources of synthesized evidence.
b. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary	Students (I) can construct an account of the Solar System and Earth's formation using simple models to represent planets within the solar system.	Students (I) can apply evidence from ancient Earth materials to describe the Solar System and Earth's formation and use mathematical models to	Students (I) can apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of the	Students (I) can construct complex explanations of the Solar System and Earth's formation using early history and mathematical models to represent the motion, both

surfaces to construct an account of the Solar System and Earth's formation and early history and be able to use mathematical models to represent the motion, both past and present, of planets within the solar system (ESS1-6; HS-ESS1-4)		represent the motion, both past and present, of planets within the solar system.	Solar System and Earth's formation and early history and be able to use mathematical models to represent the motion, both past and present, of planets within the solar system	past and present, of planets within the solar system applying scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces.
c. Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks and the process of mantle convection. (HS-ESS1-5)	Students (I) can identify the impact of the past and current movements of continental and oceanic crust.	Students (I) can summarize the impact of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks and the process of mantle convection.	Students (I) can evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks and the process of mantle convection.	Students (I) can evaluate the impact of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks and the process of mantle convection concepts to changes both at the micro or macro scale.
d. Communicate scientific ideas about the way that stars, both sunlike and non-sunlike, produce elements through the process of nuclear fusion and specifically explain the relationship between nuclear fusion and gravity in this process. (HS-ESS1-1; HS-ESS1-3)	Students (I) can communicate simple scientific ideas about the way that stars, both sunlike and non-sunlike, produce elements through the process of nuclear fusion.	Students (I) can communicate, and explain, scientific ideas about the way that stars, both sunlike and non-sunlike, produce elements through the process of nuclear fusion and specifically explain the relationship between nuclear fusion and gravity in this process.	Students (I) can communicate an explanation supported by multiple sources of evidence consistent with the scientific ideas about the way that stars, both sunlike and non-sunlike, produce elements through the process of nuclear fusion and specifically explain the relationship between nuclear fusion and gravity in this process.	Students (I) can communicate complex explanations of scientific ideas about the way that stars, both sunlike and non-sunlike, produce elements through the process of nuclear fusion and specifically explain the relationship between nuclear fusion and gravity in this process.

e. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. (HS-ESS3-1)	Students (I) can construct a simple explanation based on evidence for how the availability of natural resources have influenced human activity.	Students (I) can construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.	Students (I) can construct an explanation supported by multiple sources of evidence consistent with how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.	Students (I) can construct complex explanations supported by multiple sources of evidence consistent with how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
f. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. (HS-ETS1-3)	Student evaluates a solution to a complex real-world problem.	Student evaluates a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.	Student evaluates a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. Students assign priorities for each criterion and constraint that allows for a logical and systematic evaluation of alternative solution.	Students generate a list of three or more realistic criteria and two or more constraints, including such relevant factors as cost, safety, reliability, and aesthetics that specifies an acceptable solution to a complex real-world problem. Students assign priorities for each criterion and constraint that allows for a logical and systematic evaluation of alternative solution proposals, analyzing the strengths and weaknesses of the solution with respect to each criterion and constraint, as well as social and cultural acceptability, describing possible barriers to implementing each solution.

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#2 - Life Science: Student understands and analyzes concepts of genetics, evolution, biodiversity, ecosystems, and molecular, structural, & cellular biology.
Elementary K-2
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Performance Indicators: a. Students (I) can use math to find patterns in the natural world b. Students (I) can evaluate the impact of new data on an explanation or model of a process or system. c. Students (I) can observe patterns in systems and cite patterns as evidence for supporting their explanations.				
Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*
a. Students (I) can use math to find patterns in the natural world	Students (I) explain a pattern connected with the natural world	Students (I) can find patterns in the natural world	Students (I) can use math to find patterns in the natural world	Students (I) can use math to find and predict future patterns in the natural world
b. Students (I) can evaluate the impact of new data on an explanation or model of a process or system.	With support, students (I) can explain how data is used to explain scientific models or processes	Students (I) can make guesses (hypothesize) about how new data will effect a model of a process or system.	Students (I) can evaluate the impact of new data on an explanation or model of a process or system.	Students (I) can evaluate the impact of new data on an explanation or model of a process or system and predict future events
c. Students (I) can observe patterns in systems and cite patterns as evidence for supporting their explanations.	Students (I) can find evidence of a pattern in nature	Students (I) can observe and discuss patterns in systems	Students (I) can observe patterns in systems and cite patterns as evidence for supporting their explanations.	Students (I) can observe patterns in systems and cite patterns as evidence for supporting their explanations and hypotheses.

#2 - Life Science: Student understands and analyzes concepts of genetics, evolution, biodiversity, ecosystems, and molecular, structural, & cellular biology.
Elementary 3-5
Performance Indicators: a. Students (I) can use mathematical thinking and measurement using tools and/or models in order to make valid scientific statements.. b. Students (I) can use data analysis to interpret data. c. Students (I) can evaluate the impact of new data on an explanation or model of a process or system.

d. Students (I) can observe patterns in systems and cite patterns as evidence for supporting their explanations.				
Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*
a. Students (I) can use mathematical thinking and measurement using tools and/or models in order to make valid scientific statements.	With support, students (I) can use measurement tools to answer simple scientific questions.	Students (I) can use mathematical thinking and measurement to answer science-based questions..	Students (I) can use mathematical thinking and measurement using tools and/or models in order to make valid scientific statements.	Students (I) can use mathematical thinking and measurement using multiple tools and/or models in order to make valid and multi-faceted scientific statements.
b. Students (I) can use data analysis to interpret data.	With support, students (I) can interpret simple data (ex: pictograph)	Students (I) can use data analysis to interpret simple data.	Students (I) can use data analysis to interpret data.	Students (I) can use data analysis to interpret complex or multiple sources of data.
c. Students (I) can evaluate the impact of new data on an explanation or model of a process or system.	With support, students (I) can explain how new data could affect an idea	With support, students (I) can evaluate the impact of new data on an explanation or model of a process or system.	Students (I) can evaluate the impact of new data on an explanation or model of a process or system.	Students (I) can evaluate the impact of new data on an explanation or model of a process or system and use this new information to form new hypotheses.
d. Students (I) can observe patterns in systems and cite patterns as evidence for supporting their explanations.	Students (I) can define a pattern	Students (I) can observe a pattern in systems	Students (I) can observe patterns in systems and cite patterns as evidence for supporting their explanations.	Students (I) can observe a pattern in systems and cite patterns as evidence for supporting their explanations and proof of their conclusions in scientific inquiry

#2 - Life Science: Student understands and analyzes concepts of genetics, evolution, biodiversity, ecosystems, and molecular, structural, & cellular biology.

Middle School 6-8
Performance Indicators: a. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. And create a model to demonstrate the parts and functions that make it up. (MS-LS1-1, MS-LS1-2) b. Use arguments supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. (MS-LS1-3) c. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. (MS-LS1-5) d. Construct a scientific explanation describing the relationship between resources, multiple organisms and survival. (MS-LS2-1, MS-LS2-2) e. Develop a model (e.g., physical, mathematical, computer models) to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (MS-LS2-3) f. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. (MS-LS2-5) g. Develop and use a model to describe the difference between offspring produced through asexual and sexual reproduction. (MS-LS3-2) h. 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 on the structure and function of the organism. (LS3-1) i. Analyze and interpret data to determine the evolutionary relationships between living and extinct organisms using a variety of evidence points, including: fossil records, anatomical and embryological structures. (MS-LS4-1, MS-LS4-2 & MS-LS4-3) j. Construct an explanation and use mathematical representations to support explanations of how genetic mutations and natural selection may lead to increases and decreases of specific traits in populations over time. (MS-LS3-1, MS-LS4-4, MS-LS4-6)

Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*
a. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. And create a model to demonstrate the parts on functions that make it up (MS-LS1-1, MS-LS1-2)	Students (I) can plan an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.	Students (I) can plan an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. And plan a model to demonstrate the parts and functions that make it up.	Students (I) can conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. And create a model to demonstrate the parts and functions that make it up.	Students (I) can revise and refine an investigation, to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells from a model that I created demonstrating the parts and functions that make it up.
b. Use argument supported by evidence	Students (I) can construct a simple explanation about the relationship between the body	Students (I) can construct an explanation about the relationship between the	Students (I) can use arguments supported by evidence for how the body	Students (I) can construct complex explanations about the relationship between the

for how the body is a system of interacting subsystems composed of groups of cells. (MS-LS1-3)	as a system of interacting subsystems composed of groups of cells.	body as a system of interacting subsystems composed of groups of cells.	is a system of interacting subsystems composed of groups of cells.	body as a system of interacting subsystems composed of groups of cell.supported by multiple sources of synthesized evidence.
c. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. (MS-LS1-5)	Students (I) can construct a simple explanation for how environmental and genetic factors influence the growth of organisms.	Students (I) can construct, using scientific explanation, how environmental and genetic factors influence the growth of organisms.	Students (I) can construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.	Students (I) can construct and use complex scientific explanations based on evidence for how environmental and genetic factors influence the growth of organisms.
d. Construct a scientific explanation describing the relationship between resources, multiple organisms, and survival. (MS-LS2-1, MS-LS2-2)	Students (I) can construct a simple explanation for how resources, multiple organisms, and survival interact.	Students (I) can construct, using scientific explanation how resources, multiple organisms, and survival interact.	Students (I) can construct a scientific explanation describing the relationship between resources, multiple organisms, and survival.	Students (I) can construct and use complex scientific explanations based on evidence for how resources, multiple organisms, and survival interact.
e. Develop a model (e.g., physical, mathematical, computer models) to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (MS-LS2-3)	Students (I) can use models (e.g., physical, mathematical, computer models) to describe the cycling of matter.	Students (I) can use models (e.g., physical, mathematical, computer models) to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.	Students (I) can develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.	Students (I) can develop and use models (e.g., physical, mathematical, computer models) and experimental investigations to simulate and predict the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
f. Evaluate competing design solutions for maintaining biodiversity and ecosystem services. (MS-LS2-5)	Students (I) can identify different design solutions for maintaining biodiversity and ecosystem services.	Students (I) can summarize the effects that different design solutions for maintaining biodiversity and ecosystem services.	Students (I) can evaluate competing design solutions for maintaining biodiversity and ecosystem services.	Students (I) can evaluate the validity and reliability of past and current claims in published materials of the effects that different design solutions for maintaining biodiversity and ecosystem services have.

g. Develop and use a model to describe the difference between offspring produced through asexual and sexual reproduction. (MS-LS3-2)	Students (I) can use a model (e.g., physical, mathematical, computer models) describe asexual and sexual reproduction.	Students (I) can use a model (e.g., physical, mathematical, computer models) to describe the difference between offspring produced through asexual and sexual reproduction.	Students (I) can develop and use a model (e.g., physical, mathematical, computer models) to describe the difference between offspring produced through asexual and sexual reproduction.	Students (I) can develop and use models (e.g., physical, mathematical, computer models) and experimental investigations to simulate and predict the difference between offspring produced through asexual and sexual reproduction.
h. 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 on the structure and function of the organism (LS3-1).	Students (I) can identify a genetic mutation.	Student (I) can identify how mutations occur and describe why they are harmful.	Students (I) can identify and explain how and why mutations can occur, and the beneficial and/or negative consequences of said mutation.	Students (I) can identify, explain and extrapolate how and why mutations occur (insertion, deletion, nondisjunction, etc…) and thoroughly explain how mutations can be negative or positive and lead to evolution.
i. Analyze and interpret data to determine the evolutionary relationships between living and extinct organisms using a variety of evidence points, including: fossil records, anatomical and embryological structures. (MS-LS4-1, MS-LS4-2 & MS-LS4-3)	Students (I) can document the evolutionary relationships between living and extinct organisms.	Students (I) can ask questions to show relationships evolutionary relationships between living and extinct organisms using a variety of evidence points, including: fossil records, anatomical and embryological structures.	Students (I) can analyze and interpret data to determine the evolutionary relationships between living and extinct organisms using a variety of evidence points, including: fossil records, anatomical and embryological structures.	Students (I) can ask questions to develop and test an original model to analyze and interpret data from evolutionary relationships between living and extinct organisms that document a variety of evidence points, including: fossil records, anatomical and embryological structures and critique the success of the model.
j. Construct an explanation and use mathematical representations to	Students (I) can mathematically show how genetic mutations and natural selection may lead to increases and decreases of	Students (I) can mathematically represent the concept of how genetic mutations and natural	Students (I) can construct an explanation and use mathematical representations to support	Students (I) can use a range of linear and nonlinear functions, including trigonometric functions,

support explanations of how genetic mutations and natural selection may lead to increases and decreases of specific traits in populations over time.(MS-LS3-1, MS-LS4-4, MS-LS4-6)	specific traits in populations over time.	selection may lead to increases and decreases of specific traits in populations over time.	explanations of how genetic mutations and natural selection may lead to increases and decreases of specific traits in populations over time.	exponentials and logarithms, and computational tools for statistical analysis to explain, evaluate and mathematically represent how genetic mutations and natural selection may lead to increases and decreases of specific traits in populations over time.

#2 - Life Science: Student understands and analyzes concepts of genetics, evolution, biodiversity, ecosystems, and molecular, structural, & cellular biology.
High School 9-12
Performance Indicators: a. Explain, evaluate and mathematically represent the factors contributing to ecosystem carrying capacity, biodiversity, and human impact. (HS-LS2-1, HS-LS2-2) b. Develop and use models to show understanding of the processes of inheritance and then make and defend a claim based on evidence of heritable genetic variations. (HS-LS3-2) c. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to the organisms lacking this trait and explain the causes for variation and distribution of expressed traits in a population. (HS-LS3-3) d. Plan and carry out investigations, analyze data and make models to illustrate photosynthesis and cellular respiration (with and without oxygen) as processes in a variety of organisms that involve inputs and outputs of matter and transformation of energy. (HS-LS1-5, HS-LS1-7) e. Use mathematical representations and other models to show how matter and energy are related to the cycling of nutrients among the biosphere, atmosphere, oceans and geosphere. (HS-LS2-5) f. Construct an explanation about the relationship between natural selection and evolution and engage in arguments based on evidence about process of evolution. (HS-LS4-2) g. Ask questions and analyze and interpret data from fossil,structural, and physiological evidence that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth. (HS-LS3-2) h. Ask questions and obtain, evaluate, and communicate information about the structures and functions within unicellular and/or multicellular organisms. (HS-LS1-2)

Grade 9-12 Scoring Criteria- Proficiency 2				
Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*
a. Explain, evaluate and mathematically represent the factors contributing to ecosystem carrying capacity, biodiversity, and human impact. (HS-LS2-1, HS-LS2-2)	Students (I) can mathematically recognize the factors contributing to ecosystem carrying capacity, biodiversity, and human impact.	Students (I) can mathematically represent the factors contributing to ecosystem carrying capacity, biodiversity, and human impact.	Students (I) can explain, evaluate and mathematically represent the factors contributing to ecosystem carrying capacity, biodiversity, and human impact.	Students (I) can use a range of linear and nonlinear functions, including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to explain, evaluate and mathematically represent the factors contributing to ecosystem carrying capacity, biodiversity, and human impact.
B. Develop and use models to show understanding of the processes of inheritance and then make and defend a claim based on evidence of heritable genetic variations. (HS-LS3-2)	Students (I) can use models (e.g., physical, mathematical, computer models) to show understanding of the processes of inheritance.	Students (I) can use models (e.g., physical, mathematical, computer models) to show understanding of the processes of inheritance and then make and defend a claim based on evidence of heritable genetic variations.	Students (I) can use models (e.g., physical, mathematical, computer models) to simulate and predict an understanding of the processes of inheritance and then make and defend a claim based on evidence of heritable genetic variations.	Students (I) can use models (e.g., physical, mathematical, computer models) to simulate and predict an understanding of the processes of inheritance and then make and defend a claim based on evidence of heritable genetic variations within and between systems at different scales. Student can create their own model to simulate the flow of energy.
c. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to the organisms lacking this trait and explain the causes for variation and distribution of	Students (I) can construct an explanation that organisms with an advantageous heritable trait tend to increase in proportion to the organisms lacking this trait.	Students (I) can apply evidence from concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to the organisms lacking this trait.	Students (I) can apply evidence from concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to the organisms lacking this trait and explain the causes for variation and distribution of expressed traits in a population.	Students (I) can construct complex explanations using evidence from concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to the organisms lacking this trait and explain the causes for variation and distribution of expressed traits in a population

expressed traits in a population. (HS-LS3-3)				
d. Plan and carry out investigations, analyze data and make models to illustrate photosynthesis and cellular respiration (with and without oxygen) as processes in a variety of organisms that involve inputs and outputs of matter and transformation of energy. (HS-LS1-5, HS-LS1-7)	Students (I) can plan an investigation to illustrate photosynthesis and cellular respiration (with and without oxygen) as processes in a variety of organisms.	Students (I) can plan an investigation to illustrate photosynthesis and cellular respiration (with and without oxygen) as processes in a variety of organisms that involve inputs and outputs of matter and transformation of energy.	Students (I) can plan and carry out investigations, analyze data and make models to illustrate photosynthesis and cellular respiration (with and without oxygen) as processes in a variety of organisms that involve inputs and outputs of matter and transformation of energy.	Students (I) can revise and refine an investigation, based on evidence analyzing data and models to illustrate photosynthesis and cellular respiration (with and without oxygen) as processes in a variety of organisms that involve inputs and outputs of matter and transformation of energy.
e. Use mathematical representations and other models to show how matter and energy are related to the cycling of nutrients among the biosphere, atmosphere, oceans and geosphere. (HS-LS2-5	Students (I) can mathematically show how matter and energy are related to the cycling of nutrients among the biosphere, **or** atmosphere, **or** oceans, **or** geosphere.	Students (I) can mathematically represent how matter and energy are related to the cycling of nutrients among the biosphere, atmosphere, oceans and geosphere.	Students (I) can use mathematical representations and other models to show how matter and energy are related to the cycling of nutrients among the biosphere, atmosphere, oceans and geosphere.	Students (I) can use a range of linear and nonlinear functions, including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to explain, evaluate and mathematically represent how matter and energy are related to the cycling of nutrients among the biosphere, atmosphere, oceans and geosphere.
f. Construct an explanation about the relationship between natural selection and evolution and engage in arguments based on evidence about process of evolution. (HS-LS4-2)	Students (I) can construct a simple explanation about the relationship between natural selection and evolution.	Students (I) can construct an explanation about the relationship between natural selection and evolution and engage in arguments based on evidence about process of evolution.	Students (I) can construct an explanation supported by multiple sources of evidence consistent with the relationship between natural selection and evolution and engage in arguments based on evidence about process of evolution.	Students (I) can construct complex explanations about the relationship between natural selection and evolution and engage in arguments based on evidence about process of evolution supported by multiple sources of synthesized evidence.

g. Ask questions and analyze and interpret data from fossil, structural, and physiological evidence that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth. (HS-LS3-2)	Students (I) can document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth.	Students (I) can ask questions to show relationships between fossil, structural, and physiological evidence that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth.	Students (I) can ask questions and analyze and interpret data from fossil, structural, and physiological evidence that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth.	Students (I) can ask questions to develop and test an original model to analyze and interpret data from fossil, structural, and physiological evidence that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth and critique the success of the model.
h. Ask questions and obtain, evaluate, and communicate information about the structures and functions within unicellular and/or multicellular organisms. (HS-LS1-2)	Students (I) can document information about the structures and functions within unicellular or multicellular organisms.	Students (I) can ask questions to evaluate information about the structures and functions within unicellular and/or multicellular organisms.	Students (I) can ask questions and obtain, evaluate, and communicate information about the structures and functions within unicellular and/or multicellular organisms.	Students (I) can ask questions to develop and test an original model to analyze and interpret data and obtain, evaluate, and communicate information about the structures and functions within unicellular and/or multicellular organisms and critique the success of the model.

#3 - Physical Science (Energy & Interactions): Student understands how the interactions among objects can be described and represented by the motion, forces, and energy of the objects, and that these interactions can be represented with either particle or wave models.				
Elementary K-2				
Performance Indicators: a. Students (I) can ask questions about scientific models. b. Students (I) can use models to answer questions about life, physical and/or the earth and space sciences c. Students (I) can make models to demonstrate my knowledge of scientific ideas				
Elementary Scoring Criteria K-2: Proficiency 3				
Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*

a. Students (I) can ask questions about scientific models.	Students (I) can ask questions about scientific ideas	With support, students (I) can ask questions about scientific models	Students (I) can ask questions about scientific models.	Students (I) can ask questions about scientific models and connect these answers to real-life problems and solutions.
b. Students (I) can use models to answer questions about life, physical and/or the earth and space sciences	Students (I) can use models to answer simple questions about the model	Students (I) can use models to answer simple data-based questions about life, physical, and/or the earth and space sciences	Students (I) can use models to answer questions about life, physical and/or the earth and space sciences	Students (I) can use models to answer big idea questions and make connections between life, physical and/or the earth and space scientists and the students' own environment
c. Students (I) can make models to demonstrate my knowledge of scientific ideas	Students (I) can make models with support and in collaboration with others to demonstrate knowledge of scientific ideas	Students (I) can duplicate given models to demonstrate knowledge of scientific ideas	Students (I) can make models to demonstrate my knowledge of scientific ideas	Students (I) can make complex models to demonstrate my knkowledge of scientific ideas

#3 - Physical Science (Energy & Interactions): Student understands how the interactions among objects can be described and represented by the motion, forces, and energy of the objects, and that these interactions can be represented with either particle or wave models.
Elementary 3-5
Performance Indicators: a. Students (I) can ask questions to develop and test models b. Students (I) can use models (e.g., physical, mathematical, computer models) to simulate and predict movement in systems. c. Students (I) can describe some of the aspects of changes of energy and matter. d. Students (I) can make predictions and investigate different systems by examining different materials, structures and interconnections to solve a problem.
Grade 3-5 Scoring Criteria- Proficiency 3

Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*
a. Students (I) can ask questions to develop and test models	With support, students (I) can ask questions about models	Students (I) can ask questions about models	Students (I) can ask questions to develop and test models	Students (I) can ask questions and use the answers to develop, test, and then refine models.
b. Students (I) can use models (e.g., physical, mathematical, computer models) to simulate and predict movement in systems.	With support, students (I) can describe what a model is showing.	Students (I) can use models (e.g., physical, mathematical, computer models) to simulate movement in systems.	Students (I) can use models (e.g., physical, mathematical, computer models) to simulate and predict movement in systems.	Students (I) can use models (e.g., physical, mathematical, computer models) to simulate and predict movement in complex systems.
c. Students (I) can describe some of the aspects of changes of energy and matter.	Students (I) can define energy and matter	Students (I) can investigate and discuss changes in energy	Students (I) can describe some of the aspects of changes of energy and matter.	Students (I) can describe changes of energy and matter in a system in terms of energy and matter flows into, out of, and within that system can apply the concepts that energy cannot be created or destroyed.
d. Students (I) can make predictions and investigate different systems by examining different materials, structures and interconnections to solve a problem.	Students (I) can investigate different systems by examining different materials, structures and interconnections.	With support, students (I) can make predictions and investigate different systems by examining different materials, structures and interconnections.	Students (I) can make predictions and investigate different systems by examining different materials, structures and interconnections to solve a problem.	Students (I) can make predictions and investigate different systems by examining different materials, structures and interconnections to reveal the system's function and purpose or to solve a problem.

#3 - Physical Science (Energy & Interactions): Student understands how the interactions among objects can be described and

represented by the motion, forces, and energy of the objects, and that these interactions can be represented with either particle or wave models.
Middle School 6-8
Performance Indicators: a. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. (MS-PS2-1) b. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. (MS-PS2-2) c. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. (MS-PS2-5) d. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. (MS-PS3-3) e. Construct, use, and present arguments to support the claim that energy is conserved as energy changes from one form to another, including potential and kinetic energy (MS-PS3-5). f. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. (MS-PS4-1) g. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. (MS-PS4-2) h. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. (MS-PS2-3)

Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*
a. MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.	Studenta (I) can identify Newton's 3 Laws of Motion	Students (I) can identify and apply Newton's first 2 laws of motion to the motion of two colliding objects.	Students (I) can identify and apply all 3 laws of motion to colliding objects.	Students (I) can identify, apply and build on Newton's 3 Laws to principals other than colliding objects.
b. 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.	Students (I) can recall the definitions of force and mass and am gaining an awareness that forces can be added.	Students (I) can describe expected results of an investigation based upon my understanding of the relationship between force and mass.	Students (I) can independently and accurately plan an investigation that combines a sound understanding of force and motion and takes into account all the elements of a formal scientific investigation.	Students (I) see my investigation includes a scenario from real life that seeks to solve a community concern. I will share my investigation beyond the classroom.

c. 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.	Students (I) can identify examples of fields that allow objects to exert force from a distance, such as, gravity, magnetism, and nuclear forces.	Students (I) can begin to distinguish which fields and forces might most easily be demonstrated by way of an investigation. I am developing an understanding of effective experimental design that requires some support.	Students (I) can independently design an investigation which incorporates effective experimental design. I am able to evaluate my own work and that of my peers.	Students (I) can support my peers in conducting investigations of fields and forces between objects that are not in contact.
d. MS-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.*	Students (I) can define thermal energy and explain briefly how it is transferred.	Students (I) can demonstrate an understanding of what materials or construction might minimize or maximize thermal energy transfer. I am developing an understanding of the design process that requires some support.	Students (I) can independently design, construct, and test a device that minimizes or maximizes thermal energy transfer.	Students (I) see my design has real-world application. I can promote my design for use outside of the classroom.
e. MS-PS3-5 Construct, use, and present arguments to support the claim that energy is conserved as energy changes from one form to another, including potential and kinetic energy.	Students (I) can identify the law of the conservation of energy.	Students (I) can identify and explain the law of the conservation of energy	Students (I) can identify, explain and apply the law of the conservation of energy to real world phenomena.	Students (I) can apply the conservation of energy to real world phenomena and demonstrate a clear understanding of how it directly links to the conservation of mass.
f. MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.	Students (I) can label a wave diagram with partial accuracy.	Students (I) can compare the amplitudes of two standing waves and determine which wave has more energy with support.	Students (I) can independently compare the amplitudes of two standing waves and determine which wave has more energy.	Students (I) can apply my understanding of energy from waves to recent designs for alternative energy production.

g. MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.	Students (I) can identify examples of substances that seem to transmit, reflect or absorb waves such as infrared radiation from the Sun or sound from a musical instrument.	Students (I) can modify a resonance device to illustrate how sound waves are transmitted or absorbed with support.	Students (I) can independently modify a resonance device to illustrate how sound waves are transmitted or absorbed with support.	Students (I) can support my peers as they work to develop and use a model to describe the way in which waves are reflected, absorbed, or transmitted.
h. MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.	Students (I) can identify that there is a relationship between electric and magnetic forces with partial clarity.	Students (I) can ask questions about data to determine the factors that affect the strength of electric and magnetic forces with some support and guidance.	Students (I) can independently ask questions about data to determine the factors that affect the strength of electric and magnetic forces.	Students (I) can provide guidance to my peers as they ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

#3 - Physical Science (Energy & Interactions): Student understands how the interactions among objects can be described and represented by the motion, forces, and energy of the objects, and that these interactions can be represented with either particle or wave models.
High School 9-12
Performance Indicators: a. Analyze data to support the claim that the relationship between the mass, acceleration and net force acting on an object is described by Newton's second law. (HS-PS2-1, HS-PS2-2) b. Analyze data to support the claim that the total linear momentum of a system of objects is conserved if there is no net force acting on the system. (HS-PS2-1, HS-PS2-2) c. Analyze data to support the claim that for rotational systems the relationships between inertia, rotational acceleration and net Torque acting on an object is described by Newton's second law, and that the total momentum of objects is conserved if there is no net force acting on the system. (HS-PS2-1, HS-PS2-2) d. Use the mathematical representation of the concept of fields to describe the gravitational force between objects and the associated motion and interactions. (HS-PS2-4, HS-PS3-5) e. Use the mathematical representation of the concept of fields to describe the change in the energy of objects due to the interaction between gravitation and other forces. (HS-PS2-4, HS-PS3-5) f. Use the mathematical representation of the concept of fields to describe how forces and their associated energies create and impact rotational motion and rotational mechanics. (HS-PS2-4, HS-PS3-5)

g. Use the mathematical representation of the concept of fields to describe the electrical forces between objects and changes in the energy of objects due to the interaction between electrical fields, electrical force and other forces. (HS-PS2-4, HS-PS3-5)
h. Develop and use models and experimental investigations to show that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles and energy associated with the relative positions of particles, and that the change in energy of one component in a system is related to changes in energy of other components of the system and to the flow of energy into and out of the system. (HS-PS3-1, HS-PS-3-2, HS-PS3-3, HS-PS3-4)
i. Use mathematical representations to support a claims regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. (HS-PS4-1)
j. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter, and how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. (HS-PS4-4, HS-PS4-5)
k. Develop models and conduct investigations to illustrate field force interactions within magnetic fields and within electric fields as well as to illustrate the relationship between changing electric current and changing magnetic fields. (HS-PS2-5; HS-PS3-5)
l. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. (HS-ETS1-2)

Grade 9-12 Scoring Criteria- Proficiency 3

Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*
a. Analyze data to support the claim that the relationship between the mass, acceleration and net force acting on an object is described by Newton's second law. (HS-PS2-1, HS-PS2-2)	Students (I) can use data to support Newton's second law.	Students (I) can analyze data to support the claim that the relationship between the mass, acceleration and net force acting on an object is described by Newton's second law.	Students (I) can analyze data to support the claim that the relationship between the mass, acceleration and net force acting on an object is described by Newton's second law, and that the total momentum of a system of objects is conserved if there is no net force on the system.	Students (I) can analyze data and construct models to illustrate the relationship between the mass, acceleration and net force acting on an object is described by Newton's second law, and that the total momentum of a system of objects is conserved if there is no net force on the system.
b. Analyze data to support the claim that the total linear momentum of a system of objects is conserved if there is no net force	Students (I) can support the claim that momentum is conserved if there is no force.	Students (I) can use data to support the claim that momentum is conserved if there is no force.	Students (I) can analyze data to support the claim that the relationship between the mass, acceleration and net force acting on an object is described by Newton's second law, and that the total momentum of a system of	Students (I) can analyze data and construct models to illustrate the relationship between the total linear momentum of a system of objects, net force acting on the system, and conserved momentum.

acting on the system. (HS-PS2-1, HS-PS2-2)			objects is conserved if there is no net force on the system.	
c. Analyze data to support the claim that for rotational systems the relationships between inertia, rotational acceleration and net Torque acting on an object is described by Newton's second law, and that the total momentum of objects is conserved if there is no net force acting on the system. (HS-PS2-1, HS-PS2-2)	Students (I) can use data to support Newton's second law.	Students (I) can analyze data to support the claim that rotational systems-inertia, rotational acceleration and net Torque-act on an object is described by Newton's second law.	Students (I) can analyze data to support the claim that rotational systems-inertia, rotational acceleration and net Torque-act on an object is described by Newton's second law, and that the total momentum of objects is conserved if there is no net force acting on the system.	Students (I) can analyze data and construct models to illustrate the relationship between rotational systems-inertia, rotational acceleration and net Torque-on an object as described by Newton's second law, and that the total momentum of objects is conserved if there is no net force acting on the system.
d. Use the mathematical representation of the concept of fields to describe the gravitational force between objects and the associated motion and interactions. (HS-PS2-4, HS-PS3-5)	Students (I) can mathematically show gravitational forces between objects.	Students (I) can mathematically represent the concept of fields to describe the gravitational forces between objects.	Students (I) can use the mathematical representation of the concept of fields to describe the gravitational forces between objects, and the changes in the energy of the objects due to their interaction.	Students (I) can use a range of linear and nonlinear functions, including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to explain, evaluate and mathematically represent how the concept of fields to describe the gravitational forces between objects, and the changes in the energy of the objects due to their interaction.
e. Use the mathematical representation of the concept of fields to	Students (I) can describe gravitational forces between objects.	Students (I) can mathematically represent the concept of fields to describe the gravitational forces	Students (I) can use the mathematical representation of the concept of fields to describe the change in the	Students (I) can use a range of linear and nonlinear functions, including trigonometric functions,

describe the change in the energy of objects due to the interaction between gravitation and other forces. (HS-PS2-4, HS-PS3-5)		between objects.	energy of objects due to the interaction between gravitation and other forces.	exponentials and logarithms, and computational tools for statistical analysis to explain, evaluate and mathematically represent how the concept of fields describe the change in the energy of objects due to the interaction between gravitation and other forces.
f. Use the mathematical representation of the concept of fields to describe how forces and their associated energies create and impact rotational motion and rotational mechanics. (HS-PS2-4, HS-PS3-5)	Students (I) can show how forces and energies create rotational motion and rotational mechanics.	Students (I) can mathematically represent how forces and their associated energies create and impact rotational motion and rotational mechanics.	Students (I) can mathematically represent the concept of fields to describe how forces and their associated energies create and impact rotational motion and rotational mechanics.	Students (I) can use a range of linear and nonlinear functions, including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to explain, evaluate and mathematically represent how the concept of fields to describe how forces and their associated energies create and impact rotational motion and rotational mechanics.
g. Use the mathematical representation of the concept of fields to describe the electrical forces between objects and changes in the energy of objects due to the interaction between electrical fields, electrical force and other forces. (HS-PS2-4, HS-PS3-5)	Students (I) can show electrical forces in objects and changes in the energy of objects due to the interaction between electrical fields and electrical force.	Students (I) can mathematically represent the concept of fields to describe the electrical forces between objects due to the interaction between electrical fields and forces.	Students (I) can use the mathematical representation of the concept of fields to describe the electrical forces between objects and changes in the energy of objects due to the interaction between electrical fields, electrical force and other forces.	Students (I) can use a range of linear and nonlinear functions, including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to explain, evaluate and mathematically represent how the concept of fields to describe the electrical forces between objects and changes in the energy of objects due to the interaction between electrical fields, electrical force and other forces.

h. Develop and use models and experimental investigations to show that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles and energy associated with the relative positions of particles, and that the change in energy of one component in a system is related to changes in energy of other components of the system and to the flow of energy into and out of the system. (HS-PS3-1, HS-PS-3-2, HS-PS3-3, HS-PS3-4)	Students (I) can use models (e.g., physical, mathematical, computer models) to show that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles and energy associated with the relative positions of particles.	Students (I) can use models (e.g., physical, mathematical, computer models) to show that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles and energy associated with the relative positions of particles, and that the change in energy of one component in a system is related to changes in energy of other components of the system and to the flow of energy into and out of the system.	Students (I) can develop and use models (e.g., physical, mathematical, computer models) and experimental investigations to show that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles and energy associated with the relative positions of particles, and that the change in energy of one component in a system is related to changes in energy of other components of the system and to the flow of energy into and out of the system	Students (I) can develop and use models (e.g., physical, mathematical, computer models) and experimental investigations to simulate and predict an understanding that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles and energy associated with the relative positions of particles, and that the change in energy of one component in a system is related to changes in energy of other components of the system and to the flow of energy into and out of the system. Student can create their own model to simulate the flow of energy.
i. Use mathematical representations to support a claims regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. (HS-PS4-1)	Students (I) can mathematically support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.	Students (I) can plan an investigation to illustrate mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.	Students (I) can plan and carry out investigations, analyze data and use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.	Students (I) can revise and refine an investigation, based on evidence analyzing data and models to illustrate mathematical representations to support claims regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

j. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter, and how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. (HS-PS4-4, HS-PS4-5)	Students (I) can locate materials to show the effects that different frequencies of electromagnetic radiation have when absorbed.	Students (I) can identify the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter, and how some technological devices use the principles of wave behavior.	Students (I) evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter, and how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.	Students (I) can apply the principles expressed in the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter, and how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy in an independent investigation.
K. Develop models and conduct investigations to illustrate field force interactions within magnetic fields and within electric fields as well as to illustrate the relationship between changing electric current and changing magnetic fields. (HS-PS2-5; HS-PS3-5)	Students (I) illustrate field force interactions within magnetic fields and within electric fields.	Students (I) illustrate field force interactions within magnetic fields and within electric fields as well as to illustrate the relationship between changing electric current and changing magnetic fields	Develop models and conduct investigations to illustrate field force interactions within magnetic fields and within electric fields as well as to illustrate the relationship between changing electric current and changing magnetic fields.	Students (I) can construct complex models and conduct investigations to illustrate field force interactions within magnetic fields and within electric fields as well as to illustrate the relationship between changing electric current and changing magnetic fields.
L. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be	Student attempts to design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	Student designs a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	Student designs a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. Students propose two or	Students restate the original complex problem into a finite set of two or more sub-problems in writing or as a diagram or flowchart. Students propose two or more solutions that are based on

solved through engineering. (HS-ETS1-2)			more solutions that are based on student-generated data and/or scientific information	student-generated data and/or scientific information from other sources. Students describe how solutions to the sub-problems are interconnected to solve all or part of the larger problem, describing criteria and constraints, including quantification when appropriate.

#4 - Physical Science (Properties of Matter): Students understand and analyze matter, reactions and physical systems.

Elementary K-2

Performance Indicators:
a. Students (I) can define an engineering problem by stating the problem to be solved as clearly as possible.
b. Students (I) can design solutions to engineering problems by generating a number of different possible solutions and deciding which idea would work best.
c. Students (I) can create a simple machine to solve a problem.
d. Students (I) can discuss how engineering is used to address environmental issues.

Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*
a. Students (I) can define an engineering problem by stating the problem to be solved as clearly as possible.	Students (I) can explain what a problem is	Students (I) can define an engineering problem	Students (I) can define an engineering problem by stating the problem to be solved as clearly as possible.	Students (I) can define an engineering problem by stating the problem to be solved as clearly as possible as well as identifying some constraints.
b. Students (I) can design solutions to engineering problems by generating a number of different	Students (I) can connect a problem to some potential solutions	Students (I) can come up with ideas of solutions to a given problem	Students (I) can design solutions to engineering problems by generating a number of different	Students (I) can design solutions to engineering problems by generating a number of different possible solutions and deciding which

possible solutions and deciding which idea would work best.			possible solutions and deciding which idea would work best.	idea would work best, explaining the criteria for their choice and some constraints.
c. Students (I) can create a simple machine to solve a problem.	Students (I) can identify some machines that help with problems	With support, students (I) can work collaboratively to design a simple machine	Students (I) can create a simple machine to solve a problem.	Students (I) can create a simple machine that works to solve a problem
d. Students (I) can discuss how engineering is used to address social and environmental issues.	Students (I) know what environmental issues are	Students (I) can give an example of how an engineering solution has worked to address an environmental issue.	Students (I) can discuss how engineering is used to address environmental issues.	Students (I) can discuss how engineering is used to address environmental issues in both the local and global communities.

#4 - Physical Science (Properties of Matter): Students understand and analyze matter, reactions and physical systems.

Elementary 3-5

Performance Indicators:
a. Students (I) can define an engineering problem by stating the problem to be solved as clearly as possible in terms of what success looks like.
b. Students (I) can design solutions to engineering problems by generating a number of different possible solutions, then evaluating the solutions to see which one might best address the problem.
c. Students (I) can come up with, discuss and refine a design. The final design is improved on through the process.
d. Students (I) can assess the social and environmental impacts around an engineering solution.

Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*
a. Students (I) can define an engineering problem by stating the problem to be solved as clearly as possible in terms of what success looks like.	With support, students (I) can define an engineering problem	Students (I) can define an engineering problem by describing the problem and its causes in detail.	Students (I) can define an engineering problem by stating the problem to be solved as clearly as possible in terms of	Students (I) can define an engineering problem by stating the problem to be solved as clearly as possible in terms of criteria for success, and limits of a

			what success looks like.	possible solution
b. Students (I) can design solutions to engineering problems by generating a number of different possible solutions, then evaluating the solutions to see which one might best address the problem.	Students (I) can connect an engineering problem to some potential solutions	Students (I) can come up with ideas of solutions to an engineering problem	Students (I) can design solutions to engineering problems by generating a number of different possible solutions, then evaluating the solutions to see which one might best address the problem.	Students (I) can design solutions to engineering problems by generating a number of different possible solutions, then evaluating potential solutions to see which ones best meet the criteria and constraints of the problem.
c. Students (I) can come up with, discuss and refine a design. The final design is improved on through the process.	With support, students (I) can come up with, discuss and change a design..	Students (I) can come up with, discuss and refine a design.	Students (I) can come up with, discuss and refine a design. The final design is improved on through the process.	Students (I) can come up with, discuss and refine and finally make a design. The final design is improved on through the process.
d. Students (I) can discuss how engineering is used to address social and environmental issues.	Students (I) know what social and environmental issues are	Students (I) can give an example of how an engineering solution has worked to address a social and/or environmental issue.	Students (I) can discuss how engineering is used to address social and environmental issues.	Students (I) can assess the social and environmental impacts around an engineering solution in relation to problems of local and global significance.

#4 - Physical Science (Properties of Matter): Students understand and analyze matter, reactions and physical systems.
Middle School 6-8
Performance Indicators: a. Develop models to describe the atomic composition of simple molecules and extended structures. (MS-PS1-1)

b. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. (MS-PS1-2) c. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. (MS-PS1-5) d. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed (MS-PS1-4). e. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. (MS-PS1-6)

Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*
a. MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.	Students (I) can identify 3 main subatomic particles of atoms and where they are located with support.	Students (I) can explain the interactions between atoms necessary for bond between atoms to form molecules.	Students (I) can apply my knowledge of the forming and breaking of molecular bonds to a developing understanding of chemical change.	Students (I) can enhance my understanding of chemical change through additional scientific inquiry.
b.MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.	Students (I) can define the term "properties" and identify several examples of properties.	Students (I) can distinguish between physical and chemical properties.	Students (I) can accurately summarize the results of a change of a substance during inquiry and determine whether a chemical change has happened.	Students (I) can articulate my understanding of the difference between a physical and chemical change to a peer.
c. MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.	Students (I) can recall the Law of Conservation of Mass with varying degrees of accuracy.	Students (I) can readily describe the Law of Conservation of Mass and am beginning to use simple chemical equations.	Students (I) can accurately and independently balance a chemical equation.	Students (I) can balance more complex chemical equations.
d. MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.	Student (I) can explain how particle motions affects the temperature of substance	Students (I) can design a device that minimizes thermal transfer.	Students (I) can design and build a device that minimizes thermal transfer.	Student (I) can design, build and explain using appropriate scientific vocabulary how the device actually minimizes thermal transfer.
e. MS-PS1-6. Undertake a design project to	Students (I) am aware that I cannot simply add or remove	Students (I) can apply my understanding of the	Students (I) can synthesize my understanding of the	Students (I) can extend my experience of this design

construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.	thermal energy myself to fulfill this performance indicator.	difference of physical and chemical processes to identify real-world examples of chemical processes that release or absorb thermal energy.	design process with a knowledge of chemical processes to construct a device that releases or absorbs thermal energy.	process by collaborating with professionals beyond my school to receive feedback on or find a community application of my design.

#4 - Physical Science (Properties of Matter): Students understand and analyze matter, reactions and physical systems.				
High School 9-12				
Performance Indicators: a. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. (HS-PS1-1) b. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron state of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties (HS-PS1-2) c. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. (HS-PS1-7) d. Develop models to illustrate the changes in the composition of atomic nuclei and the energy released during the process of fission, fusion and radioactive decay (HS-PS1-8)				
Performance Indicator	*Getting Started*	*Making Progress*	*Proficient*	*Going Beyond*
a. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. (HS-PS1-1)	Students (I) can use the periodic table to illustrate the properties of elements.	Students (I) can use the periodic table to illustrate the relative properties of elements based on the patterns of electrons.	Students (I) can use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.	Students (I) can use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms during experimental investigations.
b. Construct and revise an explanation for the outcome of a simple chemical reaction based on the	Students (I) can construct a simple explanation for the outcome of a simple chemical reaction.	Students (I) can construct an explanation for the outcome of a simple chemical reaction based on the outermost electron state of atoms and trends in the periodic table.	Students (I) can construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron state of atoms, trends in	Students (I) can construct, and revise, complex explanations for the outcome of a simple chemical reactions based on the outermost electron state of atoms, trends in the periodic

outermost electron state of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. (HS-PS1-2)			the periodic table, and knowledge of the patterns of chemical properties.	table, and knowledge of the patterns of chemical properties supported by multiple sources of synthesized evidence.
c. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. (HS-PS1-7)	Students (I) can mathematically show atoms conserved during a chemical reaction.	Students (I) can mathematically support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	Students (I) can use the mathematical representations to support a claim that atoms, and therefore mass, are conserved during a chemical reaction.	Students (I) can use a range of linear and nonlinear functions, including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to explain the claim that atoms, and therefore mass, are conserved during a chemical reaction.
d. Develop models to illustrate the changes in the composition of atomic nuclei and the energy released during the process of fission, fusion and radioactive decay (HS-PS1-8)	Students (I) can illustrate the composition of atomic nuclei and the energy released during the process of fission, **or** fusion, **or** radioactive decay.	Students (I) can use models (e.g., physical, mathematical, computer models) to illustrate the changes in the composition of atomic nuclei and the energy released during the process of fission, fusion and radioactive decay.	Students (I) can develop models (e.g., physical, mathematical, computer models) to illustrate the changes in the composition of atomic nuclei and the energy released during the process of fission, fusion and radioactive decay.	Students (I) can develop and use models (e.g., physical, mathematical, computer models) and conduct experimental investigations to illustrate the changes in the composition of atomic nuclei and the energy released during the process of fission, fusion and radioactive decay. Student can create their own model to simulate the flow of energy.