Science Detailed Performance Level Descriptors

Grades 9 and 10

Performance Level Descriptors - Science

PLD Type	Below Proficient	Approaching Proficient	Proficient	Highly Proficient
Policy	The Level 1 students are below proficient in achieving or applying the science attitudes and knowledge/ skills as specified in the Utah Core Standards. The students generally perform significantly below the standard for their grade level and are able to engage with higher-order thinking skills for all science contexts with extensive support.	The Level 2 students are approaching proficient in achieving or applying the science attitudes and knowledge/skills as specified in the Utah Core Standards. The students generally perform slightly below the standard for their grade level and are likely able to engage in higher-order thinking skills for all science contexts with support.	The Level 3 students are proficient in achieving or applying the science attitudes and knowledge/skills as specified in the Utah Core Standards. The students generally perform at the standard for their grade level and are able to engage in higher-order thinking skills for all science contexts with independence and minimal support. This level of science performance likely indicates students are on track to be sufficiently prepared for college or a career.	The Level 4 students are highly proficient in achieving or applying the science attitudes and knowledge/skills as specified in the Utah Core Standards. The students generally perform above the standard for their grade level and are able to engage in higher-order thinking skills involving all science contexts independently. This level of science performance likely indicates students are on track to be well-prepared for college or a career.
Range	**The Level 1 Students:**	**The Level 2 Students:**	**The Level 3 Students:**	**The Level 4 Students:**
Strand BIO.1: Interactions with Organisms and the Environment BIO.1.1 BIO.1.2 BIO.1.3 BIO.1.4 BIO.1.5		• **1.1** Conduct an investigation to identify data and/or identify data from an investigation that describe how living and non-living factors affect the stability and change of a population. • **1.2** Use a model to identify the cycling of matter and flow of energy among organisms in an ecosystem. • **1.3** Identify data that describe the effects of photosynthesis and cellular	• **1.1** Plan an investigation to analyze data to predict how living and non-living factors affect the stability and change of a population. • **1.2** Develop and use a model to describe the cycling of matter and flow of energy among organisms in an ecosystem. • **1.3** Analyze data to predict the effects of photosynthesis and cellular respiration on carbon reservoirs in the carbon cycle. • **1.4** Construct an argument	• **1.1** Evaluate and revise an investigation to analyze data to determine how limitations in data impact predictions of how living and non-living factors affect the stability and change of a population. • **1.2** Evaluate and revise a model to explain the cycling of matter and flow of energy among organisms in an ecosystem. • **1.3** Analyze data to determine how limitations in data impact predictions of the effects of photosynthesis and cellular

		respiration on carbon reservoirs in the carbon cycle. • **1.4** Identify evidence that supports an argument for how ecosystems maintain relatively consistent numbers and types of organisms in stable conditions. • **1.5** Identify a solution that reduces the impact caused by human activities on the environment and biodiversity.	from evidence for how ecosystems maintain relatively consistent numbers and types of organisms in stable conditions. • **1.5** Design a solution that reduces the impact caused by human activities on the environment and biodiversity.	respiration on the scale and proportion of carbon reservoirs in the carbon cycle. • **1.4** Evaluate and revise an argument for how ecosystems maintain relatively consistent numbers and types of organisms in stable conditions. • **1.5** Evaluate and revise a solution that reduces the impact caused by human activities on the environment and biodiversity.
Strand BIO.2: Structure and Function of Life BIO.2.1 BIO.2.2 BIO.2.3 BIO.2.4 BIO.2.5 BIO.2.6 BIO.2.7 (not assessed)		• **2.1** Identify evidence that supports an explanation that all organisms are primarily composed of carbon, hydrogen, oxygen, and nitrogen, and that the matter taken into an organism is broken down and recombined to make molecules necessary for life functions. • **2.2** Ask questions based on observations from an investigation to determine how the structure of cells results in cells with specialized functions. • **2.3** Use a model to identify	• **2.1** Construct an explanation using evidence that all organisms are primarily composed of carbon, hydrogen, oxygen, and nitrogen, and that the matter taken into an organism is broken down and recombined to make molecules necessary for life functions. • **2.2** Ask questions to clarify descriptions of relationships in data to determine how the structure of cells results in cells with specialized functions. • **2.3** Develop and use a model to describe the cycling of matter and flow of energy	• **2.1** Evaluate and revise an explanation using evidence that all organisms are primarily composed of carbon, hydrogen, oxygen, and nitrogen, and that the matter taken into an organism is broken down and recombined to make molecules necessary for life functions. • **2.2** Ask questions to clarify explanations of relationships in data to determine how (a) the structure and function of cells, (b) the proportion and quantity of organelles, and (c) the shape of cells result in cells with specialized functions. • **2.3** Evaluate and revise a model

		the cycling of matter and flow of energy through living things by the processes of photosynthesis and cellular respiration. • **2.4** Conduct an investigation to identify data and/or identify data from an investigation that describe how cells maintain stability within a range of changing conditions by the transport of materials across the cell membrane. • **2.5** Identify evidence that supports an explanation about the role of cell division in the production, growth, and maintenance of systems within complex organisms. • **2.6** Ask questions to identify evidence that supports an argument about how the structure and function of interacting organs and organ systems, which make up multicellular organisms, contribute to homeostasis within the organism.	through living things by the processes of photosynthesis and cellular respiration. • **2.4** Plan an investigation to determine how cells maintain stability within a range of changing conditions by the transport of materials across the cell membrane. • **2.5** Construct an explanation using evidence about the role of cell division in the production, growth, and maintenance of systems within complex organisms. • **2.6** Ask questions to clarify descriptions of evidence to construct an argument about how the structure and function of interacting organs and organ systems, which make up multicellular organisms, contribute to homeostasis within the organism.	to explain the cycling of matter and flow of energy through living things by the processes of photosynthesis and cellular respiration. • **2.4** Evaluate and revise an investigation to determine how cells maintain stability within a range of changing conditions by the transport of materials across the cell membrane. • **2.5** Evaluate and revise an explanation about the role of cell division in the production, growth, and maintenance of systems within complex organisms. • **2.6** Ask questions to clarify explanations of evidence to evaluate and revise an argument about how the structure and function of interacting organs and organ systems, which make up multicellular organisms, contribute to homeostasis within the organism.
Strand BIO.3: Genetic Patterns		• **3.1** Identify evidence that supports an explanation for how DNA determines	• **3.1** Construct an explanation using evidence for how the structure of DNA is replicated,	• **3.1** Evaluate and revise an explanation for how the structure of DNA is replicated,

BIO.3.1 BIO.3.2 BIO.3.3 BIO.3.4 BIO.3.5		specific traits. • **3.2** Use computational thinking to describe patterns in the expression of specific traits that are passed in genes on chromosomes from parents to offspring. • **3.3** Identify evidence that supports an argument that inheritable genetic variation is caused during the formation of sex cells. • **3.4** Conduct an investigation to identify data and/or identify data from an investigation that describe the variation and patterns in distribution of the traits expressed in a population. • **3.5** Identify a problem that biotechnology is able to solve.	and how DNA codes for the structure of proteins that result in specific traits. • **3.2** Use computational thinking to predict patterns in the expression of specific traits that are passed in genes on chromosomes from parents to offspring. • **3.3** Construct an argument from evidence that inheritable genetic variation is caused during the formation of sex cells. • **3.4** Plan an investigation and use computational thinking to explain the variation and patterns in distribution of the traits expressed in a population. • **3.5** Identify the most effective design solution in which biotechnology is used to identify or modify genes in order to solve a problem, and use evidence to support an argument for the effectiveness of the solution.	and how DNA and RNA code for the structure of proteins which regulate and carry out the essential functions of life and result in specific traits. • **3.2** Use computational thinking to identify how limitations in data affect a prediction of patterns in the expression of specific traits that are passed in genes on chromosomes from parents to offspring. • **3.3** Evaluate and revise an argument that inheritable genetic variation is caused during the formation of sex cells. • **3.4** Evaluate and revise an investigation and use computational thinking to predict the variation and patterns in distribution of the traits expressed in a population. • **3.5** Evaluate and revise a design solution in which biotechnology is used to identify or modify genes in order to solve a problem, and construct an argument from evidence for how the revision will improve the effectiveness of the solution.
Strand BIO.4: Evolutionary Change		• **4.1** Use information to identify the patterns in evidence that support	• **4.1** Obtain and evaluate information to describe how patterns in evidence support	• **4.1** Obtain, evaluate, and communicate information to explain how patterns in

BIO.4.1 BIO.4.2 BIO.4.3 BIO.4.4 BIO.4.5		biological evolution. • **4.2** Identify evidence that supports an explanation that natural selection is a primary cause of evolution. • **4.3** Analyze data to identify patterns that support the claim that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. • **4.4** Identify evidence that supports an argument that changes in environmental conditions may cause increases in the number of individuals of some species, the emergence of new species over time, and the extinction of other species. • **4.5** Identify the best solution for a real-world problem caused by natural selection and adaptation of populations.	biological evolution. • **4.2** Construct an explanation using evidence that natural selection is a primary cause of evolution. • **4.3** Analyze data to explain how patterns support the claim that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. • **4.4** Construct an argument from evidence that changes in environmental conditions may cause increases in the number of individuals of some species, the emergence of new species over time, and the extinction of other species. • **4.5** Evaluate a design solution for a real-world problem caused by natural selection and adaptation of populations.	evidence support biological evolution. • **4.2** Evaluate and revise an explanation that natural selection is a primary cause of evolution. • **4.3** Analyze data to determine how limitations in patterns impact support for the claim that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. • **4.4** Evaluate and revise an argument that changes in environmental conditions may cause increases in the number of individuals of some species, the emergence of new species over time, and the extinction of other species. • **4.5** Evaluate and revise a design solution for a real-world problem caused by natural selection and adaptation of populations.
Strand CHEM.1: The Structure and Properties of Atoms CHEM.1.1 CHEM.1.2 (not assessed) CHEM.1.3 (not		• **1.1** Use information to identify the structure of the atom on the basis of experimental evidence. • **1.5** Use the periodic table as a model to identify elements based on patterns.	• **1.1** Obtain and evaluate information to describe the structure of the atom on the basis of experimental evidence. • **1.5** Use the periodic table as a model to identify and describe the relative properties of	• **1.1** Obtain, evaluate, and communicate information to explain the structure of the atom on the basis of experimental evidence. • **1.5** Use the periodic table as a model to predict the relative properties of elements based

assessed) CHEM.1.4 (not assessed) CHEM.1.5			elements based on the patterns of electrons in the outermost energy level of atoms.	on the patterns of electrons in the outermost energy level of atoms.
Strand CHEM.2: The Structure and Properties of Molecules CHEM.2.1 CHEM.2.2 CHEM.2.3 CHEM.2.4		• **2.1** Identify data that describe the type of bonding that occurs between two elements based on patterns of reactivity on the periodic table. • **2.2** Conduct an investigation to identify data and/or identify data from an investigation to compare the properties of substances at the macroscopic scale and relate them to molecular structures. • **2.3** Identify evidence that supports an argument that the functions of molecules are related to their chemical structures. • **2.4** Identify the best design solution in which synthetic chemistry was used to solve a problem.	• **2.1** Analyze data to predict the type of bonding most likely to occur between two elements based on the patterns of reactivity on the periodic table. • **2.2** Plan an investigation to compare the properties of substances at the macroscopic scale and relate them to molecular structures. • **2.3** Construct an argument supported by evidence that the functions of molecules are related to their chemical structures. • **2.4** Evaluate a design solution in which synthetic chemistry was used to solve a problem.	• **2.1** Analyze data to determine how limitations in data impact the prediction of the type of bonding most likely to occur between two elements based on the patterns of reactivity on the periodic table. • **2.2** Evaluate and revise an investigation to compare the properties of substances at the macroscopic scale and relate them to molecular structures. • **2.3** Evaluate and revise an argument supported by evidence that the functions of molecules are related to their chemical structures. • **2.4** Evaluate and revise a design solution in which synthetic chemistry was used to solve a problem.
Strand CHEM.3: Stability and Change in Chemical Systems CHEM.3.1		• **3.1** Use computational thinking to identify chemical solutions that differ in the distribution and proportion of particles.	• **3.1** Use computational thinking to describe the distribution and proportion of particles in chemical solution. • **3.2** Analyze data to identify	• **3.1** Use computational thinking to predict the distribution and proportion of particles in chemical solution. • **3.2** Analyze data to determine

CHEM.3.2 CHEM.3.3 CHEM.3.4 CHEM.3.5 CHEM.3.6 CHEM.3.7 CHEM.3.8		• **3.2** Analyze data to identify patterns that assist in the description of the outcomes of simple chemical reactions. • **3.3** Conduct an investigation to identify data and/or identify data from an investigation that describe the change in properties of substances in a chemical reaction. • **3.4** Use computational thinking to observe that matter is conserved during chemical reactions and matter cycles. • **3.5** Identify a solution related to the management, conservation, and utilization of mineral resources. • **3.6** Identify experimental evidence that supports an explanation for how reaction conditions affect the rate of change of a reaction. • **3.7** Identify a chemical system in which a change in conditions produces increased or decreased amounts of products at equilibrium.	patterns that assist in the prediction of the outcomes of simple chemical reactions. • **3.3** Plan an investigation to observe the change in properties of substances in a chemical reaction to relate the macroscopically observed properties to the molecular-level changes in bonds. • **3.4** Use computational thinking to support the observation that matter is conserved during chemical reactions and matter cycles. • **3.5** Design a solution related to the management, conservation, and utilization of mineral resources. • **3.6** Construct an explanation using experimental evidence for how reaction conditions affect the rate of change of a reaction. • **3.7** Evaluate a design solution that would refine a chemical system by specifying a change in conditions that would produce increased or decreased amounts of a product at equilibrium. • **3.8** Obtain and evaluate information to describe the effects of designed chemicals in a complex real-world	how limitations in patterns impact the prediction of the outcomes of simple chemical reactions. • **3.3** Evaluate and revise an investigation to observe the change in properties of substances in a chemical reaction to relate the macroscopically observed properties to the molecular-level changes in bonds and the symbolic notation used in chemistry. • **3.4** Use computational thinking and the observation that matter is conserved to predict the masses of substances at different stages in a chemical reaction or matter cycle. • **3.5** Evaluate and revise a solution related to the management, conservation, and utilization of mineral resources. • **3.6** Evaluate and revise an explanation based on experimental evidence for how reaction conditions affect the rate of change of a reaction. • **3.7** Evaluate and revise a design solution that would refine a chemical system by specifying a change in conditions that would produce increased or decreased amounts of a product at

		• **3.8** Use information to identify the effects of designed chemicals in a complex real-world system.	system.	equilibrium. • **3.8** Obtain, evaluate, and communicate information to explain the effects of designed chemicals in a complex real-world system.
Strand CHEM.4: Energy in Chemical Systems CHEM.4.1 CHEM.4.2 CHEM.4.3 CHEM.4.4 (not assessed) CHEM.4.5		• **4.1** Identify evidence that supports an argument about whether a simple chemical reaction absorbs or releases energy. • **4.2** Identify evidence that supports an explanation of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. • **4.3** Identify a device that solves a problem by converting energy from one form into another. • **4.5** Make a claim from evidence about a solution to societal energy demands based on prioritized criteria and trade-offs that account for a range of constraints.	• **4.1** Construct an argument from evidence about whether a simple chemical reaction absorbs or releases energy. • **4.2** Construct an explanation of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. • **4.3** Design a device that solves a problem by converting energy from one form into another. • **4.5** Evaluate an argument from evidence about a solution to societal energy demands based on prioritized criteria and trade-offs that account for a range of constraints.	• **4.1** Evaluate and revise an argument about whether a simple chemical reaction absorbs or releases energy. • **4.2** Evaluate and revise an explanation of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. • **4.3** Evaluate and revise a design for a device that solves a problem by converting energy from one form into another. • **4.5** Revise an argument from evidence about a solution to societal energy demands based on prioritized criteria and trade-offs that account for a range of constraints.
Strand ESS.1: Matter and Energy in Space ESS.1.1 (not assessed) ESS.1.2 (not		• **1.3** Use a model to identify changes in matter that occur in a star's life cycle. • **1.4** Identify a space exploration challenge that can be solved through the	• **1.3** Develop and use a model to describe how changes in matter occur in a star's life cycle. • **1.4** Design a solution to a space exploration challenge by	• **1.3** Evaluate and revise a model to explain how changes in matter occur in a star's life cycle. • **1.4** Evaluate and revise a solution to a space exploration

assessed) ESS.1.3 ESS.1.4		structure and function of a device.	breaking it down into smaller, more manageable problems that can be solved through the structure and function of a device.	challenge by breaking it down into smaller, more manageable problems that can be solved through the structure and function of a device.
Strand ESS.2: Patterns in Earth's History and Processes ESS.2.1 ESS.2.2 ESS.2.3 ESS.2.4 ESS.2.5 ESS.2.6		• **2.1** Identify data that describe changes in Earth's formation and 4.6-billion-year history. • **2.2** Use a model based on evidence of Earth's interior to identify the cycling of matter by convection. • **2.3** Identify patterns on Earth's surface that are the result of plate tectonics. • **2.4** Use a model to identify internal and surface Earth processes that operate at different scales over space and time. • **2.5** Identify evidence that supports the claim that co-evolution of two of Earth's systems led to periods of stability and change over geologic time. • **2.6** Identify a solution that reduces the effects of natural disasters on humans.	• **2.1** Analyze data to construct an explanation for the changes in Earth's formation and 4.6-billion-year history. • **2.2** Develop and use a model based on evidence of Earth's interior to describe the cycling of matter by convection. • **2.3** Construct an explanation for how plate tectonics results in patterns on Earth's surface. • **2.4** Develop and use a model to describe how Earth's internal and surface processes operate at different scales over space and time. • **2.5** Construct an argument from evidence for how the co-evolution of two of Earth's systems led to periods of stability and change over geologic time. • **2.6** Evaluate design solutions that reduce the effects of natural disasters on humans.	• **2.1** Analyze data to evaluate and revise an explanation for the changes in Earth's formation and 4.6-billion-year history. • **2.2** Evaluate and revise a model based on evidence of Earth's interior to explain the cycling of matter by convection. • **2.3** Evaluate and revise an explanation for how plate tectonics results in patterns on Earth's surface. • **2.4** Evaluate and revise a model to explain how Earth's internal and surface processes operate at different scales over space and time. • **2.5** Evaluate and revise an argument for how the co-evolution of Earth's systems led to periods of stability and change over geologic time. • **2.6** Evaluate and revise a design solution that reduces the effects of natural disasters on humans.
Strand ESS.3: System Interactions—		• **3.1** Conduct an investigation to identify data and/or identify data	• **3.1** Plan an investigation of the properties of water and its effects on Earth's materials	• **3.1** Evaluate and revise an investigation of the properties of water and its effects on

Atmosphere, Hydrosphere, and Geosphere ESS.3.1 ESS.3.2 ESS.3.3 ESS.3.4 ESS.3.5 ESS.3.6 ESS.3.7 (not assessed)		from an investigation that describe the properties of water and its effects on Earth's materials and surface processes. • **3.2** Identify patterns in weather and climate caused by the movement of energy and water throughout the oceans. • **3.3** Identify an atmospheric process driven by energy from the Sun. • **3.4** Analyze patterns in data to identify factors that influence weather at a given location. • **3.5** Use a quantitative model to describe the cycling of carbon among Earth's systems. • **3.6** Analyze data from global climate records to identify changes to Earth's systems throughout geologic time.	and surface processes. • **3.2** Construct an explanation of how energy and water move throughout the oceans and cause patterns in weather and climate. • **3.3** Construct an explanation of how energy from the Sun drives atmospheric processes and how atmospheric currents transport matter and energy. • **3.4** Analyze patterns in data to explain how factors influence weather at a given location. • **3.5** Develop and use a quantitative model to describe the cycling of carbon among Earth's systems. • **3.6** Analyze data from global climate records to describe changes to Earth's systems throughout geologic time and make predictions about future variations based on modern trends.	Earth's materials and surface processes. • **3.2** Evaluate and revise an explanation of how energy and water move throughout the oceans and cause patterns in weather and climate. • **3.3** Evaluate and revise an explanation of how energy from the Sun drives atmospheric processes and how atmospheric currents transport matter and energy. • **3.4** Analyze patterns in data to evaluate and revise an explanation of how factors influence weather at a given location. • **3.5** Evaluate and revise a quantitative model to describe the cycling of carbon among Earth's systems. • **3.6** Analyze data from global climate records to describe changes to Earth's systems throughout geologic time and to determine how limitations in data impact predictions about future variations based on modern trends.
Strand ESS.4: Stability and Change in Natural Resources ESS.4.1		• **4.1** Identify evidence that supports an explanation for how the availability of natural resources, the occurrence of natural	• **4.1** Construct an explanation for how the availability of natural resources, the occurrence of natural hazards, and changes in climate affect	• **4.1** Evaluate and revise an explanation for how the availability of natural resources, the occurrence of natural hazards, and changes in climate

ESS.4.2 ESS.4.3 ESS.4.4		hazards, and changes in climate affect human activity. • **4.2** Use computational thinking to identify the relationships between the sustainability of natural resources and biodiversity within Earth's systems. • **4.3** Identify a problem in developing, managing, and utilizing energy and mineral resources. • **4.4** Identify a major global or local environmental problem based on one of Earth's systems.	human activity. • **4.2** Use computational thinking to explain the relationships between the sustainability of natural resources and biodiversity within Earth's systems. • **4.3** Design a solution for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios on large and small scales. • **4.4** Design a solution to a major global or local environmental problem based on one of Earth's systems.	affect human activity. • **4.2** Use computational thinking to predict how a change in an Earth system will affect the relationships between the sustainability of natural resources and biodiversity within Earth's systems. • **4.3** Evaluate and revise a design solution for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios on large and small scales. • **4.4** Evaluate and revise a design solution to a major global or local environmental problem based on one of Earth's systems.
Strand PHYS.1: Forces and Interactions PHYS.1.1 PHYS.1.2 PHYS.1.3		• **1.1** Identify data that describe a cause and effect relationship between the net force on an object and its change in motion as summarized by Newton's Second Law of Motion. • **1.2** Use computational thinking to identify a system in which the total momentum is conserved. • **1.3** Identify a solution that has the function of minimizing the impact force on an object during a	• **1.1** Analyze data to determine the cause and effect relationship between the net force on an object and its change in motion as summarized by Newton's Second Law of Motion. • **1.2** Use computational thinking to support the claim that the total momentum of a system is conserved when there is no net force acting on the system. • **1.3** Design a solution that has the function of minimizing the impact force on an object	• **1.1** Analyze data to predict how a change in both the net force on and the mass of an object changes its motion as summarized by Newton's Second Law of Motion. • **1.2** Use computational thinking to evaluate and revise a claim about the conservation of momentum in a system when the initial conditions of the system change. • **1.3** Evaluate and revise a solution that has the function of minimizing the impact force on

		collision.	during a collision.	an object during a collision.
Strand PHYS.2: Energy PHYS.2.1 PHYS.2.2 PHYS.2.3 PHYS.2.4 PHYS.2.5		• **2.1** Analyze data to track the transfer of energy within a system. • **2.2** Conduct an investigation to identify evidence and/or identify evidence from an investigation that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system. • **2.3** Use a macroscopic model to identify that energy can be accounted for as a combination of energies associated with the motion of objects and energy associated with the relative positions of objects. • **2.4** Identify a real-life problem that can be solved with a device that converts one form of energy into another form of energy. • **2.5** Identify a major global problem that can be solved through energy transfers and transformations.	• **2.1** Analyze data to track and calculate the transfer of energy within a system. • **2.2** Plan an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system. • **2.3** Develop and use a macroscopic model to describe that energy can be accounted for as a combination of energies associated with the motion of objects and energy associated with the relative positions of objects. • **2.4** Design a solution by constructing a device that converts one form of energy into another form of energy to solve a complex real-life problem. • **2.5** Design a solution to a major global problem that requires the application of conservation of energy principles through energy transfers and transformations and that accounts for societal	• **2.1** Analyze data to determine how limitations in data impact the prediction of energy transfer within a system. • **2.2** Evaluate and revise an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system. • **2.3** Evaluate and revise a macroscopic model to describe that energy can be accounted for as a combination of energies associated with the motion of objects and energy associated with the relative positions of objects. • **2.4** Evaluate and revise a solution in which a device that converts one form of energy into another form of energy solves a complex real-life problem. • **2.5** Evaluate and revise a solution to a major global problem that requires the application of conservation of energy principles through energy transfers and

			energy needs and wants.	transformations and that accounts for societal energy needs and wants.
Strand PHYS.3: Fields PHYS.3.1 PHYS.3.2 (not assessed) PHYS.3.3 PHYS.3.4		• **3.1** Use computational thinking to identify patterns in gravitational and electric fields. • **3.3** Identify data that describe the effect of a change in the position of an object on electric and gravitational forces and energy. • **3.4** Use a model to identify the effects on a field as characteristics of its source and surrounding space are varied.	• **3.1** Use computational thinking to compare the scale and proportion of gravitational and electric fields. • **3.3** Analyze data to compare the effect of changes in position of interacting objects on electric and gravitational forces and energy. • **3.4** Develop and use a model to evaluate the effects on a field as characteristics of its source and surrounding space are varied.	• **3.1** Use a computational model to compare the scale and proportion of gravitational and electric fields using Newton's Law of Gravitation and Coulomb's Law. • **3.3** Analyze data to differentiate between cause and correlation in the interactions of objects through electric and gravitational forces. • **3.4** Use a model to predict the effects on a field as characteristics of its source and surrounding space are varied.
Strand PHYS.4: Waves PHYS.4.1 PHYS.4.2 (not assessed) PHYS.4.3 PHYS.4.4 PHYS.4.5		• **4.1** Analyze data to identify qualitative relationships based on patterns observed in frequency, wavelength, and speed of waves traveling in various media. • **4.3** Use information to identify the effects that different frequencies of electromagnetic radiation have when absorbed by biological materials. • **4.4** Identify evidence that supports an explanation about the stability of digital transmission and storage of	• **4.1** Analyze data to identify both qualitative and quantitative relationships based on patterns observed in frequency, wavelength, and speed of waves traveling in various media. • **4.3** Evaluate information about the effects that different frequencies of electromagnetic radiation have when absorbed by biological materials. • **4.4** Ask questions and construct an explanation about the stability of digital transmission and storage of information and their impacts	• **4.1** Analyze data to derive both qualitative and quantitative relationships based on patterns in frequency, wavelength, and speed of waves traveling in various media. • **4.3** Communicate information to explain the effects that different frequencies of electromagnetic radiation have when absorbed by biological materials. • **4.4** Ask questions to clarify explanations to evaluate and revise an explanation about the stability of digital transmission and storage of information and

		information and their impacts on society. • **4.5** Use information to identify how devices use the principles of electromagnetic radiation and its interactions with matter to transmit and capture information and energy.	on society. • **4.5** Evaluate information about how devices use the principles of electromagnetic radiation and its interactions with matter to transmit and capture information and energy.	their impacts on society. • **4.5** Communicate information to explain how devices use the principles of electromagnetic radiation and its interactions with matter to transmit and capture information and energy.