Performance Expectation *and Louisiana Connectors*
HS-PS1-1 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 and the composition of the nucleus of atoms. **LC-HS-PS1-1a Identify the periodic table as a model to use to predict the properties of elements.** **LC-HS-PS1-1b Identify that the periodic table was created based on the patterns of electrons in the outermost energy level of atoms.** **LC-HS-PS1-1c Identify that the number of electrons in the outermost energy level of atoms impacts the behavior of the element.** **LC-HS-PS1-1d Identify the periodic table as a model that predicts the number of electrons and other subatomic particles.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Developing and using models: Modeling in 9-12 builds on K-8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. • Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system. **Use a model based on evidence to identify and describe the components of a system.** **Use a model based on evidence to identify and describe the relationships between the components of a system.** **Use a model based on evidence to predict relationships between systems or within a system.**	**STRUCTURE AND PROPERTIES OF MATTER** Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS.PS1A.a) **Atoms are the basic unit of a chemical element.** **Atoms are made of subatomic particles: protons, neutrons, and electrons.** **Atoms have a nucleus.** **The nucleus of an atom is made of positively charged protons and neutrons, which have no net charge.** **A positively charged nucleus is surrounded by smaller negatively charged electrons.** The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS.PS1A.b) **Electrons in the outermost energy level are called valence electrons.** **The periodic table of elements is an arrangement of the chemical elements ordered by atomic number or the number of protons in atoms.** **The periodic table is used to predict the patterns of behavior of elements.** **The arrangement of the groups of the periodic table reflects the patterns of electrons in the outermost energy level of atoms, and therefore, the chemical properties of the elements in each group.** **The atomic mass listed for each element on the periodic table corresponds to the relative abundance of that element's different isotopes.**	**PATTERNS** Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. **Patterns can be used to explain phenomena.** **Different patterns can be observed at different scales (micro and macro) in a system.** **Classifications used at one scale may fail or need revision when information from smaller or larger scales is introduced.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Identify that models can help illustrate relationships between systems or within a system.	**TYPES OF INTERACTIONS** Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (HS.PS2B.c) **The patterns and behaviors of elements are based on the attraction and repulsion between electrically charged particles and the patterns of the outermost electrons.** **The reactivity and electronegativity of atoms can be determined by an element's location on the periodic table and its valence electrons attraction to the nucleus.** **The number and types of bonds formed by an element and between elements, the number and charges of stable ions, and the relative sizes of atoms can be determined by an element's location on the periodic table.**	

Clarification Statement	
Physical Science	Examples of properties that could be predicted from patterns could include metals, nonmetals, metalloids, number of valence electrons, types of bonds formed, or atomic mass. Emphasis is on main group elements.
Chemistry	Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, atomic radius, atomic mass, or reactions with oxygen. Emphasis is on main group elements and qualitative understanding of the relative trends of ionization energy and electronegativity.

Performance Expectation *and Louisiana Connectors*
HS-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. **LC-HS-PS1-2a Identify an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms.** **LC-HS-PS1-2b Identify an explanation for the outcome of a simple chemical reaction based on trends in the periodic table.** **LC-HS-PS1-2c Construct an explanation for the outcome of a simple chemical reaction based on the chemical properties of the elements involved.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing explanations and designing solutions: Constructing explanations (science) and designing solutions (engineering) in 9-12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. **Construct an explanation based on valid and reliable evidence from a**	**STRUCTURE AND PROPERTIES OF MATTER** The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS.PS1A.b) **Electrons in the outermost energy level are called valence electrons.** **The periodic table of elements is an arrangement of the chemical elements ordered by atomic number as determined by an atoms number of protons.** **The periodic table is used to predict the patterns of behavior of elements.** **The arrangement of the groups of the periodic table reflects the patterns of electrons in the outermost energy level of atoms, and therefore, the chemical properties of the elements in each group.** **The atomic mass listed for each element on the periodic table corresponds to the relative abundance of that element's different isotopes.** **CHEMICAL REACTIONS** The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS.PS1B.c) **A chemical reaction is the process in which substances undergo chemical changes that results in the formation of new substances.** **Atoms are conserved in chemical reactions.** **Predicting involves making an inference about a future event based on evidence.**	**PATTERNS** Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. **Patterns can be used to explain phenomena.** **Different patterns can be observed at different scales (micro and macro) in a system.** **Classifications used at one scale may fail or need revision when information from smaller or larger scales is introduced.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
variety of sources. **Construct an explanation based on valid and reliable evidence from the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.** **Revise an explanation based on valid and reliable evidence from a variety of sources.** **Revise an explanation based on valid and reliable evidence from the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.**	**An element's chemical and physical properties can be predicted knowing only its position on the periodic table.**	

Clarification Statement	
Physical Science	Examples of chemical reactions could include the reaction of sodium and chlorine, carbon and oxygen, or hydrogen and oxygen. Reaction classification includes synthesis, decomposition, single displacement, double displacement, and acid-base.
Chemistry	Examples of chemical reactions could include the reaction of sodium and chlorine, carbon and oxygen, or carbon and hydrogen. Reaction classification aids in the prediction of products (e.g., synthesis, decomposition, single displacement, double displacement, and acid-base).

Performance Expectation *and Louisiana Connectors*
HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. **LC-HS-PS1-7a Identify a chemical equation, and identify the reactants and products which support the claim that matter (i.e., atoms) is neither created or destroyed in a chemical reaction.** **LC-HS-PS1-7b Identify a mathematical representation (e.g., table, graph) or pictorial depictions that illustrates the claim that mass is conserved during a chemical reaction.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Using mathematics and computational thinking: Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions, including computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. • Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. **Use mathematical or algorithmic forms for scientific modeling of phenomena to describe claims.** **Use mathematical or algorithmic forms for scientific modeling of**	**CHEMICAL REACTIONS** The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS.PS1B.c) **A chemical reaction is the process in which substances undergo chemical changes that results in the formation of new substances.** **Atoms are conserved in chemical reactions.** **Predicting involves making an inference about a future event based on evidence.** **An element's chemical and physical properties can be predicted knowing only its position on the periodic table.** **The periodic table can be used to predict the outcome of chemical reactions.**	**ENERGY AND MATTER** The total amount of energy and matter in closed systems is conserved. **When materials interact within a closed system, the total mass of the system remains the same.** **When materials interact within a closed system, energy may change forms, but the total amount of energy within the system remains the same.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
design solutions to describe claims. **Use mathematical or algorithmic forms for scientific modeling of phenomena to support claims.** **Use mathematical or algorithmic forms for scientific modeling of design solutions to support claims.** **Use mathematical or algorithmic forms for scientific modeling of phenomena to describe explanations.** **Use mathematical or algorithmic forms for scientific modeling of design solutions to describe explanations.** **Use mathematical or algorithmic forms for scientific modeling of phenomena to support explanations.** **Use mathematical or algorithmic forms for scientific modeling of design solutions to support explanations.**		

Clarification Statement	
Physical Science	Emphasis is on using mathematical ideas to communicate the relationship between masses of reactants and products as well as balancing chemical equations.
Chemistry	Emphasis is on using mathematical ideas as they relate to stoichiometry to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the

Clarification Statement	
	macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.

Performance Expectation *and Louisiana Connectors*
HS-PS1-8 Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. **LC-HS-PS1-8a Identify models that illustrate nuclear processes (i.e., fusion, fission, and radioactive decays), involve the release or absorption of energy.** **LC-HS-PS1-8b Contrast changes during the processes of alpha, beta, or gamma radioactive decay using graphs or pictorial depictions of the composition of the nucleus of the atom and the energy released.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Developing and using models: Modeling in 9-12 builds on K-8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s). • Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system. **Develop or use a model to identify and describe the components of a system.** **Develop or use a model to identify and describe the relationships between the components of a system.** **Develop or use a model to predict relationships between systems or within a system.** **Identify that models can help**	**NUCLEAR PROCESSES** Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS.PS1C.a) **Fission, fusion, and radioactive decay (alpha, beta, and gamma) are nuclear processes.** **Nuclear fission and fusion reactions release energy.** **In fission reactions, an atom is split into two or more smaller atoms.** **In fusion reactions, two smaller atoms fuse together to create a heavier atom.** **When a nuclear process takes place, radioactive particles and/or gamma radiation may be produced.** **Radioactive decay is the breakdown of an atomic nucleus resulting in the release of energy and matter from the nucleus.** **The total number of neutrons plus protons is the same both before and after the nuclear process of radioactive decay.** **Typically nuclear processes release much more energy per atom involved than do chemical processes.** **The energy that is released or absorbed during nuclear processes are harmful to human tissues.**	**ENERGY AND MATTER** In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. **The total number of protons plus neutrons is the same before and after nuclear processes occur.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
illustrate relationships between systems or within a system.		

Clarification Statement	
Physical Science	Emphasis is only on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations. Radioactive decay focus is on its relationship to half-life.
Chemistry	Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations. Emphasis is on alpha, beta, and gamma radioactive decays.

Performance Expectation *and Louisiana Connectors*
HS-PS2-1 Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. **LC-HS-PS2-1a Predict changes in the motion of a macroscopic object, such as a falling object, an object rolling down a ramp, or a moving object being pulled by a constant force using data (e.g., tables or graphs of position or velocity as a function of time for an object subject to a net unbalanced force).**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Analyzing and interpreting data: Analyzing data in 9-12 builds on K-8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. • Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. **Analyze data using tools in order to make valid and reliable scientific claims.** **Analyze data using tools in order to determine an optimal design solution.** **Analyze data using technology in order to make valid and reliable scientific claims.** **Analyze data using technology in order to determine an optimal**	**FORCES AND MOTION** Newton's second law accurately predicts changes in the motion of macroscopic objects. (HS.PS2.A.a) **Unbalanced forces applied to an object will cause acceleration.** **The size of this acceleration is determined by the mass of the object and the size of force applied.** **Forces might change the motion of objects (e.g., During tug-of-war, if forces on opposite teams are equal, the rope will not move.).** **Forces change the motion of objects. Newton's Laws can be used to predict these changes.** **Newton's second law describes the effects of the size of the total force and the object's mass on its resulting acceleration.** **The reason why objects may react differently to equal sized forces is explained by Newton's second law.**	**CAUSE AND EFFECT** Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. **Evidence is required when attributing an observed phenomenon to a specific cause.** **Evidence is required to explain the causal mechanisms in a system under study.** **Evidence is required to support a claim about the causal mechanisms in a system under study.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
design solution. **Analyze data using models in order to make valid and reliable scientific claims.** **Analyze data using models in order to determine an optimal design solution.**		

Clarification Statement	
Physical Science	Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object rolling down a ramp, or a moving object being pulled by a constant force. Emphasis is on one-dimensional motion and macroscopic objects moving at nonrelativistic speeds.
Chemistry	Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object rolling down a ramp, or a moving object being pulled by a constant force. Emphasis is on kinematics, one-dimensional motion, two-dimensional motion, and macroscopic objects moving at non-relativistic speeds.

Performance Expectation *and Louisiana Connectors*
HS-PS2-2 Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. **LC-HS-PS2-2a Identify an example of the law of conservation of momentum (e.g., in a collision, the momentum change of an object is equal to and opposite of the momentum change of the other object) represented using graphical or visual displays (e.g., pictures, pictographs, drawings, written observations, tables, charts).**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Using mathematics and computational thinking: Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions, including computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. • Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. **Use mathematical or algorithmic forms for scientific modeling of phenomena to describe claims.** **Use mathematical or algorithmic**	**FORCES AND MOTION** Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object. In any system, total momentum is always conserved. (HS.PS2A.b) **Momentum is the product of an object's mass and its velocity.** **Momentum is determined by the speed of an object and the direction it is traveling (velocity) of an object and the object's mass.** **The momentum of an object is in the same direction as its velocity.** **The more momentum an object has, the harder it is to stop.** **The Law of Conservation of Momentum can be used to predict the outcomes of collisions between objects and can aid in understanding the energy transfers and energy transformations in these collisions.** If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. (HS.PS2A.c) **Momentum is conserved as long as there are no new objects added to the system.** **The total momentum of any group of objects remains the same unless outside forces act on the object.** **Only unbalanced forces can change the momentum of an object.** **An impulse represents how much the momentum of an object changes when a force acts on it over a period of time.**	**SYSTEMS AND SYSTEM MODELS** When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. **Making models helps people understand things they cannot observe directly.** **Scientists use models to represent things that are either very large or very small.** **Any model of a system incorporates assumptions and approximations (e.g., the boundaries and initial conditions of the**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
forms for scientific modeling of design solutions to describe claims. Use mathematical or algorithmic forms for scientific modeling of phenomena to support claims. Use mathematical or algorithmic forms for scientific modeling of design solutions to support claims. Use mathematical or algorithmic forms for scientific modeling of phenomena to describe explanations. Use mathematical or algorithmic forms for scientific modeling of design solutions to describe explanations. Use mathematical or algorithmic forms for scientific modeling of phenomena to support explanations. Use mathematical or algorithmic forms for scientific modeling of design solutions to support explanations.	The impulse describes the relationship between the force acting on an object and the change it produces in the object's momentum.	system, inputs and outputs). It is critical to be aware of a system's physical, chemical, biological, and social interactions and how they affect the model's reliability and precision.

Clarification Statement	
Physical Science	Emphasis is on calculating momentum and the qualitative meaning of conservation of momentum.
Chemistry	Emphasis is on the quantitative conservation of momentum in interactions and the qualitative meaning of this principle as well as systems of two macroscopic bodies moving in one dimension.

Performance Expectation *and Louisiana Connectors*
HS-PS2-3 Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. **LC-HS-PS2-3a Evaluate a device (e.g., football helmet or a parachute) designed to minimize force by comparing data (i.e., momentum, mass, velocity, force, or time).**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing explanations and designing solution: Constructing explanations (science) and designing solutions (engineering) in 9-12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. **Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.** **Evaluate a solution to a complex real-world problem, based on**	**FORCES AND MOTION** If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. (HS.PS2A.c) **Momentum is conserved as long as there are no new objects added to the system.** **The total momentum of any group of objects remains the same unless outside forces act on the object.** **Only unbalanced forces can change the momentum of an object.** **An impulse represents how much the momentum of an object changes when a force acts on it over a periods of time.** **The impulse describes the relationship between the force acting on an object and the change it produces in the object's momentum.** **DEFINING AND DELIMITING ENGINEERING PROBLEMS** Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS.ETS1A.a) **A first step in designing a device to solve a problem is prioritizing criteria and constraints for the design of the device.** **The social, economic, and political forces of a society have a significant influence on what science and technology solutions are implemented.** **OPTIMIZING THE DESIGN SOLUTION** Criteria may need to be broken down into simpler ones that can be approached	

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. **Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.**	systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed. (HS.ETS1C.a) **It is important to prioritize the benefits and costs of the design of a solution to a problem. The decision as to which criteria are critical and which ones can be traded off is a judgment based on the situation and the needs of the system.**	

Clarification Statement	
Physical Science	Examples of evaluation and refinement could include determining the success of a device at protecting an object from damage such as, but not limited to, impact resistant packaging and modifying the design to improve it. Emphasis is on qualitative evaluations.
Chemistry	Examples of evaluation and refinement could include determining the success of the device at protecting an object from damage and modifying the design to improve it by applying the impulse-momentum theorem. Examples of a device could include a football helmet or an airbag. Emphasis is on qualitative evaluations and/or algebraic manipulations.

Performance Expectation *and Louisiana Connectors*
HS-PS2-5 Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current. **LC-HS-PS2-5a Identify situations and provide evidence where an electric current is producing a magnetic field.** **LC-HS-PS2-5b Identify situations and provide evidence where a magnetic field is producing an electric current.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Planning and carrying out Investigations: Planning and carrying out investigations to answer questions or test solutions to problems in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. **Plan an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types,**	**TYPES OF INTERACTIONS** Forces that act over a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (HS.PS2B.b) **Moving electric charges produce magnetic fields; changing magnetic fields induce electric currents.** **An electric field is the field around a charged particle that exerts a force on other charged particles.** **A magnetic field is a region around a magnet in which a magnetic force acts. (It is not always an attraction, sometimes it is a repulsion.)** **Moving electric charges produce magnetic fields.** **Electrical energy carried by currents in wires can be used to create magnetic fields.** **Magnets and rotating coils can be used to create electric currents.** **DEFINITIONS OF ENERGY** "Electrical energy" may mean energy stored in a battery or energy transmitted by electric currents. (HS.PS3A.d) **Electrical energy is a form of energy that can be transferred by moving charges through a complete circuit.** **A battery is a combination of two or more electrochemical cells in a series.** **Batteries are portable sources of electrical energy.**	**CAUSE AND EFFECT** Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. **Evidence is required when attributing an observed phenomenon to a specific cause.** **Evidence is required to explain the causal mechanisms in a system under study.** **Evidence is required to support a claim about the causal mechanisms in a system under study.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
how much, and accuracy of data needed to produce reliable measurements. **Revise an investigation individually and collaboratively to produce data to serve as the basis for evidence.** **Conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence.**		

Clarification Statement	
Physical Science	Emphasis is on designing and conducting investigations including evaluating simple series and parallel circuits. Qualitative evidence is used to explain the relationship between a current-carrying wire and a magnetic compass.
Chemistry	Evidence of changes within a circuit can be represented numerically, graphically, or algebraically using Ohm's law. Emphasis is on designing and conducting investigations using qualitative evidence to determine the relationship between electric current and magnetic fields. Examples of evidence can include movement of a magnetic compass needle when placed in the vicinity of a current-carrying wire, and a magnet passing through a coil that turns on the light of a Faraday flashlight.

Performance Expectation *and Louisiana Connectors*
HS-PS3-2 Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles/objects and energy associated with the relative positions of particles/objects. **LC-HS-PS3-2a Identify that two factors, an object's mass and height above the ground, affect gravitational potential energy (i.e., energy stored due to position of an object above Earth) at the macroscopic level.** **LC-HS-PS3-2b Identify that the mass of an object and its speed determine the amount of kinetic energy the object possesses.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Developing and using models: **Developing and using models:** Modeling in 9-12 builds on K-8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s). • Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system. **Develop or use a model to identify and describe the components of a system.** **Develop or use a model to identify and describe the relationships between the components of a system.** **Develop or use a model to predict relationships between systems or within a system.**	**DEFINITIONS OF ENERGY** Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. There is a single quantity called energy. A system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS.PS3A.a) **Energy is the ability to do work or cause change.** **Energy transforms from one form to another, but these transformations are not always reversible.** **A system's total energy is conserved regardless of the transfers within the system.** **The total energy of a system changes only by the amount of energy transferred into and out of the system.** At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS.PS3A.b) **Energy takes many forms; forms may include motion, sound, light, and thermal energy.** These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS.PS3A.c)	**ENERGY AND MATTER** Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. **Energy cannot be created or destroyed. Energy can be transferred from one object to another and can be transformed from one form to another, but the total amount of energy never changes.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Identify that models can help illustrate relationships between systems or within a system.	**Energy can be modeled as either motions of particles or as stored in force fields (electric, magnetic, gravitational).** **At the microscopic scale, energy can be understood as a force that mediates interactions between particles.** **Electromagnetic radiation is a phenomenon in which energy stored in fields moves across space (light, radio waves) with no supporting matter medium.**	

Clarification Statement	
Physical Science	Emphasis is on designing and conducting investigations including evaluating simple series and parallel circuits. Qualitative evidence is used to explain the relationship between a current-carrying wire and a magnetic compass.
Chemistry	Evidence of changes within a circuit can be represented numerically, graphically, or algebraically using Ohm's law. Emphasis is on designing and conducting investigations using qualitative evidence to determine the relationship between electric current and magnetic fields. Examples of evidence can include movement of a magnetic compass needle when placed in the vicinity of a current-carrying wire, and a magnet passing through a coil that turns on the light of a Faraday flashlight.

Performance Expectation *and Louisiana Connectors*
HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. **LC-HS-PS3-3a Identify the forms of energy that will be converted by a device that converts one form of energy into another form of energy.** **LC-HS-PS3-3b Identify steps in a model of a device showing the transformations of energy that occur (e.g., solar cells, solar ovens, generators, turbines).** **LC-HS-PS3-3c Describe constraints to the design of the device which converts one form of energy into another form of energy (e.g., cost or efficiency of energy conversion).**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing explanations and designing solutions: Constructing explanations (science) and designing solutions (engineering) in 9-12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. **Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.** **Evaluate a solution to a complex**	**DEFINITIONS OF ENERGY** At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS.PS3A.b) **Energy takes many forms; forms of energy are motion, sound, light, and thermal energy.** **ENERGY IN CHEMICAL PROCESSES** Although energy cannot be destroyed, it can be converted to other forms—for example, to thermal energy in the surrounding environment. (HS.PS3D.a) **A system does not destroy energy when carrying out any process.** **When carrying out a process, most often some or all of the energy has been transferred to heat the surrounding environment.** **Energy can be transformed into other energy forms.** **To produce energy typically means to convert some stored energy into a desired form.** **DEFINING AND DELIMITING ENGINEERING PROBLEMS** Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS.ETS1A.a) **A first step in designing a device to solve a problem is prioritizing criteria and constraints for the design of the device.**	**ENERGY AND MATTER** Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. **The processes of energy transformation and energy transfer can be used to understand the changes that take place in physical systems.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. **Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.**	**The social, economic, and political forces of a society have a significant influence on what science and technology solutions are implemented.**	

Clarification Statement	
Physical Science	Emphasis is on qualitative evaluations of devices. Constraints could include use of renewable energy forms and efficiency. Emphasis is on devices constructed with teacher approved materials. Examples of devices can be drawn from chemistry or physics clarification statements below.
Chemistry	Emphasis is on both qualitative and quantitative evaluations of devices. Constraints could include use of renewable energy forms and efficiency. Focus of quantitative evaluations is limited to total output for a given input. Emphasis is on devices constructed with teacher approved materials. Examples of devices in chemistry could include hot/cold packs and batteries.
Physics	Emphasis is on both qualitative and quantitative evaluations of devices. Constraints could include use of renewable energy forms and efficiency. Focus of quantitative evaluations is limited to total output for a given input. Emphasis is on devices constructed with teacher approved materials. Examples of devices in physics could include Rube Goldberg devices, wind turbines, solar cells, solar ovens, and electric motors.

Performance Expectation *and Louisiana Connectors*
HS-PS3-4 Plan and conduct 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 (second law of thermodynamics). **LC-HS-PS3-4a Identify the temperatures of two liquids of different temperature before mixing and after combining to show uniform energy distribution.** **LC-HS-PS3-4b Investigate the transfer of thermal energy when two substances are combined within a closed system.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Planning and carrying out investigations: Planning and carrying out investigations to answer questions (science) or test solutions to problems (engineering) in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. **Plan an investigation individually and collaboratively to produce data to serve as the basis for evidence,**	**CONSERVATION OF ENERGY AND ENERGY TRANSFER** Energy cannot be created or destroyed, but it can be transported from one place to another, transformed into other forms, and transferred between systems. (HS.PS3B.b) **Energy cannot be created or destroyed.** **Energy can be transferred from one object to another and can be transformed from one form to another.** **The processes of energy transformation and energy transfer can be used to understand the changes that take place in physical systems.** Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). (HS.PS3B.e) **Energy can change from one kind to another.** **When two substances (e.g., water or air) of different temperature are combined (within a closed system), the result will be a more uniform temperature (energy) distribution in the system.** **ENERGY IN CHEMICAL PROCESSES AND EVERYDAY LIFE** Although energy cannot be destroyed, it can be converted to less useful other forms—for example, to thermal energy in the surrounding environment. (HS.PS3D.a) **Energy can be transformed into other energy forms.**	**SYSTEMS AND SYSTEM MODELS** When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. **Making models helps people understand things they cannot observe directly.** **Scientists use models to represent things that are either very large or very small.** **Any model of a system incorporates assumptions and approximations (e.g., the boundaries and initial conditions of the system, inputs and**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements. **Revise an investigation individually and collaboratively to produce data to serve as the basis for evidence.** **Conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence.**	**When "producing" or "using" energy, most often some or all of the energy has been transferred to heat the surrounding environment.**	**outputs).** **It is critical to be aware of a system's physical, chemical, biological, and social interactions and how they affect the model's reliability and precision.**

Clarification Statement	
Physical Science, Chemistry, and Physics	Emphasis is on analyzing data from student investigations and using mathematical thinking appropriate to the subject to describe the energy changes quantitatively and conceptually. Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water.

Performance Expectation *and Louisiana Connectors*
HS-PS3-2 Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles/objects and energy associated with the relative positions of particles/objects. **LC-HS-PS3-2a Identify that two factors, an object's mass and height above the ground, affect gravitational potential energy (i.e., energy stored due to position of an object above Earth) at the macroscopic level.** **LC-HS-PS3-2b Identify that the mass of an object and its speed determine the amount of kinetic energy the object possesses.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Developing and using models: **Developing and using models:** Modeling in 9-12 builds on K-8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s). • Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system. **Develop or use a model to identify and describe the components of a system.** **Develop or use a model to identify and describe the relationships between the components of a system.** **Develop or use a model to predict relationships between systems or within a system.**	**DEFINITIONS OF ENERGY** Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. There is a single quantity called energy. A system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS.PS3A.a) **Energy is the ability to do work or cause change.** **Energy transforms from one form to another, but these transformations are not always reversible.** **A system's total energy is conserved regardless of the transfers within the system.** **The total energy of a system changes only by the amount of energy transferred into and out of the system.** At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS.PS3A.b) **Energy takes many forms; forms may include motion, sound, light, and thermal energy.** These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS.PS3A.c)	**ENERGY AND MATTER** Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. **Energy cannot be created or destroyed. Energy can be transferred from one object to another and can be transformed from one form to another, but the total amount of energy never changes.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Identify that models can help illustrate relationships between systems or within a system.	**Energy can be modeled as either motions of particles or as stored in force fields (electric, magnetic, gravitational).** **At the microscopic scale, energy can be understood as a force that mediates interactions between particles.** **Electromagnetic radiation is a phenomenon in which energy stored in fields moves across space (light, radio waves) with no supporting matter medium.**	

Clarification Statement	
Physical Science	Emphasis is on designing and conducting investigations including evaluating simple series and parallel circuits. Qualitative evidence is used to explain the relationship between a current-carrying wire and a magnetic compass.
Chemistry	Evidence of changes within a circuit can be represented numerically, graphically, or algebraically using Ohm's law. Emphasis is on designing and conducting investigations using qualitative evidence to determine the relationship between electric current and magnetic fields. Examples of evidence can include movement of a magnetic compass needle when placed in the vicinity of a current-carrying wire, and a magnet passing through a coil that turns on the light of a Faraday flashlight.

Performance Expectation *and Louisiana Connectors*
HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. **LC-HS-PS3-3a Identify the forms of energy that will be converted by a device that converts one form of energy into another form of energy.** **LC-HS-PS3-3b Identify steps in a model of a device showing the transformations of energy that occur (e.g., solar cells, solar ovens, generators, turbines).** **LC-HS-PS3-3c Describe constraints to the design of the device which converts one form of energy into another form of energy (e.g., cost or efficiency of energy conversion).**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing explanations and designing solutions: Constructing explanations (science) and designing solutions (engineering) in 9-12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. **Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.** **Evaluate a solution to a complex**	**DEFINITIONS OF ENERGY** At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS.PS3A.b) **Energy takes many forms; forms of energy are motion, sound, light, and thermal energy.** **ENERGY IN CHEMICAL PROCESSES** Although energy cannot be destroyed, it can be converted to other forms—for example, to thermal energy in the surrounding environment. (HS.PS3D.a) **A system does not destroy energy when carrying out any process.** **When carrying out a process, most often some or all of the energy has been transferred to heat the surrounding environment.** **Energy can be transformed into other energy forms.** **To produce energy typically means to convert some stored energy into a desired form.** **DEFINING AND DELIMITING ENGINEERING PROBLEMS** Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS.ETS1A.a) **A first step in designing a device to solve a problem is prioritizing criteria and constraints for the design of the device.**	**ENERGY AND MATTER** Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. **The processes of energy transformation and energy transfer can be used to understand the changes that take place in physical systems.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. **Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.**	**The social, economic, and political forces of a society have a significant influence on what science and technology solutions are implemented.**	

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Performance Expectation *and Louisiana Connectors*
HS-PS3-5 Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. **LC-HS-PS3-5a Use a model to identify the cause and effect relationships between forces produced by electric or magnetic fields and the change of energy of the objects in the system.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Developing and using models: Modeling in 9-12 builds on K-8 experiences and progresses to using synthesizing and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s). • Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system. **Develop or use a model to identify and describe the components of a system.** **Develop or use a model to identify and describe the relationships between the components of a system.** **Develop or use a model to predict relationships between systems or within a system.** **Identify that models can help**	**RELATIONSHIP BETWEEN ENERGY AND FORCES** When two objects interacting through a field change relative position, the energy stored in the field is changed. (HS.PS3C.a) **When two objects interact, each one exerts a force on the other.** **These forces can transfer energy between the objects.** **Forces between two objects at a distance are explained by force fields (gravitational, electric, or magnetic) between them.** **The energy stored in the field is consistent with the change in energy of the objects.**	**CAUSE AND EFFECT** Cause and effect relationships can be suggested and predicted for complex natural and human-designed systems by examining what is known about smaller scale mechanisms within the system. **An understanding of small scale mechanisms within a system can uncover cause and effect relationships for complex systems (natural and human-designed).** **An understanding of small scale mechanisms within a system can be predictive of cause and effect relationships for**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
illustrate relationships between systems or within a system.		**complex systems (natural and human-designed).**

Clarification Statement	
Physical Science	Examples of models could include drawings, diagrams, simulations and texts, such as what happens when two charged objects or two magnetic poles are near each other.
Physics	Examples of models could include drawings, diagrams, and texts, such as drawings of what happens when two charges of opposite polarity are near each other.

Performance Expectation *and Louisiana Connectors*
HS-PS4-1 Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. **LC-HS-PS4-1a Qualitatively describe cause and effect relationships between changes in wave speed and type of media through which the wave travels using mathematical and graphical representations.** **LC-HS-PS4-1b Identify examples that illustrate the relationship between the frequency and wavelength of a wave.** **LC-HS-PS4-1c Identify evidence that the speed of a wave depends on the media through which it travels.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Using mathematics and computational thinking: Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions (e.g., trigonometric, exponential and logarithmic) and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. • Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. **Use mathematical or algorithmic forms for scientific modeling of phenomena to describe claims.**	**WAVE PROPERTIES** The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. (HS.PS4A.a) **The speed of a wave in a particular medium is constant. For this wave, the frequency and the wavelength are related to one another.** **The speed of a wave can also be affected by the type of material through which it travels.**	**CAUSE AND EFFECT** Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. **Evidence is required when attributing an observed phenomenon to a specific cause.** **Evidence is required to explain the causal mechanisms in a system under study.** **Evidence is required to support a claim about the causal mechanisms in a system under study.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Use mathematical or algorithmic forms for scientific modeling of design solutions to describe claims. **Use mathematical or algorithmic forms for scientific modeling of phenomena to support claims.** **Use mathematical or algorithmic forms for scientific modeling of design solutions to support claims.** **Use mathematical or algorithmic forms for scientific modeling of phenomena to describe explanations.** **Use mathematical or algorithmic forms for scientific modeling of design solutions to describe explanations.** **Use mathematical or algorithmic forms for scientific modeling of phenomena to support explanations.** **Use mathematical or algorithmic forms for scientific modeling of design solutions to support explanations.**		

Clarification Statement	
Physical Science	Emphasis is on describing waves both qualitatively and quantitatively. Qualitative focus includes standard repeating waves and transmission/absorption of electromagnetic waves/radiation.

Clarification Statement	
Physics	Examples of data could include electromagnetic radiation traveling through a vacuum and glass, sound waves traveling through air and water, and seismic waves traveling through the Earth. Emphasis is on algebraic relationships and describing those relationships qualitatively.

Performance Expectation *and Louisiana Connectors*
PS4-4 Evaluate the validity and reliability of claims in published materials regarding the effects that different frequencies of electromagnetic radiation have when absorbed by matter. **LC-PS4-4a Recognize the relationship between the damage to living tissue from electromagnetic radiation and the energy of the radiation.**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Obtaining, evaluating, and communicating information: Obtaining, evaluating, and communicating information in 9-12 builds on K-8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. • Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. **Evaluate the validity and reliability of claims that appear in scientific and technical texts, verifying the data when possible.** **Evaluate the validity and reliability of claims that appear in media reports, verifying the data when possible.** **Evaluate the validity and reliability of methods that appear in scientific and technical texts, verifying the**	**ELECTROMAGNETIC RADIATION** When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells. (HS.PS4B.b) **Energy from the sun takes the form of electromagnetic waves such as infrared, visible, and ultraviolet electromagnetic waves.** **Electromagnetic waves carry a single form of energy called electromagnetic (radiant) energy.** **The radiation from the sun consists of a range of energies in the electromagnetic spectrum.** **Electromagnetic radiation when absorbed can be converted to thermal energy.** **Electromagnetic waves carry energy that can have important consequences when transferred to objects or substances.** **Some electromagnetic radiation can cause damage to living cells.**	**CAUSE AND EFFECT** Cause and effect relationships can be suggested and predicted for complex natural and human-designed systems by examining what is known about smaller scale mechanisms within the system. **An understanding of small scale mechanisms within a system can uncover cause and effect relationships for complex systems (natural and human-designed).** **An understanding of small scale mechanisms within a system can be predictive of cause and effect relationships for complex systems**

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
data when possible. **Evaluate the validity and reliability of methods that appear in media reports, verifying the data when possible.** **Evaluate the validity and reliability of designs that appear in scientific and technical texts, verifying the data when possible.** **Evaluate the validity and reliability of designs that appear in media reports, verifying the data when possible.**		**(natural and human-designed).**

Clarification Statement
Emphasis is on the idea that photons associated with different frequencies of light have different energies, and the damage to living tissue from electromagnetic radiation depends on the energy of the radiation. Examples of published materials could include trade books, magazines, web resources, videos, and other passages that may reflect bias. Emphasis is on qualitative descriptions.